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Experimental Investigation on Strength Properties of Concrete Blended with Dolomite Dust Powder with Slag Sand and Recycled Agrregates

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ABSTRACT

The most common building material utilized for hundreds of years is concrete. Natural resources are needed to produce concrete, and as a result, energy and natural resource output are declining daily. One of the major sources of carbon dioxide, a powerful greenhouse gas that contributes to global warming, is this cement producing company. Society has been concerned about the expense of concrete materials used in construction and civil engineering projects. This need has prompted researchers to look at potential new concrete component substitutes. In order to decrease cost and environmental impact, several experimental researches have been conducted to determine the best substitute for these basic ingredients for concrete. Dolomite powder may be utilized advantageously in concrete as a partial replacement for cement by taking into accounts all of these factors and the current necessity. In this study, the strength and workability characteristics of concrete mixed with slag sand, dolomite dust powder, and recycled aggregate are examined.

In this study, dolomite dust powder is utilized as a partial substitute for cement at 0, 10, 20, 30, and 40% by weights of cement, and slag sand is used as a total replacement to Natural sand and partial replacement of coarse aggregate by recycled aggregate at 0, 20, 40, 60, 80 and 100% by weight, in M30 grade concrete. In this study, concrete strength properties for compressive, split tensile and flexural strengths at 28 days are determined through experimental investigations. The results have been analyzed by plotting graphs and useful conclusions have been drawn for producing sustainable concrete of M30 grade.

Keywords: Dolomite, Slag sand, recycled aggregate, Compressive strength, Tensile strength and Flexural strength.

I. INTRODUCTION

1.1. GENERAL

In the globe today, concrete is the most used building material. Skyscrapers, industrial parks, highways, roadways, and hydro constructions are only a few examples of the buildings for which concrete is used extensively in construction. Concrete is the most often used building material because it can be arranged in a variety of geometrical forms. It consists of a mixture of cement, coarse and fine aggregates, and water. These materials have disposal hurdles, health risks, and aesthetic drawbacks. Due to its broad usage in concrete, cement is being used more and more globally. Every year, almost 5 billion kg of cement are produced there and throughout the world. Moreover, the cement making is lowering the lime supplies with within globe and also wants a great quantity of energy.

Spreading the sedimentary rock generating minerals led to the formation of Dolomite powder. Up to a particular percentage, dolostone may be used as a filler metal to cement in concrete. Dolomitization is the name given to this chemical alteration. $CaMg(CO3)2$ makes up the carbonated mineral known as dolomite. Dolomite is a mineral that forms rocks and is renowned for its exceptional flowability and dispersibility. Dolomite has a very high resistance to weathering. Dolomite's exceptional surface polish, strength, and density make it a popular building material. Dolomite is a popular filler element in concrete applications because of its increased strength and hardness. It is possible to reduce construction costs and increase structural durability and strength by using the right calcite powder.

Cement should not be confused with concrete since the term only refers to the material used to bind the key components of concrete. The other components of concrete are cement cementations composites like fly ash and dolomite, coarse aggregate like crushed stone, sandstone, and granite, as well as sand and water.

