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Structural Behaviour of Concrete Beams Using Marble Dust and Hybrid Rods in Self Compaction Concrete

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ABSTRACT: The lookup on the improvement of electricity in concrete led to the invention of many new techniques. Likewise the alternative of primary elements (cement, nice aggregate, coarse aggregate) with different cloth is additionally occurring in a huge, such as changing cement with silica fumes, GGBS, fly ash, Granite and Marble powder etc.,

In this mission experimental learn about used to be carried out the usage of Granite powder in self-compaction concrete. This undertaking targets in utilizing the development enterprise waste (i.e. marble dust) in a beneficial manner to put together the concrete and additionally to limit the environmental impact due to the damping of marble powder. This undertaking is carried out as an experimental investigation on the residences of M-40 concrete with alternative of high-quality mixture through Marble powder.

The a number of proportions of marble powder changed for fantastic combination (i.e., Natural sand) are 0%, 5%, 10%, 15%, 20% and results will be studied. In addition to the find out about of sparkling and hardened homes of concrete in the self-compaction and fabrication will be carried out for a beam the usage of TMT rods and HYBRID rods.

The float houses of concrete is characterised in the sparkling nation through exams used for self-compacting concrete, such as droop flow, V-funnel and L-box take a look at respectively. The range of trial combos is used and check such as stoop flow, V- funnel and L-box etc., are performed to test their permissible limits.

The structural behaviour of beam below exceptional loading circumstance will be studied in self compaction concrete with the combine proportions enjoyable the nominal energy parameter. The the use of of Granite powder and in TMT bars and HYBRID bar concrete beams are studied with the aid of experimentations.

KEYWORDS: Marble powder, concrete, compressive strength, split tensile test, flexure test.

I. INTRODUCTION

General

Development of new technological know-how in the fabric science is progressing rapidly. In last three many years a lot of lookup used to be carried out for the duration of globe to enhance the overall performance if concrete on phrases of electricity and sturdiness quantities. Consequently concrete has no longer remaining development fabric consisting of cement. Aggregate, and water only, however has becomes an engineered customized fabric with a number of new materials to meet the specific needs of building industry. The developing use of concrete in one-of-a-kind architectural configurations and intently spaced reinforcing bars have made it very vital to produce concrete that make certain roper filling capability .good structural overall performance and sufficient durability.

In latest years, a lot of lookup was once carried out via the world to necessary the performance and ample he overall performance of concrete in phrases of is most necessary property.

In general, when the clean excellent of SCC used to be satisfactory, the overall performance of SCC was similar to that of self-compaction concrete. However, expertise about the performance of SCC precast harassed concrete participants is limited. Reinforced concrete, concrete-steel, and hybrid metal bar of armoured concrete are phrases given to a construction composed mainly of concrete and having a small quantity of metallic so embedded as to take the main tensile stresses and possibly the secondary tensile and shearing stresses developed.

As the energy of concrete in compression is countless instances its electricity in tension, and as plain concrete breaks in anxiety besides warning, the addition of the metallic corrects a deficiency of plain concrete, and the mixture varieties a shape which has many vital applications in engineering and architectural construction. With the improvement of the

Portland cement industry and the speedy extension of the use of concrete, it is now not abnormal that strengthened concrete has come into favor and that its use in buildings, arches, and foundations has grown rapidly. The benefits presented by means of strengthened concrete for many strains of development are quite apparent, however conservative engineers and architects have been fairly reluctant to appoint it because of the feeling that the standards governing its power Sand and marble powder action have no longer been properly established. Many assessments have been made on bolstered concrete and sizable valuable information is available. However, such facts are scattered extensively via more than a few engineering publications and the effects are no longer altogether constant.

II. RELATED STUDY

1. Mogawer and Stuart 1996

Studied whether mastic and mixture properties can distinguish good mineral fillers from poor ones. Eight mineral fillers with known performance were obtained from three European countries. Mastics were tested for stiffness using the BBR, DSR and ring-and-ball softening point. They found that none of the tests distinguished among mastics with good and poor fillers. However, there was good correlation between the free binder content and the stiffness of the mastics measured by the bar and the stiffening power measured using the ring- and-ball apparatus.

