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indispensable material being used in infrastructure development throughout the world. Glass is commonly used in building / construction industries and large amount of glass is powdered daily. The disposal of waste glass is an environmental issue as waste glass causes disposal problem. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. The appropriate utilization of Municipal Solid Waste Incineration (MSWI) residues is a worldwide studied topic over the last decades. One of the possibilities is to use MSWI ashes in concrete production, as it is done with coal combustion products Glass powder and municipal solid waste finer than 600 µ is reported to have pozzolanic behaviour. An attempt is made to investigate the possibility of using the waste glass powder, municipal solid waste are the partial replacement of ordinary Portland cement in concrete.

The study has been made to evaluate the effect on mechanical and durability properties of M40 grade concrete made with replacement of cement with and municipal solid waste, (0%, 5%, 10%, 15%, 20% and 25%) by weight. For each set mechanical properties were studied by performing Compression test for Cubes, Flexural test for beams and Split Tensile test for cylinders and durability properties were studied by performing acid attack, alkaline attack and Sulphate attack test for cubes.

1. INTRODUCTION

Concrete is a blend of cement, sand, coarse aggregate and water. The key factor that adds value to concrete is that it can be designed to withstand harshest environments significant role. Today global warming and environmental devastation have become manifest harms in recent years, concern about environmental issues, and a changeover from the mass waste, mass consumption, and mass production society of the past to a zero emanation society is now viewed as significant. Normally glass does not harm the environment in any way because it does not give off pollutants, but it can harm humans as well as animals, if not dealt carefully and it is less friendly to

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environment because it is non biodegradable. Thus, the development of new technologies has been required.

The term glass contains several chemical diversities including soda-lime silicate glass, alkali silicate glass and borosilicate glass. To date, these types of glasses glass powder have been widely used in cement and aggregate mixture as pozzolana for civil works. The introduction of waste glass in cement will increase the alkali content in the cement. It also help in bricks and ceramic manufacture and it preserves raw materials, decreases energy consumption and volume of waste sent to landfill. As useful recycled materials, glasses and glass powder are mainly used in fields related to civil engineering, for example, in cement, as pozzolana (supplementary cementitious materials), and coarse aggregate. Their recycling ratio is close to 100%, and it is also used in concrete without adverse effects in concrete durability. Therefore, it is considered ideal for recycling.

Objectives of the study

The following are the main objectives of the study

1. To determine the workability, the overall strength, as well as the rate of strength gain for varying water cement ratios of concrete containing glass powder and municipal solid waste.
1 Compare the results of the glass powder and municipal solid waste concrete to a conventional mix.
2 To study the compressive strength, split tensile strength, flexural strength of concrete by using glass powder and municipal solid waste (MSW).
3 To study the durability of concrete by using glass powder and municipal solid waste (MSW).

2. LITERATURE REVIEW

Veena V. Bhat , N. Bhavanishankar Rao, et al (2014)

Glass is commonly used in building / construction industries and large amount of glass is powdered daily. The disposal of waste glass is an environmental issue as waste glass causes disposal problem. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. Glass powder has finer than 600µ is reported to have pozzolanic behaviour. An attempt is made to investigate the possibility of using the waste glass powder as the partial replacement of ordinary Portland cement in concrete. Concrete with replacement of cement by waste glass powder such as 5%, 10%, 15% and 20% were produced and properties of this concrete has been compared with concrete of control mix with no replacement. Cube specimens of 24 numbers were cast, cured and tested for 7 day and 28 days strength. Compression test was conducted and the results were compared. The findings revealed an increase in compressive strength with the increase in the replacement of cement by glass powder. To reduce the demand for cement, glass powder replacements can be adopted. The

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replacement of glass powder decreases the unit weight as well as the porosity as indicated by the decrease in water absorption. It reduces the quantity of cement to be used in concrete. Also glass powder is proved to be economical and is considered as environmental friendly construction material.