To evaluate the workability with various proportions of

II. LITERATURE REVIEW

1. **Preethi Getal (2015)**, performed research on repercussions of applying Dolomite powdered as a partial replacement material to cement. Dolomite powder was substituted at 0, 5, 10, 15, 20% of total and 25% of cement in M20 grade. The compressive, split tensile as well as flexural strength of concrete containing Dolomite powder were examined with the properties of the reference specimens. The findings revealed that as the % substitution of plaster with Dolomite powder rises, the compression, the split tensile and also the flexural, approach a highest value and then drop. The maximum flexural and compressive strength was achieved at a substitution of 10% but was determined to be 31.24 N/mm^2 as well as 8.48 N/mm^2 respectively. The greatest tensile strength was attained at 15% substitution and it was determined to be 4.25 N/mm^2. The biggest growth in 28th day flexure and compressive strength was determined to also be 10.4% and 17.8% accordingly. The percentage improvement in split tensile strength was 39.8%. The use Dolomite powder minimizes the cost of mortar. Since the expense of dolomite is cheaper that of cement.
2. **Deepa Bala krishnan S and Paulose K.C (2013),** have carried out some research on workability & strength properties for self-compacting concrete utilizing fly ash & Dolomite powder. They developed high volume fly coal inner concrete with 12.5, 18.75, 25 as well as 37.5% of the clinker (by mass) supplied by fly ash et 6.25, 12.5 and 25% of the cement was replaced by Dolomite powder. For all degrees of concrete production, concrete increased performance in the new and hardened stages as compared to the benchmark mixture.
3. **J. Satheesh Kumar, G. Palaniselvan, D. Jayganesh, & J. Vijayaraghavan (2016)** focussed on M20 grade concrete. The proportion of Dolomite powder as substituted cement in this experiment are 0%, 5%, 10%, 15% and 20%. The freshness property is modifiability and hardened characteristics are compression test, flexural strength, split tensile strength have already been put out using the data of FTIR, SEM, EDAX. After executing cement test, they found at small proportion, between 5 to 15%, dolomite addition performs the function of active ingredient or even works as cement replacement. At increasing level of Dolomite “devaluation” effect occurs.
4. **K. Sathish kumar, K.Anitha (2017),** performed study on replacement levels of cement with Dolomite powder at 20, 25, 30 & fine aggregate with copper slag of 20% by the mass in M20 grade.The Dolomite powder with copper slag is combined with normal cement and coarse aggregate inside the grade of M20 with the mix percentage of 1:1.5:3. The concrete cubes / cylinders were cast with varied quantity of Dolomite powder and copper slag. The testing specimens were cured & tested for split tensile and compressive strength in 7 days, 14 days & 28 days for concrete. The addition of Dolomite powder and copper slag boosted the tensile and compressive properties of concrete, the compressive strength for M20 concrete is 27 MPa and it is improved by substitution of 20% copper slag and Dolomite powder. Thus, the adoption of these eco-friendly products has transformed waste into riches.

5. **A. Muthukumaran (2017**), done research by replacement percentages of cement with Dolomite powder in the range of 10, 20, 30 & fine aggregate by M-sand at 10, 20 & 30% by the weight in M25 grade concrete.By the experimental investigation it was concluded that replacement with Dolomite powder and m sand is found to improve the strength of concrete. The target mean of M25 grade concrete is 31.6 N/mm^2. The optimal replacement percentage of cement with Dolomite powder is 10% and sand with m-sand is 10%.

6. **Isa Yuksel, Omer Ozkan, and Turhan Bilir (2006),** conducted an investigation into the utilization of non-ground granulated blast furnace slag as a fine aggregate in concrete. Their study emphasized that the crucial factor influencing strength and durability characteristics is the ratio of GGBs to sand.

7. **Juan M. Manso and colleagues (2004),** in their laboratory work, endeavored to create concrete with commendable properties using oxidizing Electric Arc Furnace (EAF) slag as both fine and coarse aggregates. The durability assessment, which encompassed soundness, leaching tests, and accelerated aging evaluations, revealed that EAF slag concrete exhibited acceptable performance, particularly in regions where winter temperatures rarely dip below 32°F (0°C).

8. **Li Yun-feng, Yao Yan, and Wang Liang (2009),** investigated into the impact of steel slag powder on the workability and mechanical properties of concrete. Their experiments demonstrated that mechanical properties could be further enhanced through the synergistic effects and mutual activation when composite mineral admixtures containing steel slag powder and blast furnace slag powder were incorporated into concrete.

9. **Lun Yunxia, Zhou Mingkai, Cai Xiao, and Xu Fang (2008),** harnessed steel slag as a fine aggregate to enhance the volume stability of mortar. Their experimental findings indicated that variations in powder ratio, free lime content, and linear expansion rates could effectively express improvements in volume stability achieved through different treatment methods. Autoclave treatment was identified as a more efficacious process for enhancing the volume stability of steel slag.

