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Comparative Study on Strength Properties of Cement Concrete due to Partial Replacement of Fine Aggregate (River sand & M-Sand) by Silica Sand

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ABSTRACT: Concrete is a material composed of cement, fine aggregates and coarse aggregates mashed up with water and hardening over time. Portland Cement is the most common race of cement used in the manufacture of concrete. Concrete requires a few weeks to achieve maximum hardness and strength. The concrete is not rotted, corroded or breaks as easily as other building materials, the concrete can be formed or emitted in almost any desired manner. Concrete gradually solidifies after mixing due to the chemical interaction between cement and water. Normally, its strength is tested after 28 days, but the strength of concrete can continue to increase for a year after mixing. Cement composition, curing conditions, humidity and temperature. The longer it is stored in a humid environment (100% humidity) and the higher the temperature, the greater its resistance to any age. Air entrainment, the introduction of very small layers of air into the concrete mix, significantly increases the resistance of the end product to frost cracking. Most outdoor installations today use this technique. Silica is that the name of a bunch of reservoirs of Si associated degredement, the 2 most plentiful components within the earth's crust. acid is often found in an exceedingly crystalline state and infrequently in an amorphous state. of 1 silicon atom and two oxygen atoms, giving the formula SiO_2 . Quartz sand or industrial sand is sand with a very high silicon dioxide content that's not used for construction purposes. For a given supply of sand to be appropriate for process glass, it should not solely contain a awfully high share of silica, however additionally strictly restricted quantities of bound gold elements. they need roughly uniform grain size. Most sand sources utilized in the development traden't meet these needs and are so not suitable for glass production. the commercial use of silica sand depends on its transparency and corporeal properties.

KEYWORDS: Silica sand, M Sand, River sand, Compressive Strength, Flexural Strength.

I. INTRODUCTION

Adding of different materials for the concrete and studying its behavior is an old technique. The 3 main sorts of crystal-like quartz, mineral and mineral, are steady at completely dissimilar heats and exhibit portions. Types of silica sand are White silica sand, Brown silicas and, Round grained silica sand based on the physical properties and there different composition and source of availability.

Scope of Present Investigation

To produce mix design as per code IS 10262:2009 and to decide the compressive power of blend via way of means of partial changing sand via way of means of silica sand and m sand.

II. LITERATURE REVIEW

Kerai Jignesh (2015) "Effect of the use of silica sand as a unique great cloth". Tests have been executed to find out the finely certified bodily and chemical residences and this finely certified silica become partly changed with the aid of using a great unit (15%, 30%, 45% and 60%). From the SEM evaluation, it become concluded that at 15% substitution, the combination stays homogeneous due to the fact the micropores are stuffed and the transition quarter is dense.

B. Durga, M. Indira (2016) carried out the experimental have a look at on "Different Effects of Partial Substitution of

Fine Aggregate with the aid of using Silica Sand in Cement Concrete on MaltarCement".Theessentialgoal of this paintings is to have a look at the results of quartz sand while used as a partial alternative for great aggregates (herbal sand). Silica sand acts as a filler cloththat is inert howevercomplements the hydration methodthrubodily activity. micro-fillingresidences of quartz sand, the pores of concrete are decreased, enhancing the moisture resistance of concrete. in comparison to the energy of traditional concrete. Class M25 concrete is taken as a have a look at. The most advantagepercent reached is 60% and it need to be cited that with a 100% substitute the end resultacquired is same to that of conventionalconcrete.In this paintings, it becomeobserved that ,

- 1) The substitutepercent closest to the most advantagebecome 60% withinside the case of compressive energy and 40% withinside the case of tensile energy after 28 days.
- 2) Compressive energyexpandedwith the aid of using 32% for 60% substitute and 13% for tensile energy for 40% substitute after 28 days.
- 3) SEM evaluationbecomeadditionallyaccomplished to have a look at the grain length of the quartz sand with the aid of using spreading it at one-of-a-kind intervals. Being crystalline in nature, it is able to be used as a filler.