The WMD used as partial replacement of pc clinker in the amount of 0%, 2.5%, 5.0%, 7.5% and 10% by weight and grounded together with pc clinker and gypsum in order to produce composed cement with additive. Amount of gypsum was fixed as 5% by weight in the cement manufacturing in this study. Amount of WMD was substituted with the same amount of Portland cement clinker. The mixture proportions of constituents used for production of composed cement with WMD. Portland cement clinker, WMD and gypsum should be separately grounded at specified proportions by means of ball milling. Grinding period was fixed as 1 h in the experiments. The cement pastes are to be prepared by using laboratory type mixer. Initial and final setting times and standard consistency of cement pastes were determined. Soundness of cement pastes was determined by le chatelier method. Prepared cement mortars were placed into the steel moulds and after 24 h, samples were removed from moulds.

2. Bouziani Tayeb, Benmounah Abdelbaki1, Bederina Madani and Lamara Mohamed (2011)

Recently, the consumption of aggregates in construction has rapidly increased because of the rapid economic development of countries. The sand concrete is a family of cement concretes which can be used to overcome the economic problems met in the use of coarse aggregates. Moreover, many applications (In France particularly) of self-compacting sand. concretes (SCSC) were attempted concrete of repairs, soil grouting and deep foundations for building) in the project Sablocrete. SCSC can be regarded as a special type of sand concrete, because the constituent materials used in SCSC are essentially the same as those of sand concrete. Normally, sand concrete consist of a mixture of sands, cement, one or more admixtures, additions and water. The main difference between SCSC and the sand concrete is the actual proportioning of these materials.

3. Ali 1996, Cooley Et Al. 1998

Found that fly ash can be used as a mineral filler to improve resilient characteristics and stripping resistance. it evaluated the stiffening potential of bag house fines using conventional and super pave binder tests and established a reasonable upper limit on the percent bulk volume of dry compacted bag house fines, as determined by the Pennsylvania state university- modified (penn state modified) rig den void test, which would limit the stiffening potential. Because of the setting of the fines during testing with dsr, only the softening point test and the Brookfield viscometer gave test data that has excellent correlation with the rig den voids.

Marble as a coarse aggregate (wuetal., 2001) and as a fine aggregate passing through 1 mm sieve (binicietal., 2007). Generally, in literature waste marble dust has been replaced with either all of the fine aggregate (0 - 4 mm) or passing 1 mm sieve. However, not a single study on the performance of the concrete prepared by replacing very fine sand and marble powder (passing 0.25 mm sieve) with WMD. the studies concerning the utilization of marble dust, which is obtained as a by-product of marble sawing and shaping processes in the factories those operating in our region as a fine sand and marble powder aggregate into the normal strength concrete have not reached a convincing conclusion; in other words, additional studies and investigations are necessary to fully evaluate the potential usages of this waste material.

Therefore, the aim of this current study is both to avoid the environmental pollution and to investigate the usability of the marble dust instead of very fine sand and marble powder passing through a 0.25 mm sieve at proportions of 0, 25, 50 and 100% by weight on the concrete. In this way, we will help to protect the environment by consuming the

waste marble dust obtained as a by-product of marble sawing and shaping processes in the factories those operating in our region.

4. Bahar Demirel

Marble has been commonly used as a building material since the ancient times. The industry's disposal of the Marble powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world (Corinaldesi et al., 2010). Marble blocks are cut into smaller blocks in order to give them the desired smooth shape. During the cutting process about 25% the original marble mass is lost in the form of dust. In Turkey marble dust is settled by sedimentation and then dumped away which results in environmental pollution, in addition to forming dust in summer and threatening both agriculture and public health. Therefore, utilization of the marble dust in various industrial.

A. MATERIAL FOR SELF COMPACTION CONCRETE

Portland Pozolonic cement:

Portland Pozolonic cement concrete is major amongst the development fabric used in civil engineering venture round the world. The motives for its frequently use of varied, however amongst the greater significance are the monetary and full-size availability of its constituents, its versatility and adaptability, as evidenced by way of the many kinds of building in which it is used, and the minimal upkeep requirement at some stage in services. Concrete is special amongst principal building substances in that it is typically designed in particular for a unique task the use of domestically handy materials.