10. **Sean Monkman, Yixin Shao, and Caijun Shi (2009),** explored the feasibility of using carbonated Ladle Furnace (LF) slag as a fine aggregate in concrete. Their approach involved CO2 treatment to reduce free lime content while converting gaseous CO2 into solid carbonates. The resulting carbonated LF slag was employed as a fine aggregate in zero-slump press-formed compact mortar samples and compared to similar samples containing standard river sand. The 28-day strength of mortars incorporating carbonated slag sand proved comparable to those using regular river sand. This carbonation process rendered LF slag suitable as a fine aggregate, offering significant potential for carbon sequestration in a valuable form derived from waste slag material. Mortars incorporating carbonated LF slag sand exhibited the most substantial reductions in CO2 emissions.

III. OBJECTIVES OF RESEARCH

1. To study the effect of Slag-sand & Dolomite powder on fresh properties of M30 grade concrete.

2. To investigate the impact of using Slag-sand as fine aggregate & DP as partial replacement for cement in M30 concrete in respect of compressive, splitting tensile strength and flexural strength.

3. To determine the best proportion for DP that may be added as partial cement replacement in the producing M30 grade sustainable concrete.

IV. MATERIALS AND METHODOLOGY

The blends were created with the goal of giving concrete its maximum strength. The mix proportions of the different materials used in the concrete mixes are provided based on the IS 10262-2009 Code approach.

4.1. MATERIALS USED

4.1.1. CEMENT

Ordinary Portland Cement (OPC) of 53 grade from Zuari cement of India from a single batch has been used in the present investigation. The chemical and physical properties of OPC are presented in Table 1(a) and Table 1(b) respectively.

Table 1(a). Chemical composition of OPC used

S.NO	Constituent	Percentage
1.	Cao	64.00
2.	Sio_2	22.00
3.	Al_2o_3	4.10
4.	Fe_2o_3	3.60
5.	Mgo	1.53
6.	So_3	1.90

Table 1(b). Physical Characteristics of OPC

S.No	Property	Test result
1	Normalconsistency	29%
2	Specific gravity	3.15
3	Initial setting time	65min
4	Final setting time	550min
5	Soundness	3mm
6	Fineness (sieve)	95%

4.1.2. COARSE AGGREGATE

The coarse aggregates originate from a combination of naturally existing rock fragments and crushed granite. Concrete's strength qualities may also be affected by the coarse aggregate's form. These can be found in a variety of shapes, with angular aggregates potentially providing the best density of mix and minimizing void holes. As per IS: 383-1970, we are now using angular coarse aggregates with a nominal maximum size of 20mm in this project. The nearby quarry provides this crushed stone with a specific gravity is 2.745 (See Fig 1)

Fig 1. Natural Granite Coarse aggregate for the reference mix

4.1.3. WATER

The primary ingredient in making concrete is water. Concrete was mixed and cured using drinkable water. Oils, acids, alkalis, salts, biological matter, and other pollutants that might harm concrete should not be present in the water used to mix concrete, including the free water on the aggregates.

4.1.4. DOLOMITE POWDER

Popular rock-forming material is dolomite. It is made up of calcium magnesium carbonate, which has the chemical formula CaMg(CO3)2. It makes up a significant portion of the sedimentary rock known as dolostone as well as the metamorphic rock known as dolomitic marble. Dolomitic limestone is a word used to describe limestone that includes some dolomite. The rock in the Dolomite Mountains in Italy gave rise to the term "dolomite" for this mineral. The mountains have the name of a 1750–1801. French geologist by the name of Deodat de Dolomieu. Cement by mass is substituted with Dolomite Powder (DP). The colour of Dolomite powder is white and it has a specific gravity as 2.85 as tested in laboratory. The physical appearance of DP is depicted in Fig 2.