Prof. SR Vaniya, Prof. dr.KBPARIKH, Harish M.rabadiya (2016)carried out an experimental recipient have a look at called "a have a look atat theresidences of cranium concrete the use of Quartz Sand as a partial alternative for the generalgood".Thesubstitutepercent is 0%, 10%, 20%, 30%, 40% and 50% with herbalgreat grain. The conclusions have been as follows

- 1) Silica arene does now no longer have a badimpactat theresidences of SCC. 2) There is andevelopment in cleanresidences of SCC with growing silica sand.
- 3) The end result of hunchchecksuggests that changing quartz sand with 50% greatcombinationwill increase the hunchbelongingsas much as 11.49%.
- 4) In VFunnelcheck, the end resultsuggests that with the aid of usingchanging 50% quartz sand with greatcombination, the VFunnelcheck time is decreasedwith the aid of using 35.71%, because of this that the cleanresidences of SCC are improved .
- 5) In the LBoxcheck, the end resultsuggests that 50% of the quartz sand is changedwith the aid of usinggreat aggregates.

III. MATERIALS AND METHODOLOGY

- **Cement** of ordinary Portland cement (OPC 43) has used in this work, with specific gravity of 3.10, initial setting time of 45 minutes and final setting time of 450 minutes.
- **Fine aggregate**crushed stone sand of the portion from 4.75mm to 150 microns are used as fine aggregate.
- **Coarse Aggregate**of 20mm down size are used.
- **Mix design** was calculated using the IS: 10262:2009.
 - **Mix Proportion:**
 - Cement 394 kg/m³
 - Water 197 kg/m³
 - Fine aggregate655 kg
 - Coarse Aggregate 1140 kg
 - Water-Cement ratio 0.45

The methodology of the work consists of

1. Determining the material specifications to be chosen.
2. Gathering of materials.
3. Determining the qualities of the materials obtained. Perform basic cement, fine aggregate, and coarse aggregate tests.
4. Concrete grade selection.
5. Preparation of M20 grade concrete mix design.
6. Material was used to cast the cubes and beams with the control mix.
7. Test specimen preparation using --%, --%, --%, and --%of silica sand, River sand and M sand in concrete.
8. Concrete workability, compressive strength, and flexural strength tests were performed.
9. The optimal percentage of silica to add to concrete was found.

NATURALSAND specific gravity 2.67

M-Sand 2.70.

Silica Sand.Specific gravity2.66

COARSEAGGREGATESpecific gravity 6.38



IV. MIX DESIGN

Table-1 CONCRETEMIXDESIGNATION

MIX DESIGNATION	DESCRIPTION
SN1	100% NATURAL SAND.
SN2	90% NATURAL SAND+ 10% SILICA SAND.
SN3	80% NATURAL SAND+ 20% SILICA SAND.
SN4	70% NATURAL SAND+ 30% SILICA SAND.
SM1	100% M-SAND.
SM2	90% M-SAND+ 10% SILICA SAND.
SM3	80% M-SAND+ 20% SILICA SAND.
SM4	70% M-SAND+ 30% SILICA SAND

V. RESULTS AND DISCUSSIONS

The tables and bar graphs, on the other hand, illustrate the results of slump experiments performed. The check made on renewed possessions of the management concrete and concrete created with water sand, oxide sand and load with totally different percentages

