Replacement of Natural Sand From Manufactured Sand In Specified Concrete Mix For Pavement Quality Concrete

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Abstract- *The major aim of this experimental study is to produce concrete replacing 100% of river sand with M-sand (manufactured sand).M-sand gives a satisfactory strength, reduces environmental problems. A few alternatives have come up for the construction industry to bank on which manufactured sand or M-sand, as it is called. It is found to be the most suitable one to replace river sand. Manufactured sand has caught the attention of the construction industry and environmentalists alike for its quality and the minimum damages it causes to nature.*

M-sand becomes more popular in the construction industry and infrastructure, the demand for river sand and illegal sand mining would come down, A well processed manufactured sand known as M-Sand as partial or full replacement to river sand is the need as a long term solution in Indian concrete industry until other suitable alternative fine aggregate are developed.

In the present study, a comparison results of the Compressive strengths of River Sand and Manufactured sand is done with the hundred percent replacement of river sand by M sand for Pavement Quality Concrete Also use of Fly Ash as a supplementary cementitious material which is partially replaced of cement.

I. INTRODUCTION

1.1 General: Now aday, due to the huge demand for the sand for construction work in the construction industry, all our natural sand resources from the river bed got depleted. To protect our environment, the government has enforced some strict laws with rules and regulations for the supply of natural sand. So the best alternative with quality standards more or equal to the river sand is Manufactured-sand.

Since from history from many years, as we were using the natural sand only, everyone has the practical experience and knowledge of the natural sand, knowing its quality, and safety

Now these days for environmental protection is necessary for future of human's life and living organisms.

These effects cause, it has introduced replacement of natural sand by other material, which is nearly the properties like same as natural sand.

1.1 Need of Study: Concrete is widely used in making architecture structure, highway construction, foundation, runway, parking structure, pools/reservoir, concrete making, pipes, and concrete consist of mainly sand which is about 35%,which is second most ingredients use in concrete work, It may be natural sand made from river or artificial sand there are many kinds of rocks could be used to make sand there are granite, basalt, pebbles, etc. In construction industry natural sand is used as an important building material and world consumption of sand in concrete alone is around 1000 million tons/year making it scarce and limited.

Further, it has cause environment degradation like removal of mineral from top soil due to erosion and change in vegetative property leading to soil infertility problem thereby affecting agricultural productivity, hence then current focus of industry should be to partially or completely replace natural sand in concrete by waste material that is obtain through recycling without promising the quality of end product.

In the recent year, the industrial and construction industry has identified some waste material like fly ash, lime stone powder, slag, siliceous stone powder and crush sand for use in traditional concrete and due to the high rising of cost of natural sand, there must be need to replace natural sand with artificial sand. So in that study we use artificial sand or Manufactured sand used in place of natural sand in construction work, so that we can minimize the construction cost and providing same or more strength gain in our construction work. Here we have found gain strength of Pavement Quality Concrete work which is replaced of natural sand by artificial sand.

Use of Crushed sand in construction work is not new in western world. It is being used there since few decades. Crushed sand is a kind of waste material that is generated from the stone crushing industry which is abundantly available to extent of 200 million tons per annum which has land fill disposal problem and health and environment hazard. The present study is an attempt to experimental hazards. The present study is an attempt to experiment on use of crushed sand to replacement of natural sand from concrete material in construction work.

1.2 Study Objectives: Infrastructure and our construction industry in the India is facing one of the major problems that is natural fine aggregate. Court has already awarded that totally band on excavation of fine aggregate from river because they major effect on environment and changing the river direction. These materials of Cement, sand and aggregate are basic needs for any construction industry. Sand is a prime material used for preparation of mortar and concrete and also it is playing a major role in mix design and construction work. Now a day's erosion of rivers and considering the environmental issues, there is a scarcity of river sand. The shortage of river sand will adversely effect of the construction industry, So there is need to find the new alternative material to replace the river sand, such that excess river erosion which is harmful of environment is prevented. Many researchers are finding different materials to replace sand and one of the major materials is quarry stone dust M -SAND.

1.3 Natural Sand or River Sand:

Sand is a naturally occurring granular material which is composed by finely divided rock and mineral particles. The composition of sand varies, depending on the local rock sources and conditions of process of made , but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO2), usually in the form of quartz. The second most common type of sand is calcium carbonate, for example, aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish. Sand is a non-renewable resource over human timescales, and sand suitable for making concrete is in high demand.