Fig 2. Dolomite powder

4.1.5. SLAG SAND

Slag sand derived at JSW Company in India, is used. Fifty percent of finer variety & Fifty percent of coarser variety is utilized in combination. For sustainability, in the present work Natural River sand is not used. Slag sand is tried as total fine aggregate. Slag sand belonging to Zone II are used. The specific gravity of slag sand is 2.610

Fig 3. Slag sand as Fine aggregate

4.1.6. SUPER PLASTICIZER:

In order to make high-strength concrete, superplasticizers (SP) are added to fresh concrete to enhance its workability and enable the water content to be dropped. Conplast SP 430 Dis is the Super plasticizer utilized in this investigation.

4.2. MIX PROPORTIONS

Water/cement ratio is the primary important factor defining strength characteristics of concrete. The properties of the aggregate, in addition to water/cement ratio, influence the properties of the concrete. Because low w/c ratio is required to achieve desirable strength, the mix's workability suffers as a result. With today's technology, it's possible to use standard techniques for compacting mixes to create concrete with a compressive strength of at least 30 MPa after 28 days.

To obtain M30 grade strength concrete, the mix proportion was prepared in accordance with IS 10262- 2019, with a water/cement ratio of 0.5 is used. The final mix proportion arrived for M30 grade concrete is 1:1.525:2.925. Fifteen distinct mixes of Concrete with different proportions comprising Dolomite powder (0, 10, 20, 30 and 40%) as cement, coarse aggregate and Recycled aggregate at 0, 20, 40, 60, 80 and 100% by weight & slag sand are tested to examine the strength properties in terms of Compressive, Split Tensile and flexure Strengths. six cubes, six cylinders, & six prisms are molded for each combination and evaluated for strength characteristics.

4.3. CASTING OF SPECIMEN

The necessary components were weighed for these mixed proportions. Separate dry blends of cement as Dolomite powder and coarse aggregates and fine aggregates as slag sand were made. All components were blended into a homogenous mix after being added to the water. Before being added to the water in the mixer, Dolomite powder is mixed as coarse aggregate. The final casting of the mixtures was carried out right away after the testing for fresh characteristics. Test samples were cast, then they were withdrawn from the moulds after 24 hours then kept in water-curing chamber at a temperature of roughly 20°C until testing or as required by the test.

Fig 4. Casting of Specimens

4.4. CURING

The test samples were maintained in moisture for 24 hours, after which they are marked, taken from the moulds, and submerged in water throughout the period of test. Then curing should be at 27+-2°C temperature and ought to be inspected for every seven days. Curing of concrete is depicted in fig 5.

Fig 5. Curing of Specimens

V. RESULTS & DISCUSSIONS

From the explanation above, it is clear that adding Dolomite powder as a replacement to cement and slag sand as fine aggregate shows reasonable influence on the different properties of concrete when it is still fresh. Therefore, it is crucial to consider whether these effects will lead to changes in the varying characteristics of concrete during its hardened condition. The experimental program was carried out as a consequence.

5.1. COMPRESSIVE STRENGTH:

A material's ability to support loads that tend to compress it is measured by its compressive strength. Incorporating different percentages of Dolomite powder as cement replacement by weight into OPC concrete resulted in an increment in steep manner up to 20% of Dolomite powder and 40% RAC as 44.30 MPa and then after that reduction in the 28-day compressive strength has occurred, as seen in Fig. 6., and as well as the same phenomenon occurred in various percentages of RAC strength as shown.

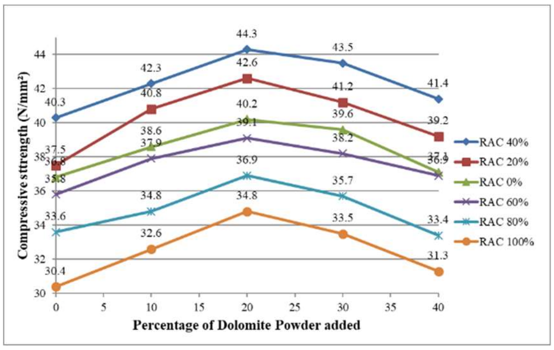

Fig 6. Variation of 28 day Compressive strength

Comparatively to conventional concrete, the findings show that the compressive strength of concrete increased sharply between 0% and 20% at the age of 28 days, and after that from 20% to 40% the compressive strength is subsequently decreased at the steep rate in the mixes containing Dolomite powder and variation with RAC. With the addition of Dolomite powder, we can observe a slight rise in the graph which represents a rise in the strength of concrete. At 20% replacement the concrete attains its maximum compressive strength when compared with the conventional mix. Therefore, it can be extrapolated that utilizing DP itself results in an increase in compressive strength.

