International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Experimental Study on Strength of SCC with Partial Replacement of Cement by Dolomite and Addition of Para Aramid Fibers

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Abstract - *This paper summarizes the research work on the experimental study on strength of SCC with partial replacement of cement by dolomite and addition of para aramid fibres. SCC is a highly flowable type of concrete that spreads in to the form without the need for mechanical vibration. Now a days self-compacting concrete is being widely used in construction over normal concrete due to its high workability, economy, less noise pollution, speedy construction etc. In the future works for strengthening concrete structure elements, it is preferred to use the dolomite powder especially when using self-compacting concrete. Dolomite, one of the type of Lime stone was employed is composed of calcium magnesium carbonate $CaMg(CO_3)_2$. However dolomite provides highest resistance to fire. Para-aramid fibres are widely used in manufacture of advanced composites for its high strength, high modulus, excellent thermal stability, and high chemical resistance. In this project para aramid fibres are added in the self-compacting concrete. Here introduce a new self-compacting concrete by combining dolomite and para aramid fibres and comparing there physical and mechanical properties.*

Key Words: Self compacting concrete, dolomite, para aramid fibers, thermal stability, chemical resistance

1. INTRODUCTION

Self-compacting concrete is a concrete mix which has a low yield stress, high deformability, good segregation resistance and moderate viscosity. In every day terms when poured scc is an extremely fluid mix with the following distinctive practical features. It flows very easily within and around the formwork, can flow through obstructions and around corners is close to self-levelling, does not require vibration or tamping after pouring and follows the shape and surface texture of a mould very closely once set. As a result pouring SCC is also much less labour intensive compared to standard concrete mixes. Once poured SCC is usually similar to standard concrete in terms of its setting and curing time and strength. SCC does not use a high proportion of water to become fluid in combined with super plasticizers and viscosity enhancing admixtures.

In the future works for strengthening concrete structure elements, it is preferred to use the dolomite powder especially when using self-compacting concrete .Dolomite , one of the type of lime stone was employed is composed of calcium magnesium carbonate $CaMg(Co_3)_2$. In this paper cement is partially replaced by dolomite. However dolomite powder provides highest resistance to fire. This is because carbonate aggregate has a substantially higher heat capacity which is beneficial in preventing spalling.

Para aramid fibres are widely used in manufacture of advanced composites for its high strength, high modulus, excellent thermal stability and high chemical resistance. Para aramid fibres are added in the self-compacting concrete and find out the mechanical properties. Here introduce a new self-compacting concrete by combining dolomite powder and par aramid fibre and comparing there physical and mechanical properties.

1.1 Objective

1. To find out the strength of SCC by partial replacement of cement by dolomite and addition of para aramid fiber.
2. Comparing the mechanical and physical properties of SCC.

2. EXPERMENTAL METHODOLOGY

The mix of the concrete used in this study is M40. The water cement ratio is used as 0.5. Cement partially replaced by dolomite at 5%, 10%, 15%, 20% and 25% respectively. Then find out the optimum percentage of replacement of cement by dolomite. At this percentage of optimum value Para aramid fibre is added at different percentage that is 0.10%, 0.15% and 0.20% respectively. Test was performed for compressive strength, split tensile strength and flexural strength of concrete for all replacement level dolomite and addition of Para aramid fibre.

2.1 Materials Used

a) Cement is a binder which can bind other materials together. Several types of Portland cement are available and the most common is ordinary Portland cement (OPC) which is grey in

colour. OPC of 53 grades is used in this experiment.

b) Sand is naturally available granular material composed of finely divided rock and mineral particles.

c) The coarse aggregate used for SCC must typically be round in shape, well graded and smaller in size than the aggregate which is used for the conventional concrete. Gradation is an important factor in choosing coarse aggregate especially in typical use of SCC.

d) Water which is used for drinking is satisfactory for usage in concrete. The water is used in concrete plays an important part in mixing, laying, compaction, setting and hardening of concrete.

e) Dolomite powder is the lime stone powder with composition of $CaCo_3$ and $MgCo_3$, pertaining to 100% combination, the proportion being varied as per mining zone. Dolomite powder has some similar characteristics of cement. Using dolomite powder in concrete can reduce the cost of concrete and may increase the strength to some extent. The cost of dolomite is lesser than that of cement. The reduction in the consumption of cement will reduce the emission of greenhouse gas. It is used to improve properties such as weathering action, reduce shrinkage, fissures development and water absorption. Dolomite has different grades and is available in different mesh size.

f) Para aramid fibres are the high performance fibre which increases the mechanical as well as thermal properties of the concrete. Addition of Para aramid fibre in SCC may improve the tensile strength, resistance to heat, less wear and tear and less abrasive. Compared to Meta aramid fibre Para aramid fibre has better strength, light weight and durable.