Natural Sand is being used as fine aggregate in concrete making and is preferred as fine aggregate in concrete work. It is mostly mined from the river beds and indiscriminate mining of sand has reportedly causing damages to our environment.

1.4 Alternative material of Fine Aggregate:

Now there is high scarcity of natural sand due to construction industry. Shortage of good quality natural sand and heavy dependency of natural sand, for concrete industry, there has been seen usage of poor-quality natural sand use for construction work which is less quality of construction work. Thus, it becomes almost necessary to find alternatives of natural sand and evaluate these alternatives for use in concrete production.

Out of several available alternatives of natural sand, crushed stone sand has emerged as the most easily available material. This material is available at all the crushing units as a by-product during production of 20mm size and 10mm size aggregates.

Another form of crushed stone sand is manufactured sand (M sand), which is better in terms of quality and fulfil the requirements of suitable material for use in concrete work.

M sand is manufactured by the methods of by crushing of coarse aggregates (20mm& 10mm) in separate sand plants or using 3 stage VSI crushers. Then this material is further processed either by washing of crushed sand with water or dry sieving, if required to improve the grading and reduce fine powder content.

we have used here stablish of VSI (Vertical Shaft Impact) crusher material of manufactured sand has used in pavement concrete. Also washing plant unit has set up stablished.

The artificial sand which is produced by the proper machines can be a better substitute of river sand. The sand should be sharp, cubical shape and with grounded edges and it should be clean and course. The grains should be of durable material. The grain sizes must be minimum voids. The presence of clay and silt retards the setting of the cement and makes weaker so it should be minimum presence of silt and clay in the M-sand material.

Manufactured Sand can be defined as all most residue, tailing or other nonvaluable waste after the extraction and processing of rocks to form is fine particles less than 4.75 mm. Manufactured Sand in concrete is drawing attention to researchers and investigators for approaching of replacement from river sand. The study of M-Sand presents the feasibility in usage of manufactured sand as substitute of Natural sand in concrete.

It was found that the compressive and flexural studies of concrete made of Manufactured Sand are nearly equal to the conventional concrete. It is like same results has given with M-Sand instead of natural sand.

In this project we are replacing the river sand and use Manufacturing Sand is used. We have targeted that the work of Pavement Quality Concrete (PQC) of highways work by using Manufactured Sand.

II. PRINCIPAL OBJECTIVES AND SCOPE:

The main aims of this report are to present knowledge regarding the production and utilisation of manufactured sand. The overall objective is to develop a technology platform for the substitute from the natural to manufactured aggregates based on hard rock. This is to be for improvement of work of new technology by the crushed sand used with fully replacement of natural aggregates. This includes knowledge of resource management, cost effective production, use of manufactured sand in concrete and the mix design concepts for concrete pavements.

2.1 Background - Why Manufactured Sand:

The motivation for this project is the increasing miss balance between the need for crushed aggregates of M sand in the society and the availability of traditionally suitable geologic sources. A strong need is realised for developing and implementing technology which is enable the use of alternative resources, reduce the need for transportation cost and present zero waste concepts for the aggregate and concrete industry.

Aggregate producers are faced with constant demands for higher quality aggregates and, at the same time, have to take environmental issues into account. The most pressing issues being the excess amounts of fines (< 4 mm) following the crushing process for manufactured aggregates. Excess fines were, and in many countries still are, considered waste, which is also useable or fines were disposed of accordingly, at great costs and contamination. Producers recognised an unused opportunity and experimented with manufactured sand from gravel and crushed hard rock of advantage is such that sand has rough surface texture and the Particle Size Distribution (PSD) curve can be adjusted when after the material is manufactured.

Extensive research programmes have been carried out, where properties of manufactured sand and its usability in concrete work has been the main focus. The results have in general been in favour of using of manufactured sand, given the right conditions concerning rock type and its production process. However, the design parameters are different with compared to natural sand.

Another advantages when sand and aggregates are manufactured is that quarries can be kept in the near places to its of end-use, thereby shortening transport distances, followed by less pollution and increased employment and opportunities for the local's people.

III. LITERATURE REVIEWS

Currently, India has taken a major initiative on developing the infrastructures such as expressway, highways, thermal power projects and industrial structures etc., to meet the requirements of globalization. In recent years, concrete technology and industries has made significant advantages which has resulted in economical improvements in strength of concrete. This economic development depends upon the intelligently use of locally available materials.