Micro structural improvement in Portland cement pastes. The hydration response of the two calcium silicates are very similar, differing solely in the quantity of calcium hydroxide fashioned as considered in the following equations.

Sand

All normal concreting sands are suitable for SCC. Both crushed and rounded sands can be used. Siliceous or calcareous sands can be used. The amount of fines less than 0.125 mm is to be considered as powder and is very important for the SCC. A minimum amount of fines (arising from the binders and the sand) must be achieved to avoid segregation.

Marble powder

Marble is a non-foliated metamorphic rock composed of recrystallized carbonate minerals, most commonly calcite or dolomite. Geologists use the term "marble" to refer to metamorphosed limestone; however, stonemasons use the term more broadly to encompass unmetamorphosed limestone. Marble is commonly used for sculpture and as a building material.

Marble is a rock resulting from metamorphism of sedimentary carbonate rocks, most commonly limestone or dolomite rock. Metamorphism causes variable recrystallization of the original carbonate mineral grains. The resulting marble rock is typically composed of an interlocking mosaic of carbonate crystals. Primary sedimentary textures and structures of the original carbonate rock (protolith) have typically been modified or destroyed.

Pure white marble is the result of metamorphism of a very pure (silicate-poor) limestone or dolomite protolith. The characteristic swirls and veins of many colored marble varieties are usually due to various mineral impurities such as clay, silt, sand, iron oxides, or chert which were originally present as grains or layers in the limestone. Green coloration is often due to serpentine resulting from originally high magnesium limestone or duotone with silica impurities. These various impurities have been mobilized by the intense pressure and heat of the metamorphism.

Super plasticizer:

As it exhibits higher workability, greater mechanical properties and better durability, HPC has been increasingly applied in the constructions such as tall building, bridges and off-shore structures. One important chemical admixture in preparing SCC is super plasticizer. The most important improvement in concrete technology during the 30 last years has been the use of super plasticizers. However, the reason that super plasticizers are much more important than any other chemical admixture is the number of improvements, which can be achieved by its use.



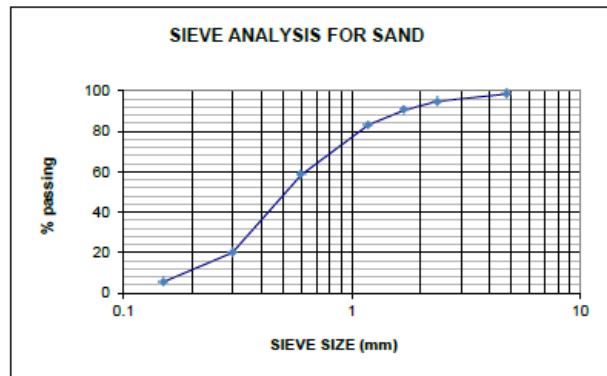
III. TESTING OF MATERIAL

SAND:

All regular concreting sands are appropriate for SCC. Both overwhelmed and rounded sands can b used. Siliceous or calcareous sands can be used. The quantity of fines much less than 0.125 mm is too viewed as powder and is very essential for the SCC. A minimal quantity of fins (arising from the binders and the sand) ought to be performed to keep away from segregation.



Plot:



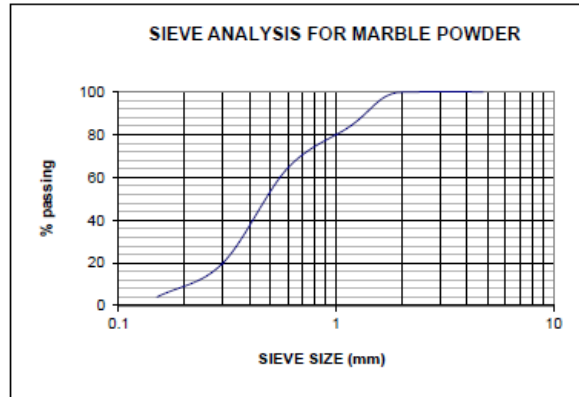
MARBLE POWDER:

Pure white marble is the end result of metamorphism of a very pure (silicate-poor) limestone or dolomite protolith. The attribute swirls and veins of many shade marble types are typically due to quite a number mineral impurities such as clay, silt, sand, iron oxides, or chert which had been at the start existing as grains or layers in the limestone. Green coloration is frequently due to serpentine ensuing from in the beginning excessive magnesium limestone or dolostone with silica impurities. These a variety of impurities have been mobilized and recrystallized by using the excessive strain and warmth of the metamorphism.