Table 2.1 Physical Properties of Dolomite Powder

Properties	Value
Specific Gravity	2.65
Colour	White
Tenacity	Brittle

Fig 1: Dolomite Powder

Fig 2: Para Aramid Fibre

2.2 Specimen Preparation

Mould of size 150mmx150mmx150mm were used to prepare the cube specimens, mould of size 150mmx300mm were used to prepare cylinder specimen and mould of size 500mmx100mmx100mm were used to prepare beam specimens for determining the compressive strength, split tensile strength and flexural strength of concrete.

Fig 3: Casting of Specimen

3. RESULT AND DISCUSSION

Result value of cube compressive strength, split tensile strength of cylinder and flexural strength of beam are as shown below.

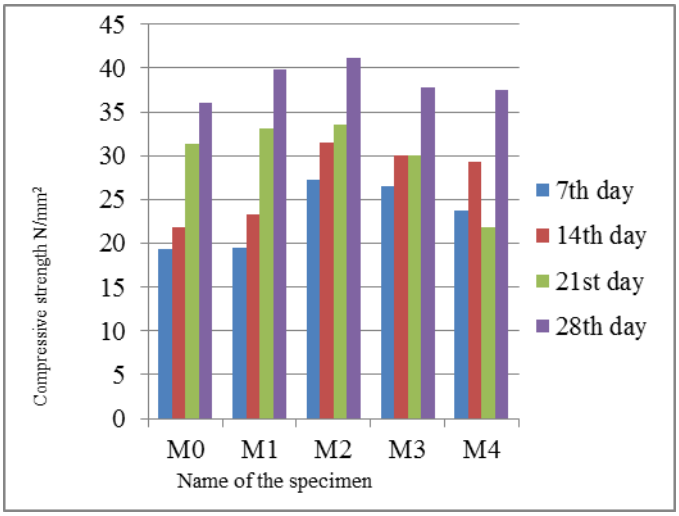

Chart 1: Compressive Strength for SCC with Cement replaced by dolomite with different percentage.

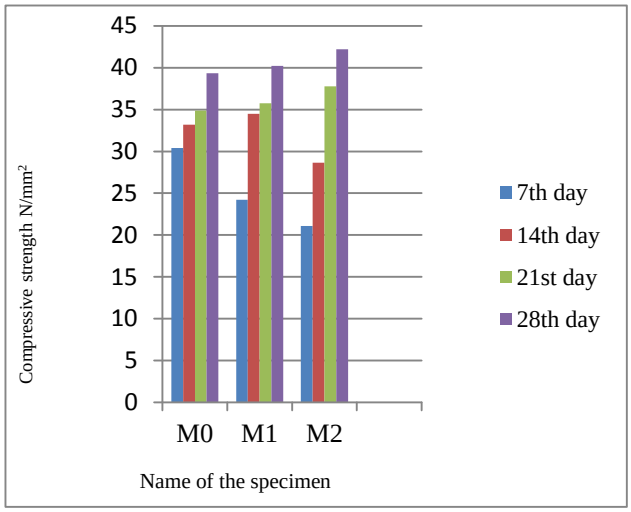

Chart 2: Compressive strength for SCC with cement replaced by dolomite and addition of Para aramid fiber.

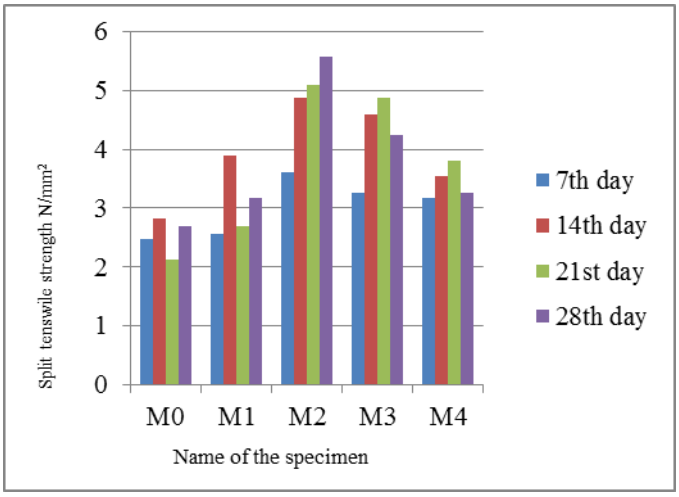

Chart 3: Split tensile strength for SCC with cement replaced by dolomite with different percentage.