One of the important ingredients of conventional concrete is natural sand of use in fine aggregate, which is expensive and scarce. However, due to the increased use of concrete is almost all types of construction works, the demand of natural or river sand has been increased for construction industry and infrastructure developments. To fulfil this demand of construction industry,

Excessive Quarry of sand from river beds is taking place causing the depletion of sand resources which is very hazardous for our environment and river. The scarcity of natural sand due to such heavy demands in developing and growing the construction activities have forced to find the suitable substitute. One of the cheapest and the easiest ways of getting substitute for natural sand is by crushing natural stone to get artificial sand of in the desired size and grading which is useful for concrete work.

[2]. Priyanka A. Jadhav and Dilip K. Kulkarni forward applications of M- sand as an attempt towards sustainable development. The effect of water cement ratio on hardened properties of cement mortar with partial replacement of river or natural sand by manufactured sand was also reported for using.

[7]. Akshay A. WaghmareAkshayG..Kadao, Ayushi R. Sharma and Sunil G. have reported the properties such as workability, compressive strength and tensile strength of concrete prepared by replacing natural sand with artificial sand at different replacement level of (0%, 20%, 40%, 60%, 80%, 100%).They have reported that the strength and durability performance of concrete made of artificial sand and natural sand.

[9].In the present investigation workability, durability and strength of concrete with manufactured sand as change to natural sand in Proportions of 0%, 20%, 40%, 60% and 100% replaced. The experimental programmes were conducted on grade of M20 and M30 grade concrete with 450 specimens. Results obtained shown that as replacement of natural sand by manufactured sand is increased, decrease in the workability of concrete. Compressive strength, split tensile strength and flexural strength tests were conducted to determine strength of concrete. The 60% replacement showed an increase in strength of about 20% and other changes to an order of minimum 0.93% in both the grades.

IV. MANUFACTURED SAND

Definitions In this report the term manufactured sand is used for aggregate material less than 4 mm that is processed from crushed rock or gravel and intended for construction use.

Various names of Manufactured Sand:

Manufactured stone sand • Manufactured fine aggregate • Crushed fine aggregate • Crusher sand • Crushed rock sand • Stone sand • Stone powder • Quarry fines • Quarry sand • Artificial sand • Leftover rocks from mining and quarrying • Surplus materials In addition different other languages operate with other definitions of manufactured sand.

4.1 Properties of Manufactured Sand :

The most important elements in the production of manufactured sand. The first and basic issues will be related to the raw material is to be found quarries, which is the inventory, classification and also excavating from where area. Material parameters will depend on the parent rock of earth, whether the aggregates are excavated and crushed from hard rock material, or they are present as sand/gravel deposits of one kind or type of deposition of rock. Geological parameters such as rock type/mineral composition and its texture, weathering of rocks, contamination, and sediment structure, will always be the initial criteria for selection and evaluation of resources of materials which is important.

4.2 General Requirements of Manufactured Sand/Artificial Sand:

1. All the particles of sand should be the higher crushing strength.
2. The surface texture of M-sand particles should be smooth.
3. The edges of the particles of M-sand should be grounded.
4. The ratio of fines should be minimum, fines should not be less than 30% .
5. M-Sand should not be any organic impurities Silt in sand should be more than minimum or nil, should not me more than 2%.
6. Manufactured sand the permissible limit of fines below 75 microns shall not be exceed 15%.

Advantages of Manufactured Sand:

1. Workability and performance is good as natural sand.
2. Setting time is normal as natural sand.
3. Specific gravity is generally high for good granite rock.
4. Better concrete quality.
5. Increase concrete strength and its durability of concrete.
6. Higher cohesion and compressive strength of concrete.
7. Reduction of voids and higher strength of concrete.

4.3 Environmental Impacts:

Now the days Common River Sand is very expensive due to excessive cost of transportation from natural Sources and also large scale the depletion of these sources of river sand creates environmental problems, which is harmful for our environment. River sand used as fine aggregates in production of concrete, problem of acute shortage in all parts of country. The continuous use of this has started serious problem with respect to its availability, cost and our environmental impact which is hazardous. In that situation Manufactured sand (M-Sand) can be economical alternative to river sand.

Large scale of mining of sand and gravels are several folds higher than the natural replenishments, has lead to irreparable damages to the land, water, biotic and social and human environments related to the many of the river systems in the world. The problem is severe of the rivers in the southwest coast of India as Kerala state, where the rivers are small with limited river bed resources. At the equivalent time, construction industry demands increasing.

