Partial Replacement of Metal Steel Slag & Waste Glass with Coarse Aggregate & Fine Aggregate

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Abstract: Weather alternate and environmental loss has ended up the maximum fundamental function in each year. Green and sustainable materials in any enterprise are helpful. Glass is extensively used materials within the international a good way to reduce the waste glass, it has to be reused. The provision of river sand has grown to be regarding difficulty. The purpose of this venture painting is to look at the effects of using waste glass as a sectional replacement for high-quality mixture and metallic slag as a sectional replacement of coarse combination. Mixes had been prepared through converting the share for beaten waste glass. The waste glass used to alter pleasant aggregate inside the proportions of 0%, 10%, **20%** & 30%,. The belongings of compressive strength have been checked on this paper. Approximately 800 Mt of raw metallic and a median of about 400Kg of strong through products are generated in the metallic industry per ton of uncooked steel. The prevailing research deals with the usage of steel slag as a partial alternative coarse mixture. The metal slag turned into changed as a partial alternative of coarse mixture in the percentage of 50%, **60%** & 70%. Compressive electricity of concrete has been taken and studied. It has been made by using changing each fines mixture and coarse combination via waste glass waste and metal slag respectively and studying the compressive strength of concrete
: This study has been undertaken to investigate the determinants of stock returns in Karachi Stock Exchange (KSE) using two assets pricing models the classical Capital Asset Pricing Model and Arbitrage Pricing Theory model. To test the CAPM market return is used and macroeconomic variables are used to test the APT. The macroeconomic variables include inflation, oil prices, interest rate and exchange rate. For the very purpose monthly time series data has been arranged from Jan 2010 to Dec 2014. The analytical framework contains.

Index Terms **- Steel slag, waste glass, manufacturing sand, Natural sand, Compressive strength, Coarse Aggregate, Concrete.**

1. INTRODUCTION

Concrete is the first-rate material where energy, sturdiness, impermeability, hearth resistance, and absorption resistance are received. Concrete is a mixture of cement, sand, coarse combination and water. Today international warming and environmental devastation have grown to be noticeable harms in current years. Commonly, glass does not harm the surroundings in any way, it is able to harm human beings in addition to animals if now not deal carefully and it's miles less friendly to the environment because it's far non-biodegradable. The glass incorporates chemical that consisting of soda-lime silicate glass, alkali-silicate glass, and borosilicate glass. Glass waste powder has been extensively used in cement and best mixture combination for civil works. Use of waste substances in the area of natural assets is one of the excellent accesses, the waste can be minimized. Use of river sand as excellent aggregate leads to the exploitation of herbal sources, reducing the water table, sinking of bridge pier and erosion of river mattress. So its miles better to update the sand by way of the different substituent. The waste glass in concrete creates a problem of alkali-silica reaction. The silica in the glass reacts with the alkalis in the cement and form a gel-like shape (ASR gel). The formation of ASR is reduced through the scale of glass combination, which shows no alkali reaction. Metal slag used as a partial alternative for the coarse mixture. Appropriate environmental conditions with the aid of powerful utilization of waste cloth. Steel slag aggregates are used as mechanical energy, stiffness, porosity, put on resistance and water absorption ability. Substitutes for traditional concrete are investigated. The test results of workability stages are the same compared to the traditional concrete.1) to find out a suitable and effective/alternative material for partial replacement of fine aggregate with waste glass. 2) The metallic slag whilst used as a replacement for coarse combination increases the strength and workability. 3) The development of the concrete aggregate properties through the addition of metallic slag in concrete is located. 4) The research of assets of concrete by way of changing each best and coarse aggregate via waste glass and metal slag, how the strength accelerated and workability decreased. Also, concrete density is reduced.

1.1 MATERIALS AND METHODS

Cement

The regular Portland cement is typically categorized into 3 grades. They may be 33 grades, 43 grades, and 53 grades. Brand used is Birla cement OPC 43grade cement and its houses are

- The particular gravity of cement pattern: 3.15
- The preliminary placing time: 36 minutes

- Very last placing time: 310 minutes
- Everyday consistency: 34%

Fine aggregate

Fine aggregate is a material pass through 4.75mm sieve and be retained on a 75µ sieve. For expanded workability and for financial system, the pleasant mixture ought to have a rounded form. The cause of the best mixture is to fill the voids and to act as a workability agent and its physical residences are,

Specific gravity of sand: 2.74
Fines modulus of sand: 2.65
Water absorption: 0.6%

Coarse aggregate

Coarse aggregate are the overwhelmed stone is used for making concrete. The maximum size of aggregate is 20mm.

- The unique gravity: 2.74
- Water absorption fee: 1.00%
- Fineness Modulus: 7.07

Water

Transportable consuming water used for the test.

Chemical Admixture

Super plasticizer is used. It's for an effective water lowering agent in concrete. It will increase the workability of concrete.

Waste Glass

The usage of waste glass inside the concrete mixture is high quality, as the production price of concrete will go down. Waste glasses are used as aggregates for concrete. The quantity of waste glass produced has step by step extended over the current years due to an ever-developing use of glass product. Most waste glass has and is being dumped into landfill sites. The land filling of waste glass is unwanted due to the fact waste glass is nonbiodegradable which makes them environmentally much less pleasant. There may be a big potential for the usage of waste glass inside the concrete creation zone. While waste glasses are reused in making a concrete product, the production value of concrete will go down.