Gunalaan Vasudevan, Seri Ganis Kanapathy pillay, et al (2013)

This study was conducted to investigate the effect of using waste glass powder in concrete. Laboratory work was conducted to determine the performance of control sample and concrete with used waste glass powder. The performance of these types of concrete was determined by the workability test, density test and compressive strength test. The workability of concrete is determined using slump test and compacting factor test. Meanwhile, compressive strength test is done to determine the strength of concrete. For each type of concrete, a total of six 150mm x 150mm x 150mm cubes were cast. The cubes were tested at the ages of 7, 14 and 28 days to study the development of compressive strength. The results indicate that the concrete with using waste glass powder were able to increase the workability of concrete and also the compressive strength. However, the density is reduced compare to standard mixture of concrete

3. MATERIALS AND MIX DESIGN

Cement

In this study Ordinary Portland cement of 53 grade (ACC cement) has been procured and has been used.



OPC 53 grade cement

Coarse aggregate

In this study coarse aggregate of nominal sizes of 20mm, 12mm are used





20mm coarse aggregates **12mm coarse aggregates**

Fine aggregate

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The fine aggregate used in this study is river sand which is obtained from local company and shown in figure with normal size of 2.36mm



Fine aggregates

Glass powder

Glass occurs naturally when rock high in silicates melt at high temperature and cool before they can form a crystalline structure. Obsidian or volcanic glass is a well known example of naturally occurring glass. When manufactured by humans the glass is a mixture of silica, sand, lime and other materials.



Glass powder

Municipal Solid waste

For this study municipal solid waste collected from dumping yard at GWMC office Warangal.



Municipal solid waste

Superplasticizers

The use of superplasticizer is practiced for production of flowing, self levelling, self compacting and for the production of high strength concrete.

In this study, CONPLAST SP430 has been used in concrete mix to have high workability.

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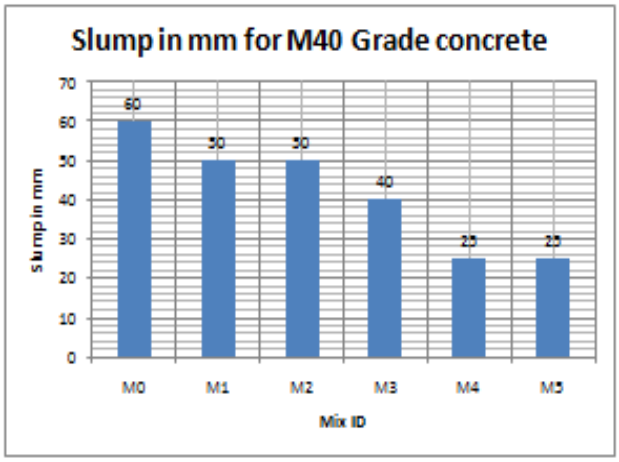
Mix design of m40 grade concrete

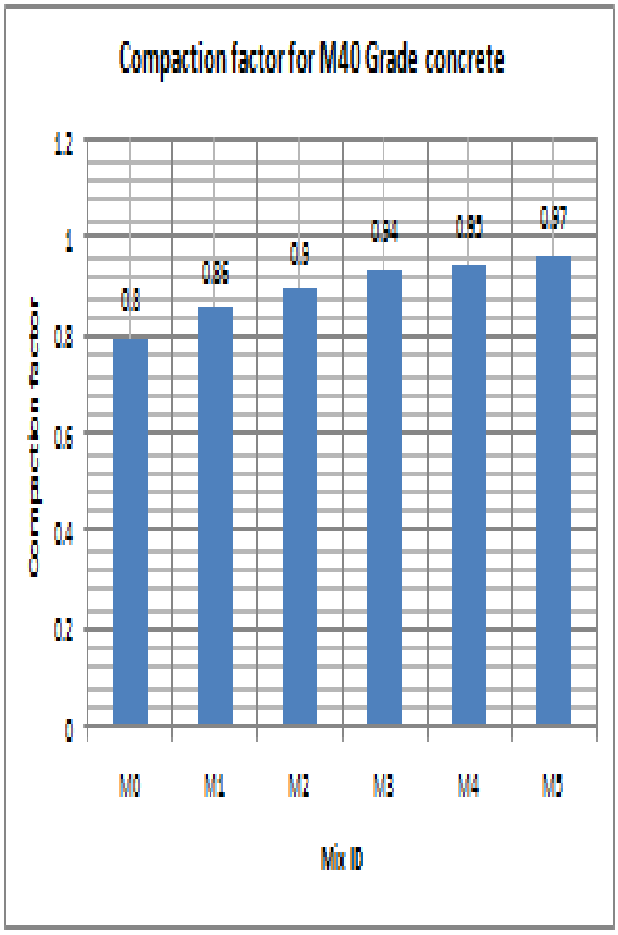
Final trial mix for M40 grade concrete is 1:1.63:2.54 at w/c of 0.45