Effects that of in the stream sand mining may not be visible immediately because it is to requires regular monitoring and takes a decade or more to surface and propagate the effects along the river channel in measurable.

4.3 Key Impact points on Environment due to Mining: -

1. Changes in bed forms:-

The river channels are those naturally modified into different bed forms depending on the changes in flow energy and their sediment discharge.

2. Continued mining of sand from the alluvial reaches of river systems and Changes in sediment characteristics Indiscriminate could impose marked changes in the grain size characteristics of river beds, in the long run. As bed materials form an important abiotic component of a river ecosystem, changes in grain size of natural sand characteristics may lead to changes in biodiversity of the system.

3. Changes in water quality / quantity:-

Floodplains of river systems and Indiscriminate mining for construction grade sand and gravel from the active channels can impose serious problems in the surface and sub-surface (groundwater) water resources. High content of suspended particulates solids in the water column arising as a result of clandestine sand mining operations can cause severe impairments to the river eco systems. water table lowering consequent to sand and gravel mining have been documented by several investigators.

4. Changes in biological environment:-

During the past three to four decades, river systems of the world have been altered significantly due to in discriminate sand mining. It has many deleterious effects on the physical, chemical and biological environments of river systems.

5. Environmental issues of Mining:-

The role of minerals and metals in economic development, mainly in the context of developing countries has received much attention and focus. This is most important aspect while design the mine layout as it depletion of ground water, lesser availability of water for industrial, agriculture land, threat to livelihood, fall of employment to farm workers, human rights violations and damage to roads and bridges. It also affects region's fragile ecosystem and rich biological and cultural diversity.

6. Air Quality:-

The mainly air quality issue with mining is dust particles. Large amount in concentration of dust can be health hazard, exacerbating respiratory disorders such as asthma and irritating the lungs and various diseases.

7. Noise & Vibration:-

Noise can be an issue because of mines normally to operate 24 hours a day and the sound levels can fluctuate widely. Surface mines mainly generate noise from overburden, transport and excavation, while the major noise source from underground mines are ventilation fans, the surface facilities and product transport.

V. MANUFACTURED SAND PRODUCTION:

This type of construction sand is manufactured in the factory or plant operated. Manufactured sand can be used as a substitute of natural sand for concrete industry. M- Sand has been used ever since from the demand for good quality sand has rapidly increased due to construction industry and infrastructure development.

This type of construction sand is prepared by crushing hard stone and hence it reduces the cost of transportation by bringing sand from river beds. M-sand contains particles of sand size is angular nature which is increase the strength of concrete.

These angular particles present in the sand increases its water demand in the production of concrete. it is artificially manufactured and it contains zero silt content. Manufactured sand is processed by factory operated so there has no oversized materials found in these types of manufactured sand by the process of crushed stone.

Manufactured Sand is produced by feeding hard stones of varying sizes to primary and secondary crusher plants (Jaw crusher and Cone crusher), these crushed stones and for size reduction are further crushed in Vertical Shaft Impact (VSI) crusher it is to reduce the particle size to that production of sand.

The VSI crusher of its unique design and also the action of attrition produces well-shaped fine aggregates particles of crusher sand that are cubical shape and angular size. The process of attrition which is also enables the reduction of surface roughness of the fine aggregate crusher sand particles to some extent. During in the processes of production, it is ensured that sand stockpiles are not contaminated with weathered/highly altered rock or with clay, and other contaminants and achieve good quality of manufactured sand for concrete.

5.1 The manufacturing process of M-sand.

- 1. Jaw crushing:
- 2. Cone crushing:
- 3. V.S.I. Crushing:
- 4. Screening:
- 5. Classification:

5.2 Screening and Washing :

It is manufactured sand, that's why it can be free from several impurities and the shape and size of the sand grains can be controlled as desired which is suits of our purposes. Manufactured sand has manufactured in a controlled environment, so there is very little probability of adulteration of this sand and there is better control over the manufacturing quality of Manufactured sand. The M-sand provides good durability and high strength to concrete. It is very reducing construction defects and good quality of material. Here we have construct unit of washing plant for clean and clear of dust impurities of fines which is removed from crushed sand which is used for Concrete work.

VI. ADDITION OF CEMENTITIOUS MATERIALS

We are using cementitious material replacement of OPC cement by fly ash.