Construction marble is a stone which is composed of calcite, dolomite or serpentine which is succesful of taking a polish. More usually in construction, specially the dimension stone trade, the term "marble" is used for any crystalline calcitic rock (and some non-calcitic rocks) useful as constructing stone. For example, Tennessee marble is certainly a dense granular fossiliferous grey to crimson to maroon Ordovician limestone that geologists name the Holston Formation.



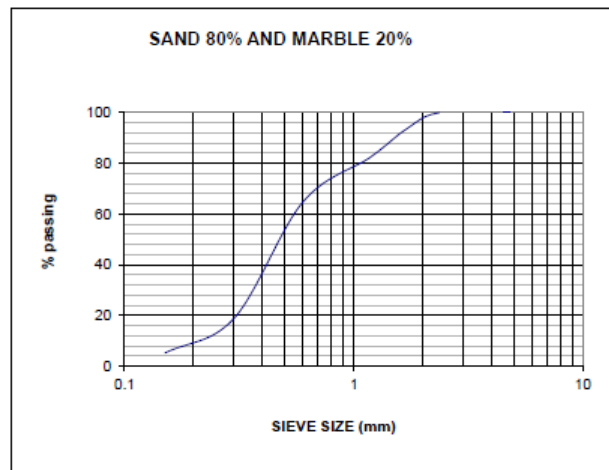
Plot:



REPLACEMENT OF SAND BY MARBLE POWDER WITH VARIOUS MIXES RATIO:

The various proportions of marble powder is replaced for fine aggregate are 0%, 5%, 10%, 15%, &20%, and partial size distribution curve for Replacement of sand in each ratio is studied.

Plot:



IV. EXPERIMENTAL PROGRAM

SLUMP FLOW TEST

The droop waft is used to examine the horizontal float of self compacting concrete in the absence of obstruction. This technique is primarily based on the check technique for identifying the slump. The diameter of the concrete circle is a measure for the filling potential of concrete. This take a look at offers proper evaluation on the filling potential of the concrete and some indication of resistance to segregation.

Procedure:

1. About 7 litres of concrete used to be taken to operate the test.
2. The base plate and internal facet of stoop cone had been moistened.
3. Slump cone was once centrally positioned over the base plate and firmly held.
4. Cone was once stuffed with concrete.
5. Then the cone was once raised vertically and concrete was once allowed to flow.
6. Diameter of the hunch was once measured.



V-funnel test:

The gear consist of a v-shaped funnel, the check is used to determine the filling capability (flow ability) of the concrete with a most mixture size of 20mm. The funnel is stuffed bout 12 litres of concrete and the time for it to float thru the equipment measured.

Procedure:

1. About 12 litres of concrete used to be taken.
2. The V- funnel was once set on company ground.
3. The internal surfaces of the funnel was once moisture.
4. The equipment used to be totally crammed with concrete besides compacting or tamping, easy strike off the concrete.
5. He entice door used to be open inside 10 sec after filling and the concrete used to be allowed to float out beneath is gravity.
6. The time for whole discharge of concrete as mentioned (the waft time).



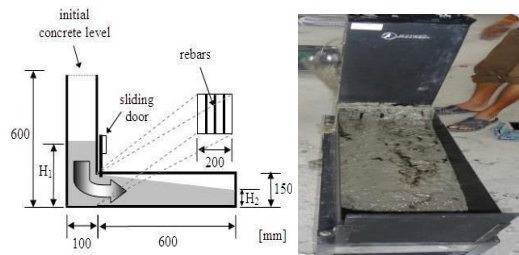
PASSING ABILITY TEST:

L-box test:

The check assesses the glide of the concrete, and additionally the extent to which it is subjected o blockading with the aid of reinforcement. The equipment consist of a rectangular- area field in the structure of an 'L', with a vertical and horizontal section, separated via a movable gate, in the front of which vertical size of reinforcement bars are fitted.