Table-2 SLUMP VALUES FOR CONTROL CONCRETE AND CONCRETE MADE WITH SILICA SAND AND NATURAL SAND WITH DIFFERENT PERCENTAGES

SLNO.	MIX DESIGNATION	SLUMP(mm)
1	SN1	83mm
2	SN2	96mm
3	SN3	106mm
4	SN4	87mm



FIG1: SLUMP VALUES FOR CONTROL CONCRETE AND CONCRETE MADE WITH NATURAL SAND AND SILICA SAND WITH DIFFERENT PERCENTAGES

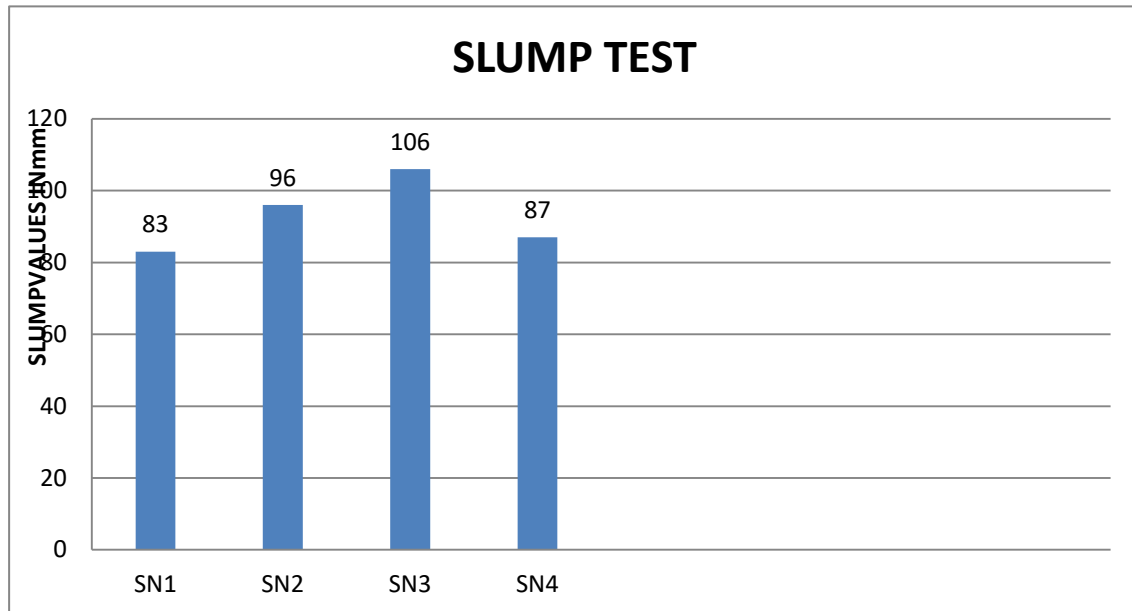
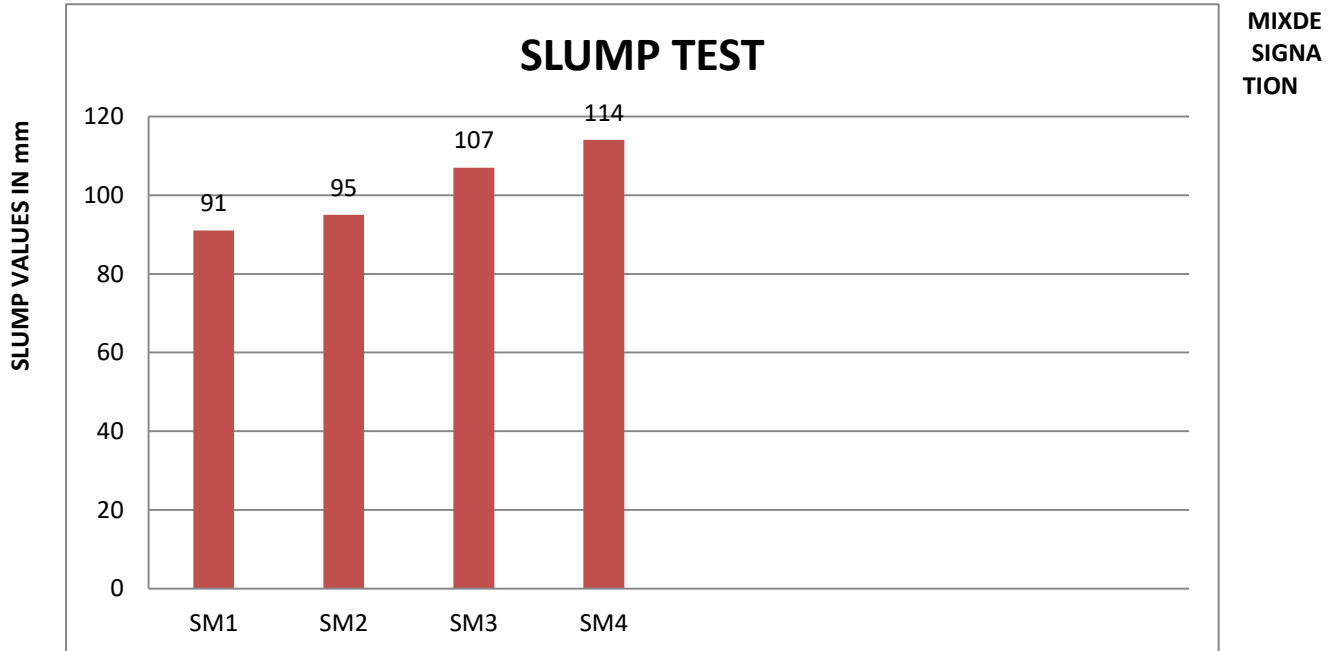