6.1 FLY ASH:

Fly ash is a very fine, glass powder during the production of electricity recovered from the gases of burning coal. These micron-sized earth elements of fly ash consist primarily of silica, alumina and iron. When it is mixed with lime and water the fly ash forms a cementitious compound with properties very similar like of Portland cement. Because of this similarity, it can be used to replace a portion or percentage of cement in the concrete, providing some distinct quality advantages. The concrete is denser resulting in a tighter, smoother surface with less bleeding of the concrete.
A comparison of fly ash particles sizes to those of several types. Fly ash is a fine residue which is composed of unburned particles that solidify while suspended in exhaust gases. Fly ash is carried off in stack gases from a boiler unit, and is collected by mechanical methods of electrostatic precipitators. Because it is collected from exhaust gases, fly ash is composed of fine spherical silt size particles in the range of 0.074 to 0.005 mm (Ferguson in 1993). Fly ash collected and using mechanical precipitators usually has coarser particles than fly ash collected using electrostatic precipitators.

6.2 OBJECTIVE OF THIS REPORT: The main objective is that of utilization of fly ash.

The production of fly ash in our country India, The necessity for the fly ash utilization which is disposal methods of fly ash • Characterization of different types of fly ash based on their physical and chemical properties of fly ash • Utilization of fly ash find out a particular which is end use for a particular waste generated during any of the processes involved for utilization. To reduce the toxicity of hazardous wastes or it to be minimize its impacts on the environment find out an alternative method of disposal of potentially harmful wastes of fly ash.

6.3 NEED FOR UTILIZATION OF FLY ASH:

Considering that the Ninth plan (1997-2002) had proposed a pivotal place to thermal power plant generation it was estimated that it shall increase at an annual rate of around 8% to 10%. Consequently, fly ash it is generation shall touch the 100 million tonne / year mark by the year of 2000 & 125 million tonne by 2003-2004. The major sources of fly ash production in India are the thermal power units of fly ash. It is estimated that by the end of the tenth plan period (March 2007) an additional 124000 MW of power sector expansion will be required in India to meet the rising energy demand of electricity. Though the state of Orissa is not thickly industrialized, the fly ash generation in the state is around of 93 lakh tones per annum. As far as the thermal power sectors in Orissa are concerned about the 22.6% of fly ash is being utilized. This trend in future may require very large amount of land area for disposal of fly ash material. According to Central Electricity authority of India, there has around 85 major coal fired thermal power plants and 305 hydro plants existing in our country India. As per the ministry of power statistics, the total installed generating capacity of hydropower(Thermal + wind) during 2003-2004 was about 79838 MW and hydropower generation was 29500 MW.

Some of the prominent Power Plants which is also producing and providing good quality Fly Ash include the following name as: Ropar Kota AnnaparaDadriRihandSingrauliUnchaharChandrapurDahanuTrombayVindyanchalRaichurRamagundamKorba Present Scenario on Fly Ash in India • Over 73 % of the total installed power generation is thermal • 230 - 250 million MT coal is being used every year • High fly ash contents varying from 30 to 50% • More than 110 million MT of ash every year generated •Ash generation in 2010 likely to reach 170 million MT • Presently around 65,000 acres of land which is occupied by ash ponds • Ministry of Environment & Forest Figures Presently as per the, 30% of Ash is being used for the Fillings work, construction, Embankments, , tiles & blocks, etc. Fly ash produced as a result of burning of coal has tremendous

potential to be utilized for various applications. Estimates of existing utilization are around as 30% of the total generated ash against 10 % in 1999 and 3-5% in 1994. The fly ash being generated from the various industries will continue increase in the subsequent years. The percentage of utilization of fly ash in India currently is very less as compared to the other countries like Germany, Netherlands etc where the utilization is above 90 %. As nearly 73% of the country's total installed power generation capacity is thermal of coal-based generation is around 90%. Around 85 thermal power stations, besides several captive power plants use bituminous and sub-bituminous coal and produced fly ash large quantities. High fly ash content around(30% - 50%) coal contributes to these large volumes of ash. Also the country's dependence on the coal for power generation has unchanged. Thus fly ash management is a major cause of concern for the future of Country of India.

In year 2017 Road Ministry has amendment that 300KM areas of construction of major works of government of India, compulsory use of fly ash in there project.