5.2. SPLIT TENSILE STRENGTH:

Testing for splitting tensile strength was done, on cylindrical specimens of Standard 300mm- height, and 150 mm diameter positioned horizontally on the compression testing machine, by application of the load till failure. Incorporating different percentages of Dolomite powder as cement replacement by weight into OPC concrete resulted in an increment in steep manner up to 20% of Dolomite powder at 40% and RAC as 4.25

MPa. Then after, reduction in the 28-day split tensile strength has occurred, as seen in Fig. 7., also as well as the same phenomenon occurred in various percentages of RAC strength.

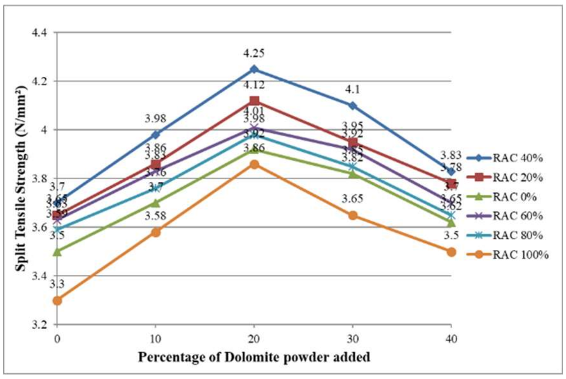

Fig 7. Variation of 28 day Split tensile strength

Comparatively to conventional concrete, the findings show that the split tensile strength of concrete increased sharply between 0% and 20% at the age of 28 days, and after that from 20% to 40% the split tensile strength is subsequently decreased at the steep rate in the mixes containing Dolomite powder and variation with RAC. With the addition of Dolomite powder, we can observe a slight rise in the graph which represents a rise in the strength of concrete. At 20% replacement the Concrete attains its maximum tensile strength when compared with the conventional mix. Therefore, it can be extrapolated that utilizing DP itself results in an increase of split tensile strength.

5.3. FLEXURAL STRENGTH:

Testing for flexural strength was done, on beam specimens of Standard 500x100x100mm positioned horizontally on the flexure testing machine. Application of the load till failure crack appears is done. Incorporating different percentages of Dolomite powder as cement replacement by weight into OPC concrete resulted in an increment in steep manner up to 20% of Dolomite powder at 40% RAC as 9.10 MPa. Then after reduction in the 28-day flexural strength has occurred, as seen in Fig. 8, and as well as the same phenomenon occurred in various percentages of RAC strength as depicted.

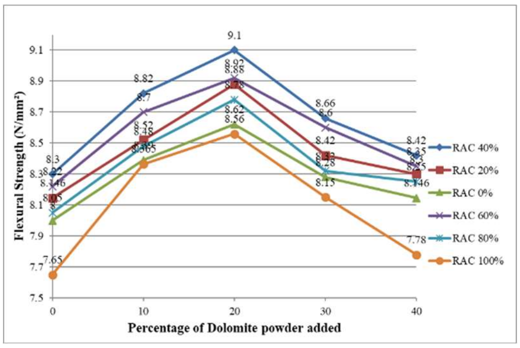

Fig 8. Variation of 28 day Flexure strength

Comparatively to conventional concrete, the findings show that the flexure strength of concrete increased sharply between 0% and 20% at the age of 28 days, and after that from 20% to 40% the flexure strength is subsequently decreased at the steep rate in the mixes containing Dolomite powder and variation with RAC. With the addition of Dolomite powder, we can observe a slight rise in the graph which represents a rise in the strength of concrete. Maximum flexural strength is noted at 20% replacement of cement by Dolomite powder when compared with the conventional mix. Therefore, it can be extrapolated that utilizing DP itself results in an increase of flexural strength.