The vertical part is stuffed with concrete, are then the gate lifted to let he concrete drift in the horizontal section. When the go with the flow has stopped, the top of the concrete at the cease of the horizontal area is expressed as a share of that final in the vertical part (H_2/H_1 in the diagram). It suggests the slope of the concrete when at rest. This is an indicated of passing ability, or the diploma to which the passage of concrete via the bars is restricted.

The horizontal part of the field can be marked at 200mm and 400mm from the gate and then taken to attain these factor measured. These are is aware of s the t_{t20} and t_{t40} time and are an indication for the filling ability. It assesses filling and passing potential of self compaction concrete and serious lack of balance (segregation) can discover visually.



U-box test:

This check is additionally known as as “box-shaped” test. The take a look at is used to measure the passing potential of self compaction concrete. The equipment consists of a vessel hat is divided via a center wall into two compartments, indicates R1 and R2.

An opening with a sliding gate is geared up between the two sections. Reinforcing bars with nominal diameter of thirteen mm are set up at the gate with centre-to-centre spacing of 50mm. This creates a clear spacing of 35mm between the bars. The left hand area is stuffed with about 20 litres of concrete then the gate lifted and concrete flows upwards into the different section. The peak of the concrete in each sections is measured. It furnished a properly direct evaluation of filling ability.



J-Ring Test

Procedure:

1. This take a look at is carried out in mixture with the droop go with the flow size as described above.
2. The Abram’s cone can be used upright or inverted. If used upright, it should be modified by
3. Removal of the foot portions so that the cone will in shape into the J-Ring apparatus.
4. After the preliminary stoop go with the flow dimension (d1), the J-Ring is positioned in the centre of the droop drift board.
5. The Abram’s cone (using the identical cone orientation) is positioned interior the J-Ring and is stuffed in one lift.
6. The cone is raised to a peak of 230 ±75 mm (9 ±3 inches) in three ±1 seconds.
7. The SCC flows thru the reinforcing bars of the J-Ring and onto the droop drift board.
8. The diameter of the hunch go with the flow patty is once more measured to grant the J-Ring Flow, d2.
9. Complete the checks with and except the J-Ring inside 6 minutes.
10. A distinction much less than 25 mm (1 in.) suggests proper passing ability, and a distinction increased Than 50 mm (2 in.) shows negative passing capability.



V. RESULTS

WORKABILITY TEST RESULT:

The investigation is carried out by way of various thee marble dirt content material by means of changing sand and the outstanding plasticizer dosage. In the first investigation the cement content material is stored as 508 kg/m3 and five



mixes have been examined in order to acquire the self-compaction concrete characteristics. The given small print of the combine composition with exceptional plasticizer dosage taken for the investigation.

DESCRIPTION	0%	10%	20%	30%	40%	Suggested value as per code
SLUMP FLOW mm	675	750	720	690	675	600-800
V-FUNNEL(sec)	8	9	11	13	14	8-12
L-BOX (mm)	0.8	0.90	1.2	0.88	0.75	0.8-1
U-BOX (mm)	28	25	27	29	34	0-30
J-RING (mm)	9	9	9	10	12	0-10

HARDENED CONCRETE RESULT:

The hardened concrete compressive strength test result for the SCC mixes obtained are given in the table given below Cubes:

Compressive strength:

Hardened concrete compressive strength test result for 7 th day

SPECIMEN INDEX	MARBLE POWDER	COMPRESSIVE STRENGTH IN 7 DAYS		
		SPECIMEN 1	SPECIMEN 2	AVG
A0	0	37.5	37.5	37.5
B5	5	38	40	39
C10	10	35.25	36.75	36
D15	15	28	30	29
E20	20	23	25	24

Compressive strength test result for 7th day

Hardened concrete compressive strength test result for 28th day

SPECIMEN INDEX	MARBLE POWDER	COMPRESSIVE STRENGTH IN 28 DAYS		
		SPECIMEN 1	SPECIMEN 2	AVG
A0	0	55.3	55.4	55.35
B5	5	56.98	60.60	58.79
C10	10	54.45	55.78	55.10
D15	15	40.3	43.71	43.5
E20	20	37.80	39.70	38.76