6.4 ENVIRONMENTAL IMPACTS OF FLY ASH:

6.5 Application of Fly Ash:

It can be used as prime material in many cement-based products, such as poured concrete, concrete block, and brick and also may purposes. Portland cement concrete pavement or PCC pavement which is one of the most common uses of fly ash. PCC can use a great deal of concrete Road construction projects using, and substituting fly ash provides significant economic benefits of construction work in project. Fly ash has also been used as embankment fill, mine fill and it has increasingly gained acceptance by the Federal Highway Administration.

Fly ash can be used with replaced with OPC cement in this thesis, which is about 20% by weight of cement it has been replaced.

6.6 Benefits:

Fly ash can be a cost-effective substitute product for Portland cement in markets. Fly ash is also recognized as an environmentally friendly material because it is a by-product and has low *embodied energy as work*, the measure of how much energy is consumed in producing of fly ash and shipping material. By contrast, Portland cement has a very high embodied of energy because its production requires a great deal of heat. Fly ash requires less water than Portland cement and is easier to the use in cold weather of season.

Other benefits are:

- Produces various set times in work
- Cold weather resistance
- High strength gains, depending on use in work
- Can be used as an admixture also
- Considered a non-shrink material of fly ash
- Produces good dense concrete with a smooth surface and sharp detail

Great workability in The World Bank has cautioned India that in 2015, disposal of coal ash or fly ash would require 1000 sq. km. of land. Since coal currently accounts for 70% of power production in the country of India, there is a need of new and innovative methods which is reducing impacts on our environment. The problem with fly ash lies in the fact that, It has not only the large quantities of land for require for disposal of fly ash, water and energy, its fine particles, if not managed well, can become airborne. Currently more 100 million tones of fly ash are being generated annually in our country India, with 65000 acres of land - 4 - being occupied by ash ponds. Such a huge quantity doseposes challenging problems in our country, in the form of land use, health hazards and environmental damages also.

Hazards By virtue of fly ash as physical characteristics and sheer volumes generated, fly ash poses problems like: • It is a very difficult material to handle in dry state, it because it's a very fine material and readily airborne even in mild wind. • It is disturbs the ecology of the region, being a source of soil material, air and also water pollution. • Long inhalation of fly ash causes silicosis, fibrosis of lungs, bronchitis, pneumonitis etc. •Fly ash has a Flying fine particle of ash poses problems for people living near power production stations, corrode structural surfaces and affect horticulture also. • Eventual settlement of fly ash particles over many hectares of land in the vicinity of power production station it brings about perceptible degeneration in soil characteristics.

- work
- Reduces crack problems, permeability, and bleeding of fly ash
- Reduces heat of hydration in work
- Allows for a low water cement ratio for similar slumps when compared it to no-fly-ash mixes of concrete
- Reduces CO2 emission

VII. EXPERIMENTAL PROGRAMMES

The main objective of this experimentation of this project is to find out the effect of replacement of natural sand

by manufactured sand with 0% to 100% for the pavement Quality Concrete M-40 grade. Various trials we have obtained on hardened properties of cement concrete. The experimental work includes the casting of cubes and beams, curing of specimen and testing of specimens. Concrete mix is prepared with proportion of Mix Design with water cement ratio of 0.34.

Three trials are carried out for each concrete mix proportion, All of the experiments are performed in normal room temperature. The ingredients namely cement, fine aggregate(Sand) and coarse aggregate(Metal). Admixture is used for improve workability of concrete work. Manufactured sand is used as a fully replacement of the natural sand by Manufactured Sand, then calculated the amount of water cement ration and mix design as per IRC:44 and IS:10262. Mix it thoroughly to get a homogeneous mix for Pavement Quality Concrete (PQC). Cube casting for compressive strength test having size 150 mmx150 mmx 150 mm and Beam of mould casting size is 700mmx150mmx150mm that are cured in water for 7 & 28 day's and tested at 7 & 28 day's on Universal Cube Testing Machine and Flexural Testing Machine.

7.1 Ingredients Used for Mix Design of PQC:

(I)Cement: Ordinary Portland cement of 53 grade satisfying with all the requirements of IS 8112-1989 was used in making the concrete slab panels and cubes for the experimental work. Cement OPC cement of reliance 53 grade and 328kg used in mix design for Pavement Quality Control experimental work.