Table-3 SLUMP VALUES FOR CONTROL CONCRETE AND CONCRETE MADE WITH SILICA SAND AND M-SAND WITH DIFFERENT PERCENTAGES

SLNO.	MIX DESIGNATION	SLUMP(mm)
1	SM1	91mm
2	SM2	95mm
3	SM3	107mm
4	SM4	114mm



FIG 2: SLUMP VALUES FOR CONTROL CONCRETE AND CONCRETE MADE WITH SILICA SAND AND M-SAND WITH DIFFERENT PERCENTAGES



COMPRESSIVE STRENGTH OF HARDENED CONCRETE

Table-4: 7 DAY COMPRESSIVE STRENGTH OF CONTROL CONCRETE AND CONCRETE MADE WITH NATURAL SAND AND SILICA SAND WITH DIFFERENT PERCENTAGES

MIX DESIGNATION	CURING PERIOD (DAYS)	FAILURE LOAD (kN)	COMPRESSIVE STRENGTH (N/mm ²)	AVERAGE COMPRESSIVE STRENGTH (N/mm ²)
SN1	28	425	18.90	19.52
		450	20.00	
		443	19.67	
SN2	28	469	20.81	20.42
		469	20.81	
		460	20.47	
SN3	28	464	20.62	21.00
		478	21.32	
		474	21.07	
SN4	28	570	20.00	20.16
		457	20.31	
		454	20.18	



Table-5: 28 DAY COMPRESSIVE STRENGTH OF CONTROL CONCRETE AND CONCRETE MADE WITH NATURAL SAND AND SILICA SAND WITH DIFFERENT PERCENTAGE.

MIX DESIGNATION	CURING PERIOD (DAYS)	FAILURE LOAD (kN)	COMPRESSIVE STRENGTH (N/mm ²)	AVERAGE COMPRESSIVE STRENGTH (N/mm ²)
SM1	28	443	19.67	20.37
		464	20.60	
		470	20.85	
SM2	28	457	20.31	20.63
		470	20.85	
		467	20.75	
SM3	28	474	21.07	21.09
		477	21.20	
		472	21.01	
SM4	28	484	21.51	21.63
		491	21.82	
		486	21.58	

Table-6: 28 DAY COMPRESSIVE STRENGTH OF CONTROL CONCRETE AND CONCRETE MADE WITH M- SAND AND SILICA SAND WITH DIFFERENT PERCENTAGES.

MIX DESIGNATION	CURING PERIOD (DAYS)	FAILURE LOAD (kN)	COMPRESSIVE STRENGTH (N/mm ²)	AVERAGE COMPRESSIVE STRENGTH (N/mm ²)
SM1	7	310	13.77	14.2
		325	14.44	
		330	14.60	
SM2	7	320	14.22	14.47
		330	14.60	
		327	14.53	
SM3	7	332	14.75	14.77
		334	14.84	
		331	14.71	
SM4	7	339	15.06	15.15
		344	15.28	
		340	15.11	



Table-7: 7 DAY COMPRESSIVE STRENGTH OF CONTROL CONCRETE AND CONCRETE MADE WITH M SAND AND SILICA SAND WITH DIFFERENT PERCENTAGES.