VI. CONCLUSIONS

These findings must be unique to this study. However, the outcomes of this study should contribute meaningfully to our understanding of how Dolomite powder affects the characteristics of concrete. Following are the study's key findings and conclusions.

1. After 28 days of testing, hardened strength characteristics using Dolomite powder revealed that the mix's compressive strength had grown, with a maximum gain of 20.38%. The inclusion of Dolomite powder may enhance the bond between the aggregate and C-S-H gel, hence concrete with Dolomite powder has a slightly higher compressive strength compared to control trials. This difference is negligible until 0% Dolomite powder; after that, it increases to 20% with 40% RAC; after that, it decreases once again. The results of this investigation also show that concrete produced with

Dolomite powder has stronger compressive strength properties than concrete made with a control mix.

2. The results indicate that the maximum compressive, tensile and flexural strengths of concrete are attained when the cement is replaced by Dolomite powder at 20%
3. The maximum split tensile strength was found at 20% of DP with 40% RAC, the split tensile strength has increased by 21.42% when compared to the normal concrete mix after 28 days.
4. The highest flexure strength was found at 20% of DP with 40% RAC, increasing the flexure strength by 13.75% when compared to the standard concrete mix after 28 days.
5. From this experimental study it is concluded that for M30 grade sustainable concrete, optimum dosage of Dolomite powder as partial replacement to cement is 20% and replacement of coarse aggregate by RCA is 40% with hundred percent slag sand as fine aggregate.

VII. REFERENCES

[1]. Marija Jelcic Rukavina, Ivan Gabrijel, Dubravka Bjegovic, (2015), "Modifications of dolomite-based self-compacting concrete properties using mineral additives", Technical Gazette 22,1, pp 233-240.

[2]. Preethi G, ME-Student, S.N.S College of Technology, Prince Arulraj G, Professor & Dean, Dept of Civil Engineering, S.N.S College of Technology,Coimbatore, (2015), "Effect of Replacement of Cement with Dolomite Powder on the Mechanical Properties of Concrete", Vol. 2, Issue 4, pp 1083-1088.

[3]. G.Latha, P.G. Student, Department of Civil Engineering, KITS College, Warangal, India,A.Suchith Reddy, Assistant Professor, Department of Civil Engineering, KITS College, Warangal, India, , K.Mounika, P.G. Student, Department of Civil Engineering, KITS College, Warangal, India, (2015), "Experimental Investigation on Strength Characteristics of Concrete Using Waste Marble Powder as Cementitious Material", IJIRSET,Vol.4, Issue 12, pp 12691-12698.

[4]. Isa yuksel, Ayten Genc, (2007), "Properties of concrete containing nonground ash and slag as fine aggregate", ACI materials journal,Vol 104, July-August, pp 397-403.

[5]. Khatib, J. M. (2008), "Metakaolin concrete at a low water to binder ratio. Construction and Building Materials".

[6]. Li Yun-feng, Yao Yan, Wang Liang, (2009), "Recycling of industrial waste and performance of steel slag green concrete", Journal of Central South university of Technology, 16, pp 768-773.

[7]. HRN EN 197-1:2012 Cement- Part 1: "Composition, specifications and conformity criteria for common cements", (EN 197-1:2011).

[8]. Shanmugapriya et al. (2012), "experimental researchers that compressive and flexural strength of concrete can be improved by partial replacement of cement by silica fume and manufactured sand for natural fine aggregates".

[9]. Deepa Balakrishnan S., Paulose K.C. Cochin University of Science and Technology, Kochi, Kerala, (2013), "Workability and strength characteristics of self-compacting concrete containing fly ash and Dolomite powder", AJER,Vol 2, pp 43-47.

[10]. "Investigation on strengthening of concrete with partial replacement of dolomite and M-sand for cement and fine aggregate" by S. Muthukumaran, N. Muralimohan, P. Sudha, IJRESM Volume-1, Issue-10, October-2018

[11]. M. Z. Chen, M. K. Zhou and S. P. Wu, "Optimization of Blended Mortars Using Steel Slag Sand," Journal of Wuhan University of Technology, Material Science Edi- tion, Vol. 3, 2007, pp. 741-744.