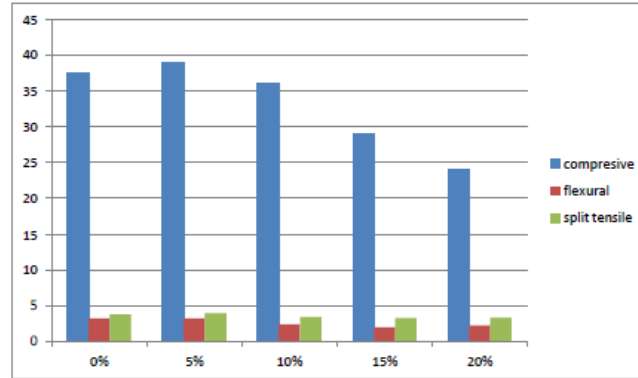
ANALYSE THE STRENGTH OF CONCRETE

Strength for different mixes it marble powder alone for 0% to 20% for 7th day test is shown in below

SPECIMEN INDEX	MARBLE POWDER	COMPRESSION STRENGTH	FLEXURAL STRENGTH	SPLIT TENSILE STRENGTH
A0	0	37.5	3.2	3.78
B5	5	39	3.2	3.4
C10	10	36	2.4	3.4
D15	15	29	2	3.28
E20	20	24	2.4	3.33



Chart:



REPLACEMENT OF MARBLE POWDER BY SAND

CYLINDER
Split tensile test:

Hardened concrete split tensile strength test result for 7th day

SPECIMEN INDEX	MARBLE POWDER	SPLIT TENSILE STRENGTH IN 7 DAYS		
		SPECIMEN 1	SPECIMEN 2	AVG
A0	0	3.92	3.88	3.78
B5	5	3.81	4.10	3.96
C10	10	3.15	3.65	3.4
D15	15	3.15	3.40	3.28
E20	20	3.15	3.52	3.33

Split tensile strength test result for 7th day

Hardened concrete split tensile strength test result for 28th day

SPECIMEN INDEX	MARBLE POWDER	SPLIT TENSILE STRENGTH IN 28 DAYS		
		SPECIMEN 1	SPECIMEN 2	AVG
A0	0	4.58	5.10	4.82
B5	5	4.61	3.91	4.9
C10	10	4.42	4.42	4.42
D15	15	3	3.26	4.9
E20	20	5	5.10	5.05

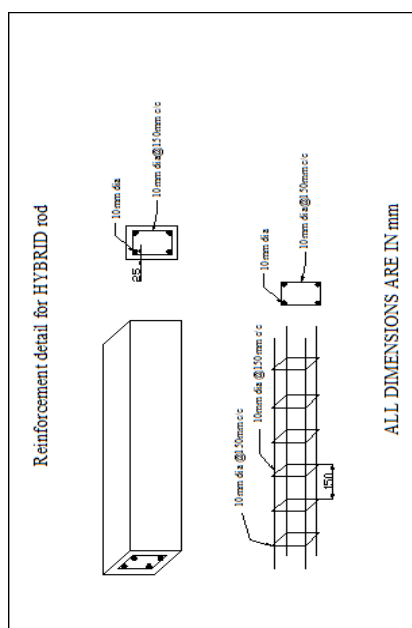
Split tensile strength test result for 28th day

BEAMS

Hardened concrete flexural strength test result for 7th day

SPECIMEN INDEX	MARBLE POWDER	FLEXURAL STRENGTH IN 7 DAYS		
		SPECIMEN 1	SPECIMEN 2	AVG
A0	0	3	3.4	3.2
B5	5	3.1	3.3	3.2
C10	10	2.2	2.6	2.4
D15	15	2	2	2
E20	20	2.4	2.10	2.24

Flexural strength test result for 7th day



VI. CONCLUSION

The fineness modulus of marble powder and sand is 4.512 and 4.74. Marble powder is very fine particles when compared to sand particles.