MIX DESIGNATION	CURING PERIOD (DAYS)	FAILURE LOAD (kN)	COMPRESSIVE STRENGTH (N/mm ²)	AVERAGE COMPRESSIVE STRENGTH (N/mm ²)
SM1	7	310	13.77	14.2
		325	14.44	
		330	14.60	
SM2	7	320	14.22	14.47
		330	14.60	
		327	14.53	
SM3	7	332	14.75	14.77
		334	14.84	
		331	14.71	
SM4	7	339	15.06	15.15
		344	15.28	
		340	15.11	

The subsequent table displays the overall compressive strength results for concrete through with river sand, silica sand and sand with dissimilar percentages of fine aggregates. The evolution of the compressive strength in the form of a graph is exposed in the graph figure 6.3

Table-8: OVERALL RESULTS OF COMPRESSIVE STRENGTH (7 DAYS).

MIX DESIGNATION	COMPRESSIVE STRENGTH (N/mm ²)	MIX DESIGNATION	COMPRESSIVE STRENGTH (N/mm ²)
	7Days		7Days
SN1	13.67	SM1	20.37
SN2	14.50	SM2	20.63
SN3	14.71	SM3	21.09
SN4	14.11	SM4	21.63



FIG 6.3: 7 DAY COMPRESSIVE STRENGTH OF CONTROL CONCRETE AND CONCRETE MADE WITH RIVER SAND, SILICA SAND AND M-SAND WITH DIFFERENT PERCENTAGES

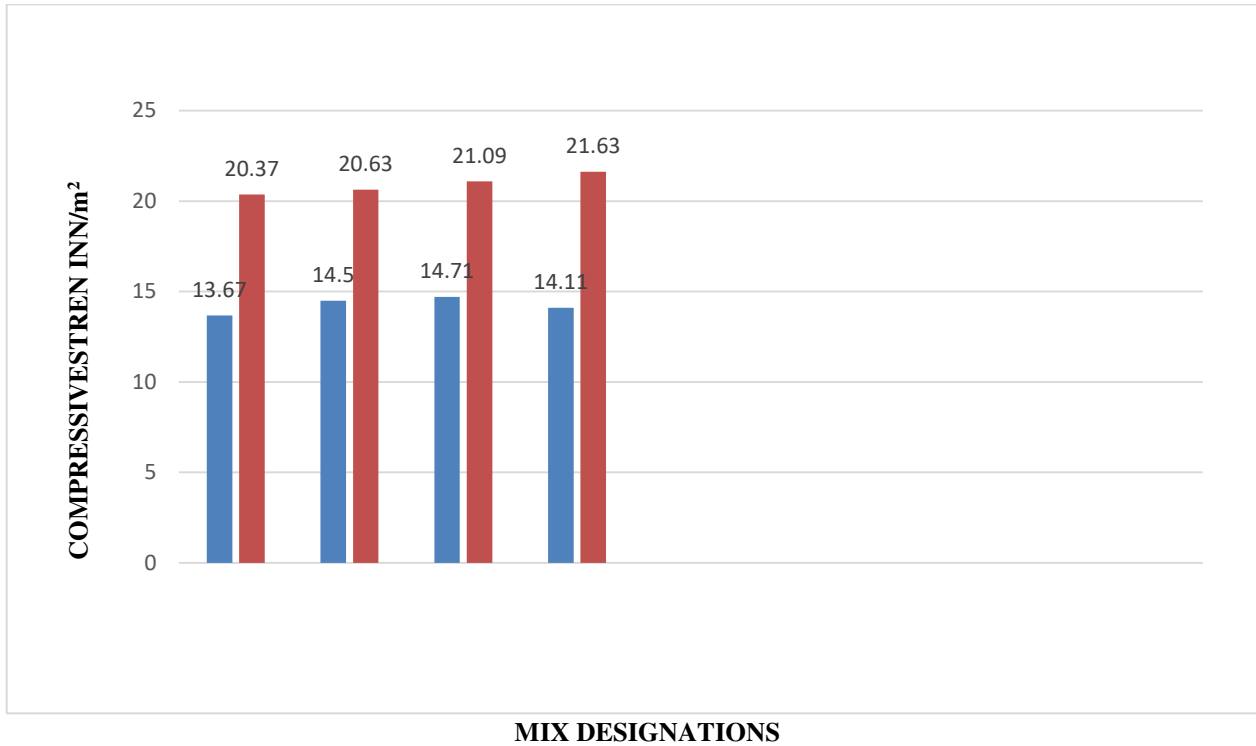
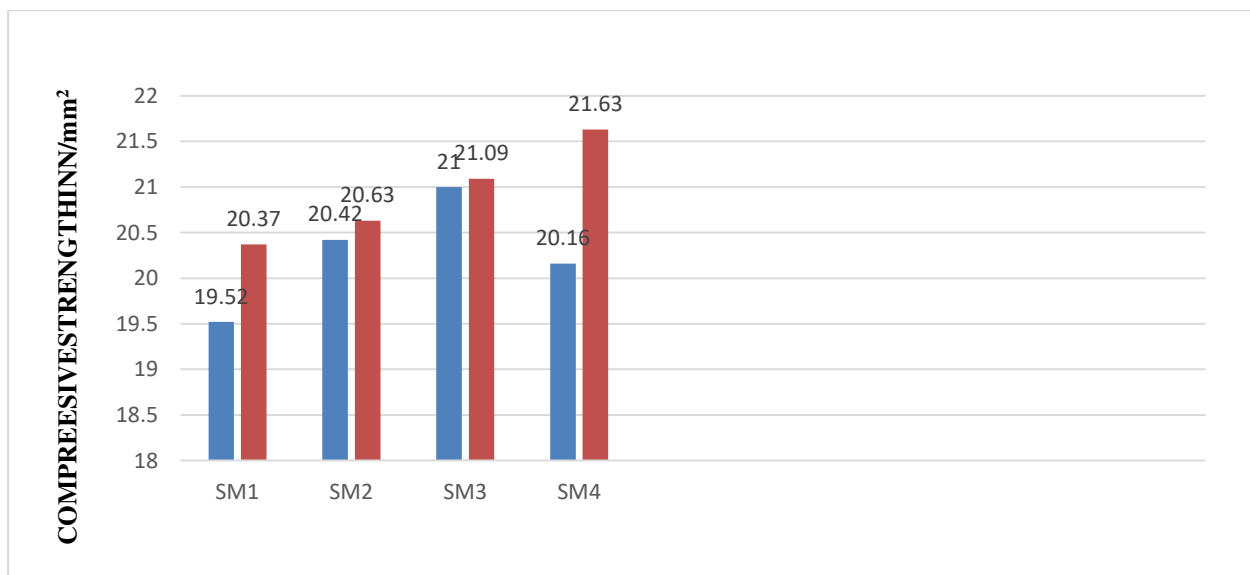