(II) Fly Ash: Fly ash has used replaced with OPC cement of reliance 53 grade 20% it can be used, IS: 3812 we have preferred for using fly ash and also MORTH section 600 for replacement of cement by fly ash. we have used 62kg and percentage of cement is 15.9% we have used of fly ash Fly Ash (NTPC Khaperkheda, Nagpur Maharashtra) for PQC work. Specific gravity of fly ash is having 2.29.

(III)Natural (or River) Sand: The natural sand having fineness modulus of sand is that 2.72 and conforming with the zone II as per IS: 383-1970 has used for the experiment after washing it with clean water. The specific gravity(sg) of this natural sand was found to be 2.566. The water absorption values obtained for the natural sand was found having 1.649%.

(IV) Manufactured sand (Crushed sand): The crushed sand having fineness modulus of 2.143 and conforming to zone II as per IS: 383-1970 was used for the experimentation after washing it with clean water. The specific gravity of artificial sand or manufactured sand was found that is to 2.809. The water absorption values obtained for the sand used was found having 1.80%.

(V) Coarse Aggregate: Crushed stone aggregates of 20mm size obtained from local quarry site were used for the experimentation. The aggregates were found specific gravity(sg) of 26.5mm is 2.995 and 10mm aggregates 2.968. The water absorption values obtained for the coarse aggregate of 26.5mm and 10mm used was found to be 0.42% and 0.88% respectively.

(VI) Water: Generally, quality of water for construction works is same as like drinking water. This is to ensure that the water which is used for concrete work reasonably free from such impurities as suspended solids, dissolved salts and organic matter, which may adversely affect the properties of the concrete, especially the setting time, hardening process, its strength and durability value, etc. It is used of borewell near the camp of plant used. The pH value of water shall not less than 6 which is obtained in project work of PQC.

(VII) Admixture: The high range water reducing admixture demand in increases for good workability and it is to achieve a specified slump. In order to identify the correct doses of admixture, HRWRA was added with high dosage may have to be stayed in the mix for a longer period of time. Type of fine aggregate or grading or crushed stone manufactured sand, the HRWRA demands increased with increasing proportions of manufactured sand using for construction work as per the manufacturer of admixture instruction. Admixture is used as percentage of 0.9% by weight is used 3.51kg.

The Features and benefits of Master Polyhued 8632

- better dispersion even in mixes with high fines
- High workability for longer periods
- Resistance to segregation even at high workability
- Extended setting with longer workability
- Reduced water content for a given workability
- Higher ultimate strengths
- Increased ease in finishing concrete
- More than 20percent water reducer

7.2 Workability: The Slump for the mixes tested and the slump recorded. Slump with min. value of 55mm and a maximum value of 90mm in laboratory condition in the field, when trials has completed. The slump is about to 25mm at site and tolerance as per MORTH +15mm & -15mm. The slump has highly and its dependent upon the amount of High Range Water Reducing Admixture (HRWRA) added in the mixture of concrete. Lower slump has associated with mix containing

poorly shaped natural sand along with Manufactured sand. The angularity of the sand decreased the slump and higher paste content may be necessary for these mixtures. We have conical and cubical shape of aggregate of metal of manufactured sand, the mix required higher dosage of high range water reducing admixture to produce slumps with in the acceptable range of 100mm to 120mm.

7.3 Mix Design: -

The mix of M-40 grade concrete for Pavement Quality Concrete designed by fully replacement of natural sand from manufactured sand. We have selected the water cement ratio 0.34 and the minimum cement content 310kg. IS Code 10262:2019 and IRC44:2017 and MORTH used for the mix design work. This approach can be used only if the concrete producer holds a special certificate of product conformity based on product testing and surveillance, coupled with certification of quality assurance.

VIII. TEST RESULTS & GRAPHS

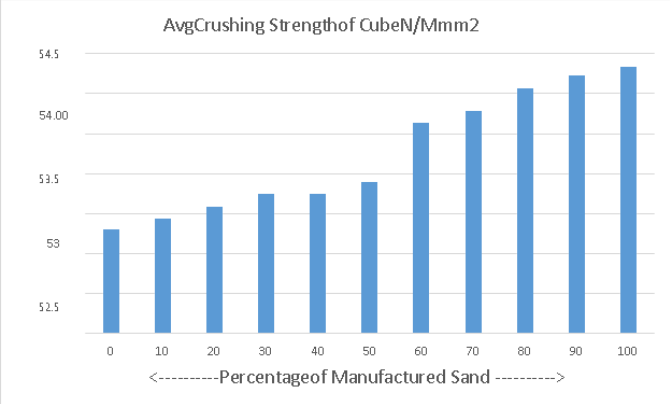
CrushedSand100% & NaturalSand0%			
COMPRESSIVESTRENGTHOFCOCRETECUBE			**(As per IS :516)**
GradeofConcrete	M-40PQC		150*150*150
Typeof Cement	RelianceOPC		3375