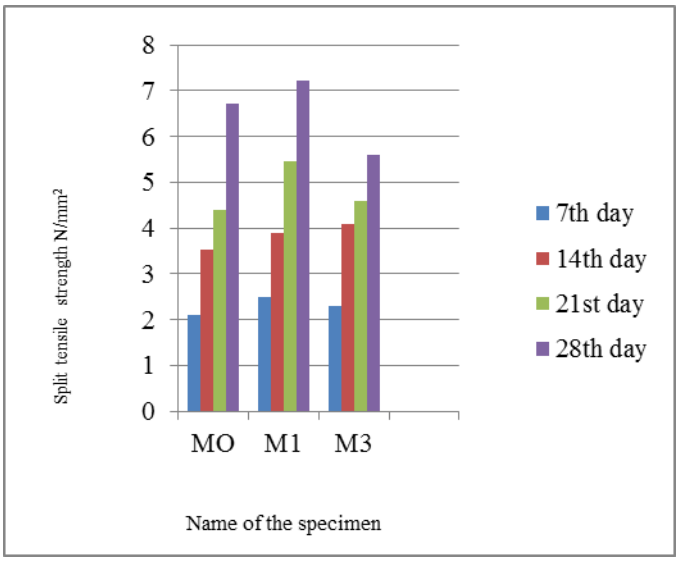

Chart 4: Split tensile strength foe SCC with cement replaced dolomite and addition of Para aramid fiber.

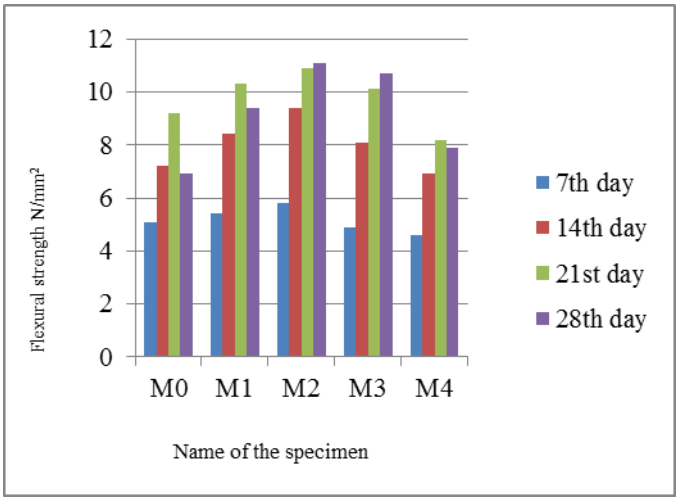

Chart 5: Compressive Strength for SCC with Cement replaced by dolomite with different percentage.

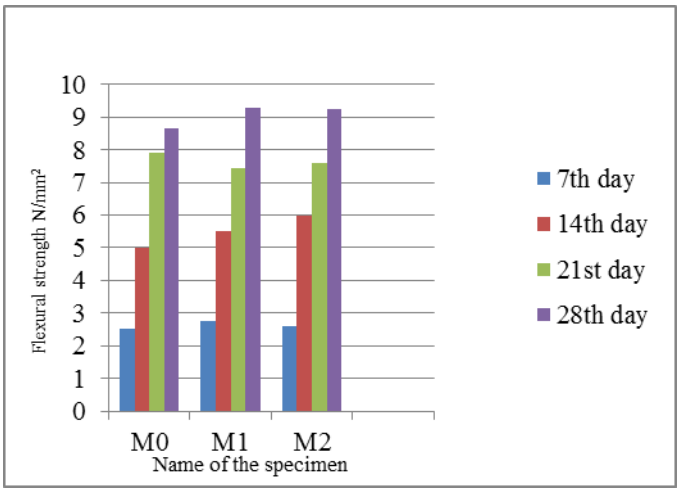

Chart 6: Flexural Strength for SCC with Cement replaced by dolomite with different percentage and addition of Para aramid fiber.

4. CONCLUSIONS

- It has been observed that the experimental results for the 15% of replacement of dolomite powder and 0.15% of addition of Para aramid fibre has increase in strength.
- Compressive strength, split tensile strength and flexural strength of concrete increased with the partial replacement of cement by dolomite and addition of Para aramid fibre with certain percentages.
- Dolomite is a common rock forming mineral. It is a calcium magnesium carbonate with a chemical composition of $CaMg(Co_3)_2$. It is primary component of the sedimentary rock known as dolo stone and the metamorphic rock known as dolomite marble.
- For this study result obtained as the maximum compressive strength, split tensile strength and flexural strength of concrete is 43.45N/mm², 5.50N/mm² and 12.55N/mm² respectively.
- For future work for strengthening of concrete structures elements cement is partially replaced by dolomite powder and addition of Para aramid fibre may improve overall strength of self-compacting concrete.
- Addition of Para aramid fibre may improve the thermal stability of the entire structures.

ACKNOWLEDGEMENT

The Author(s) wish to express their special gratitude to **Dr. P. G. Bhaskaran Nair**, PG Dean, Sree Narayana Institute of Technology, Adoor, Above all the author(s) thank **GOD** almighty for his grace throughout the work

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