Table-9: OVERALL RESULTS OF COMPRESSIVE STRENGTH. (28 DAYS).

MIX DESIGNATION	COMPRESSIVE STRENGTH (N/mm ²)	MIX DESIGNATION	COMPRESSIVE STRENGTH (N/mm ²)
	28 Days		28 Days
SN1	19.52	SM1	20.37
SN2	20.42	SM2	20.63
SN3	21.00	SM3	21.09
SN4	20.16	SM4	21.63



FIG 6.4: 28 DAYS COMPRESSIVE STRENGTH OF CONTROL CONCRETE AND CONCRETE MADE WITH RIVER SAND, SILICA SAND AND M-SAND WITH DIFFERENT PERCENTAGES.



MIX DESIGNATIONS

VI. DISCUSSIONS AND CONCLUSION

- It was found out from the slump values that the workability of concrete with fractional spare of each silica sand for natural sand and Msand is smart, but the value of sag is high at SN3 and falls continuing only in case of MSand.
- It has been pragmatic that there is a noticeable improvement in the compressive strength of the cubes with the combination of natural sand and natural sand. high for the mixture with auxiliary of 20% natural sand by silica sand.
- Only in the case of concrete cubes with replacement of MSand by silica sand does the upward trend continue.
- From the discussion following the conclusion can be derived.
- Silica can also be used as a substitute material for the thin suit and acceptable compressive strength can be achieved.
- Once the concrete has been formed, by mistreating the Natural Sand like a Fine Aggregate, a 20% reassembly can be carried out.
- Once the concrete has been made with MSand as fine aggregate, silica sand can be replaced by 30%. With this silica sand, it can be effectively used in the preparation of concrete.

VII. SCOPE FOR FURTHER STUDIES

- Effect of acid on strength properties.
- Influence of alternating wetting and drying on toughness properties.

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