4. RESULTS AND ANALYSIS

Workability:

Slump cone test:



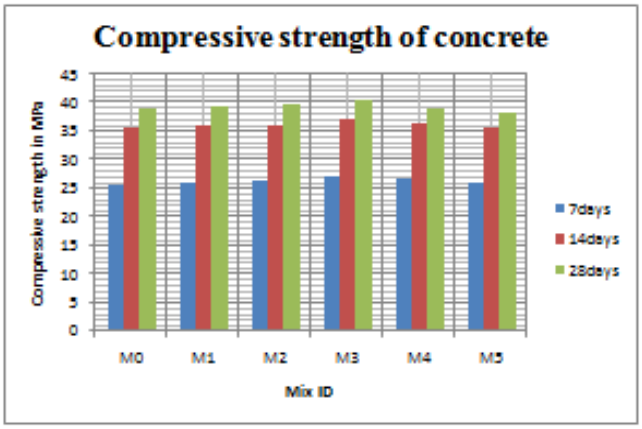


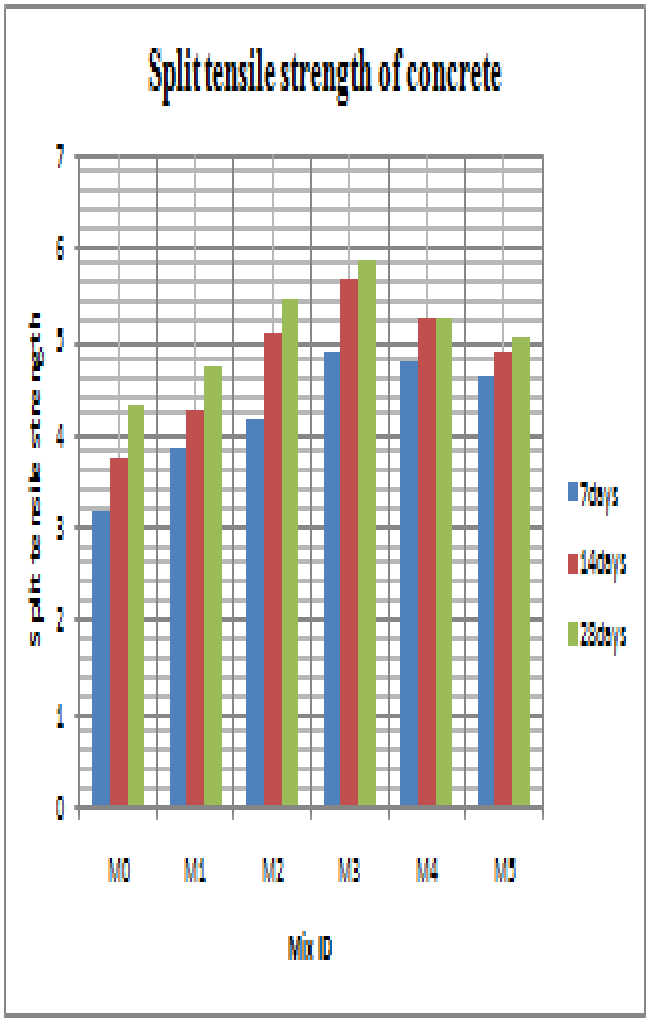
Compaction factor test

STRENGTH OF CONCRETE:

Compressive strength

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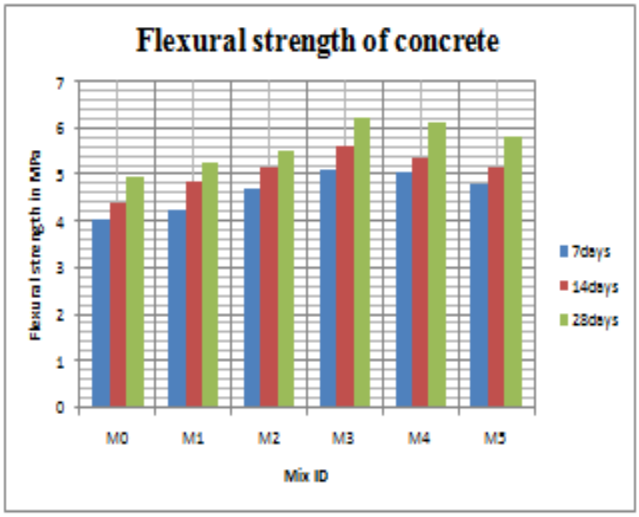


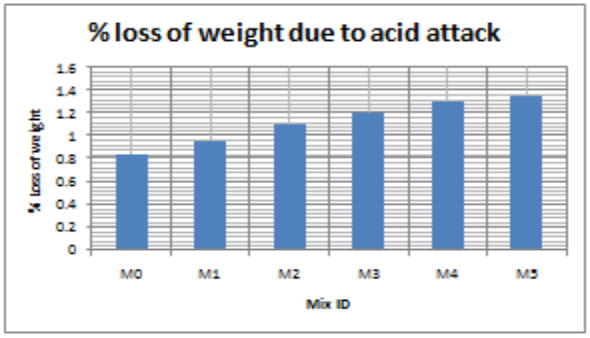


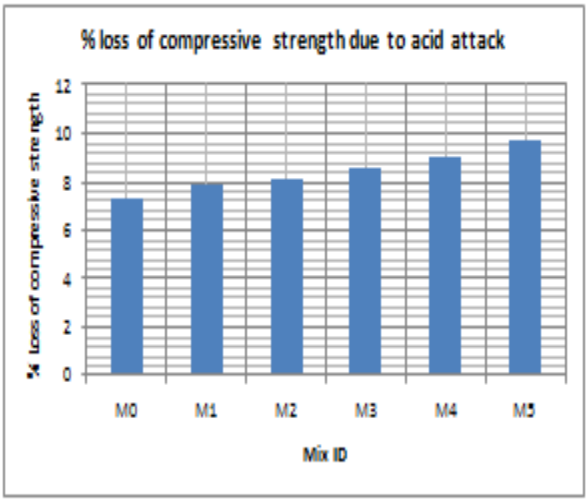
Split tensile strength

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Flexural strength





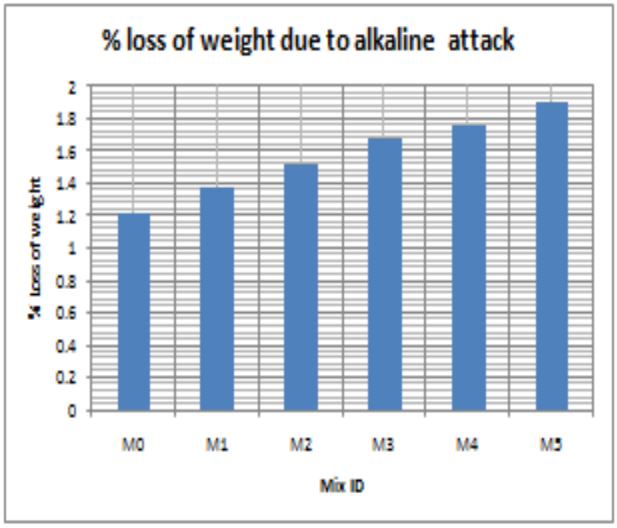


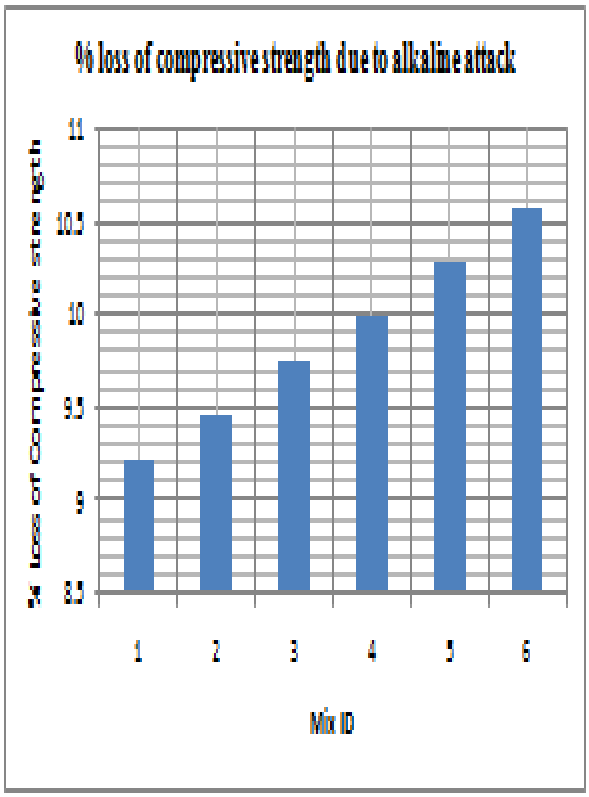
DURABILITY OF CONCRETE:

Acid attack

Alkaline attack:

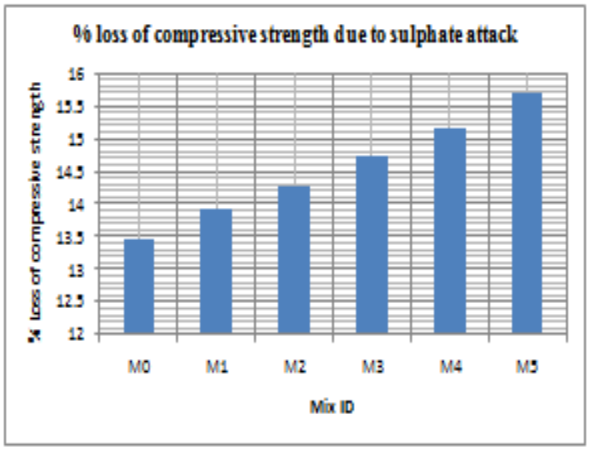
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Sulphate attack:

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concrete. The optimum value for the compressive strength was obtained at 15% Glass powder+15% Municipal solid waste.

3. Split tensile strength and flexural strength for 7days,14 days and 28days for the concrete increases initially up to 15% Glass powder+15% Municipal solid waste than decreases with increasing the percentage of Glass powder and municipal solid waste for M40 Grade concrete.

4. The addition of Glass powder and municipal solid waste significantly increased the compressive, tensile and flexural strengths of concrete with maximum strengths in each case being achieved at 15% Glass powder+15% Municipal solid waste.

5. The percentage loss of weight and percentage loss of compressive strength is increases with in increasing the percentages in all cases in durability studies in Glass powder and municipal solid waste concrete. So, the concrete is durable up to 15% Glass powder+15% Municipal solid waste.

5. CONCLUSIONS

From this study the following conclusions were made

1. The value of slump for the concrete decreases with increasing the percentage of Glass powder and municipal solid waste for M40 Grade concrete. The value of compaction factor for the concrete decreases with increasing the percentage of Glass powder and municipal solid waste for M40 Grade concrete.

2. Compressive strength for 7days, 14days, 28days for the concrete increases initially up to 15% Glass powder+15% Municipal solid waste than decreases with increasing the percentage of Glass powder and municipal solid waste for M40 Grade

So the replacement of 15% Glass powder+15% Municipal solid waste is generally useful for better strength values in M40 grade of concrete.

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