- ✓ The workability results for fresh concrete can be summarized as,
- ✓ The slump value (500-800mm), is satisfied with 0%, 5%, 10%, 15% and 20% replacement of sand by marble powder.
- ✓ V-funnel test (8-12 sec) is satisfied with 0%, 5%, 10%, 15% and 20% replacement of sand by marble powder.
- ✓ L-box test (0.8-1mm) is satisfied with 0%, 5%, 10%, 15% and 20% replacement of sand by marble powder.
- ✓ U-box test (0-30 mm) is satisfied with 0%, 5%, 10%, 15% and 20% replacement of sand by marble powder.
- ✓ J-ring tests (0-10 mm) are satisfied with 0%, 5%, 10%, 15% and 20% replacement of sand by marble powder.
- ✓ The hardened concrete test results can be summarized as,
- ✓ The compressive strength of hardened concrete is 55.35Mpa and for 5% 43.5Mpa for self compaction concrete. Thereafter, the compressive strength of the concrete reduces with increase in the percentage of marble powder.
- ✓ The flexural strength of hardened concrete is 5.3Mpa for 5% and 5.6Mpa for self compaction concrete. There after the flexural strength value reduces with increase in percentage of the marble powder.
- ✓ The split tensile strength of hardened concrete is 4.9Mpa for 5% and 4.42Mpa for self compaction concrete. There after the split tensile strength value reduces with increase in the percentage of marble powder.
- ✓ The maximum stress value is obtained at the replacement percentage of 5%. Hence this is satisfied. And the replacement proportion of 5% replacement in sand is selected for casting the beams.
- ✓ On loading, the deflection in TMT bar concrete beam is uniform up to 51.5 Mpa, after that it is decreasing gradually. The ultimate load taken by the beam is 51.5 Mpa and the corresponding deflection is 5.1 mm.
- ✓ On loading, the deflection in HYBRID bar is uniform up to 58.8Mpa, after that it is decreasing gradually. The ultimate load taken by the beam is 58.8 Mpa and the corresponding deflection is 6.1 mm.
- ✓ From load deflection curve it is concluded that the marble powder can be successfully replaced in structural member like beams.
- ✓ The scope in future work is that, it can be carried out in the various grade of concrete and it can be taken on the construction of other structural members like columns, prefabricated structure, pavers, flooring, roof slab etc.,



REFERENCES

1. Mogawer and Stuart, "An Experimental Research On Sand And Marble Powder Concrete In Mekong Delta", In Proceeding Of The 3rd International Conference- Acf/Vca On Sustainable Concrete Technology And Structures In Local Climate And Environment Conditions, Vietnam, 2008, Pp.455-461.
2. Bouziani Tayeb, Benmounah Abdelbaki1, Bederina Madani and Lamara Mohamed "Durable Fibre Reinforced Self compacting Concrete", Cement and Concrete Research, Vol. 34, No. 2, Pp. 249-254, 2004.
3. Rajan Choudhary , Satish Chandra, "Use Of Different Limestone And Chalk Powders In Self-Compacting Concrete", Cement And Concrete Research, Vol. 35, Pp. 1457-1462, 2005.
4. Bahar Demirel, "Reuse Of Local Sand And Marble Powder: Effect Of Limestone Filler Proportion On The Rheological And Mechanical Properties Of Different Sand And Marble Powder Concretes", Cement And Concrete Research, Vol. 35, Pp. 1172-1179, 2005.
5. B. Felekolu, And B. Baradan, "Utilisation Of Limestone Powder In Self-Levelling Binders", In The Proceedings Of The International Symposium On Advances In Waste Management And Recycling, Thomas Telford Ltd., Pp. 475-484,.
6. K. E. Alyamaç, And R. Ince, "A Preliminary Mix Design For SCC with Marble Powders", Construction And Building Materials, Vol. 23, Pp. 1201-1210, 2009.
7. Z. Jiang, And S. Mei, "Properties of Self-Compacting Concrete With Machine-Made Sand And Marble Powder And High-Volume Mineral Admixtures", The Open Construction And Building Technology Journal, Vol. 2, Pp. 96-102, 2008.
8. Dr.T. Felix Kala, The European Guidelines For Selfcompacting Concrete, Specification, Production And Use.
9. Ali 1996, Cooley Et Al. 1998 "The Effect Of Fly Ash And Limestone Fillers On The Viscosity And Compressive Strength Of Self-Compacting Repair Mortars", Cement And Concrete Research, Vol. 36, Pp. 1719-1726, 2006.



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