[12]. I. Yuksel, O. Ozkan and T. Bilir, "Use of Granulated Blast Furnace Slag in Concrete as Fine Aggregate," ACI Materials Journal, Vol. 103, No. 3, 2006, pp. 203-208.

[13]. J. M. Manso, J. J. Gonzalez and J. A. Polanco, "Electric Arc Furnace Slag in Concrete," ASCE Journal of Materi-als in Civil Engineering, Vol. 16, No. 6, 2004, pp. 639-

645. doi:10.1061/(ASCE)0899-1561(2004)16:6(639)

[14]. K. H. Yang, J. K. Song and J.-S. Lee, "Properties of Al-kali Activated Mortar and Concrete Using Lightweight Aggregates," Materials and Structures, Vol. 43, No. 3, 2010, pp. 403-416. doi:10.1617/s11527-009-9499-6

[15]. Y.-F. Li, Y. Yao and L. Wang, "Recycling of Industrial Waste and Performance of Steel Slag Green Concrete," Journal of Central South University Technology, Vol. 16, No. 5, 2009, pp. 768-773. doi:10.1007/s11771-009-0128-x

[16]. Y. X. Lun, M. K. Zhou, X. Cai and F. Xu, "Methods for Improving Volume Stability of Steel Slag as Fine Aggre-gate," Journal of Wuhan University of Technology, Mate-rial Science Edition, Vol. 23, No. 5, 2008, pp. 737-742.

[17]. L. Zeghichi, "The Effect of Replacement of Naturals Aggregates by Slag Products on the Strength of Con-crete," Asian Journal of Civil Engineering (Building and Housing), Vol. 7, 2006, pp. 27-35.

[18]. S. Al-Otaibi, "Recycling Steel Mill Scale as Fine Aggre- gate in Cement Mortars," European Journal of Scientific Research, Vol. 24, No. 3, 2008, pp. 332-338.

[19]. S. Monkman, Y. X. Shao and C. J. Shi, "Carbonated La- dle Slag Fines for Carbon Uptake and Sand Substitute," ASCE Journal of Materials in Civil Engineering, Vol. 21, No. 11, 2009, pp. 657-665. doi:10.1061/(ASCE)0899-1561(2009)21:11(657)

[20]. T. R. Naik, S. S. Singh, M. P. Tharaniyil and R. B. Wendfort, "Application of Foundry by Product Materials in Manufacture of Concrete and Masonry Products," ACI Materials Journal, Vol. 93, No. 1, 1996, pp. 41-50.

[21]. C. Sangeetha (2017), Performance of concrete using dolomite & vermiculite as partial replacement of cement and fine aggregate, international journal of Engineering Research & Technology, ISSN: 2278-0181.

[22]. Marija Jelcic Rukavina, Ivan Gabrijel, Dubravka Bjegovic, (2015), "Modifications of dolomite-based self-compacting concrete properties using mineral additives", Technical Gazette 22, 1, pp 233-240.

[23]. Salim Barbhuiya, "Effects of fly ash and Dolomite powder on the properties of self-compacting concrete", Construction and Building Materials, Volume. 25, 2011, pp.3301-3305

[24]. BOOKS

- Concrete technology By M.S. Shetty.
- Concrete technology By M.L. Gambhir.

[25]. IS CODES

- Plain and Reinforced Concrete- Code of Practice, Indian Standard Code 456-2000.
- Guideline for Concrete Mix Proportion, Indian Standard Code 10262- 2019.
- Methods of Test for Aggregates of Concrete, Indian Standard Code 2386-1963.
- Specification for 53 Grade Ordinary Portland cement, Indian Standard Code 12269- 1989.
- Compressive strength test: IS 516-1956.
- Split tensile strength test: IS 5816-1999. Dolomite powder", AJER,Vol 2, pp 43-47