Cube No.	Weight (gms)	Volume (cc)	Density (gm/cc)	Agein days	Loadin KN	Compressive Strength	AverageCompressive Strength
1	9264	3375	2.745	28Days	1210	53.78	
2	9311	3375	2.759	28Days	1240	55.11	54.37
3	9302	3375	2.756	28Days	1220	54.22	

28days test results comparison with percentageofCrusher Sand mixed

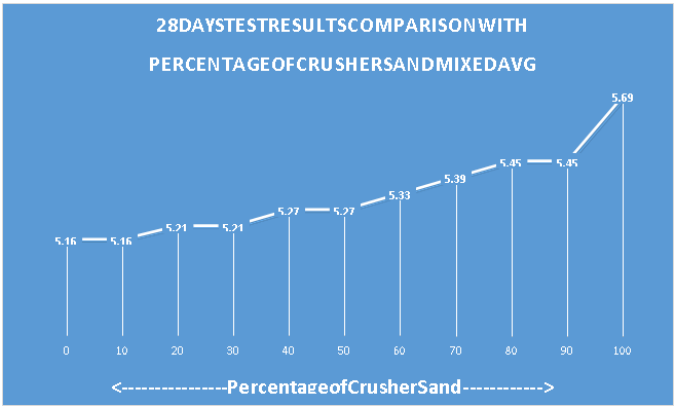
Percentage of NaturalSand	Percentage of CrusherSand	Avg CrushingStrength ofCube
%	%	N/Mmm2
100	0	52.30
90	10	52.44
80	20	52.59
70	30	52.74
60	40	52.74
50	50	52.89
40	60	53.63
30	70	53.78
20	80	54.07
10	90	54.22
0	100	54.37

CrushedSand100% & NaturalSand0%							
FLEXURALSTRENGTHOFCOCRETE BEAM							**(As per IS :516**
GradeofConcrete		M-40PQC				700*150*150	
Typeof Cement		RelianceOPC				15750	
Beam No.	Weight (gms)	Volume (cc)	Density (gm/cc)	Agein days	Position ofCracki nmm	Loadin KN	Flexural Strength N/mm²	AverageFlexural Strengt
1	43995	15750	2.793	28Days	232	31	5.51	
2	43446	15750	2.758	28Days	236	33	5.87	5.69
3	43886	15750	2.786	28Days	228	32	5.69	



28days test results comparison with percentageofCrusher Sand mixed

Percentage of NaturalSand	Percentage of CrusherSand	Avg FlexuralStrength of 28 days
%	%	N/MM2
100	0	5.16
90	10	5.16
80	20	5.21
70	30	5.21
60	40	5.27
50	50	5.27
40	60	5.33
30	70	5.39
20	80	5.45
10	90	5.45
0	100	5.69



IX. CONCLUSIONS & FURURE SCOPE

In this research, Pavement Quality concrete work for road way construction M-sand is very useful of supplementary by the replacement of natural sand. Compressive strength has similar as compared with natural strength and provide high strength, durable and strong quality of the concrete. We have finally observed that likely similar results found by the manufactured sand used in place of the natural sand use in Pavement Quality design work.

Addition of super plasticizer to a concrete mix with M-sand allows mix to have a better workability. The Manufactured needs to use clean washed coarse aggregates getting good quality of crushed sand. Mix design trial which is very important part of pavement Quality Concrete.

9.1 FUTURE SCOPPE:

In this research, Pavement Quality concrete work for road way construction M-sand is very useful of supplementary by the replacement of natural sand. Compressive strength has similar as compared with natural strength and provide high strength, durable and strong quality of the concrete. So that's the reason we use of manufacture sand in various type grades of concrete work as M-20, M-25, M-30 M-35, M-40 for structural or any other type of concrete work and also higher grades of concrete like M-45, M-50, M-55, M-60, M-65 higher grades of concrete, which is also useful of Manufactured Sand which is replaced by the natural sand. Because the properties of M sand results of Strength of Cube strength & Flexural strength which likely similar to the natural sand

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