Steel slag

Physical property: Steel slag, a spinoff of metallic making, is produced during the separation of the molten steel from impurities in metallic-making furnaces. The slag takes place as a molten liquid soften and is a complicated solution of silicates and oxides that solidifies upon cooling. Slag used in this work gathered from the steel plant.

Specific gravity: 3.4
Density: 1900kg/m3
Water absorption: 1.2%

Chemical property:

Chemical composition of slag is used to define simple oxides which are calculated from elemental analysis. Table 1.0 shows the list of compounds present in steel slag from a typical base oxygen furnace. It also depends on the rate of cooling (slag) in the steel making process.

Concrete is a mixture of cement, sand and coarse aggregates bound together with cement or binder which fills the voids between the particles and seal them together. Thus the idea of alternative of coarse aggregate with steel slag appears to be promising.

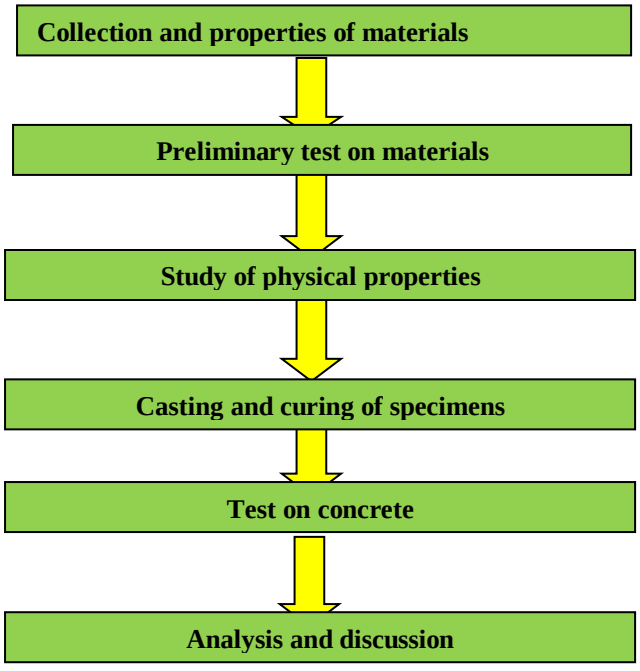
Table 1.0 Chemical composition of Steel Slag

Constituent	Composition (%)
CaO	40 - 52
SiO_2	10 - 19
FeO	10 - 40 (70 - 80% FeO, 20 - 30% Fe2O3)
MnO	5 - 8
MgO	5 - 10
Al_2O_3	1 - 3
P_2O_5	0.5 - 1
S	< 0.1
Metallic Fe	0.5 - 10

2. Objectives:

- To study the comparison of compressive strength between 7 and 28 days of curing.
- To study the strength development of concrete by percentage replacement of steel slag and glass powder by coarse and fine aggregates.
- To find the optimum measure of steel slag.
- To find the optimum measure of glass powder.
- To find the optimum measure of combined glass and steel slag in concrete mix.

3.0 RESEARCH METHODOLOGY



3.1 MIX PROPORTION FOR M-40

Mix design of M40 grade of concrete using IS 10262:2009

- Cement – 328.22 Kg /m3
- Sand – 747.474Kg/m3
- Aggregate (20mm) – 1277.388 Kg
- Water – 140 liter
- Ratio
- Cement: Sand: Aggregate:- **1: 2.27: 3.88**

3.2 CASTING AND TESTING

The molds of size 150mm x 150mm x 150mm are used for casting of cubes. The molds are cleaned but the corners are pasted with oil. One coat of slicing oil is carried out on all inner surfaces. The molds are crammed in 3 layers and the height of each layer is the approximately 1/3rd height of mold, each layer is compacted with the aid of giving 25 blows with a tamping rod over the whole cross-section uniformly for participants. After filling and compacting the molds, the top surface is made smooth and saved for duration of 24 hours. Then the mildew is removed and the cubes, cylinders, and prism are stored for the preferred duration of curing. The water must be clean and free from impurities. The water must be changed for every 3 days to received exact effects then after finishing the curing length all of the specimens ought to be eliminated and saved for drying for in the future, as it ought to be absolutely dried to received desirable outcomes. The floor of the specimens ought to be cleaned and the test is performed below the compression c trying out in the machine. Compressive strength check: all the blocks are examined in saturation circumstance after drying, containing no moisture in it. For each mix proportions, cubes are examined at 7 & 28 days, the usage of the compression testing system of 3000kN potential. The exams are done at a uniform charge stress stage with the specimen properly located and centered in the machine. Loading is implemented progressively with the assist of hydraulic pumps till the dial gauge studying get reverses its course of the movement. The reversal of needle indicates the total failure of the specimen. The dial gauge reading is cited on the instantaneous of failure, that's the closing failure load of the specimen. The tested specimen is given beneath in fig. The compressive strength is calculated as Compressive strength = most Load (N) /Plan region (mm^2).

3.3 RESULTS AND DISCUSSION

Number of cube tested for different proportion with conventional concrete and Concrete with percentage of Waste Glass powder and Steel slag are shown in table below:

Table1. Compressive Strength of cubes for Glass replacement (7 Days)

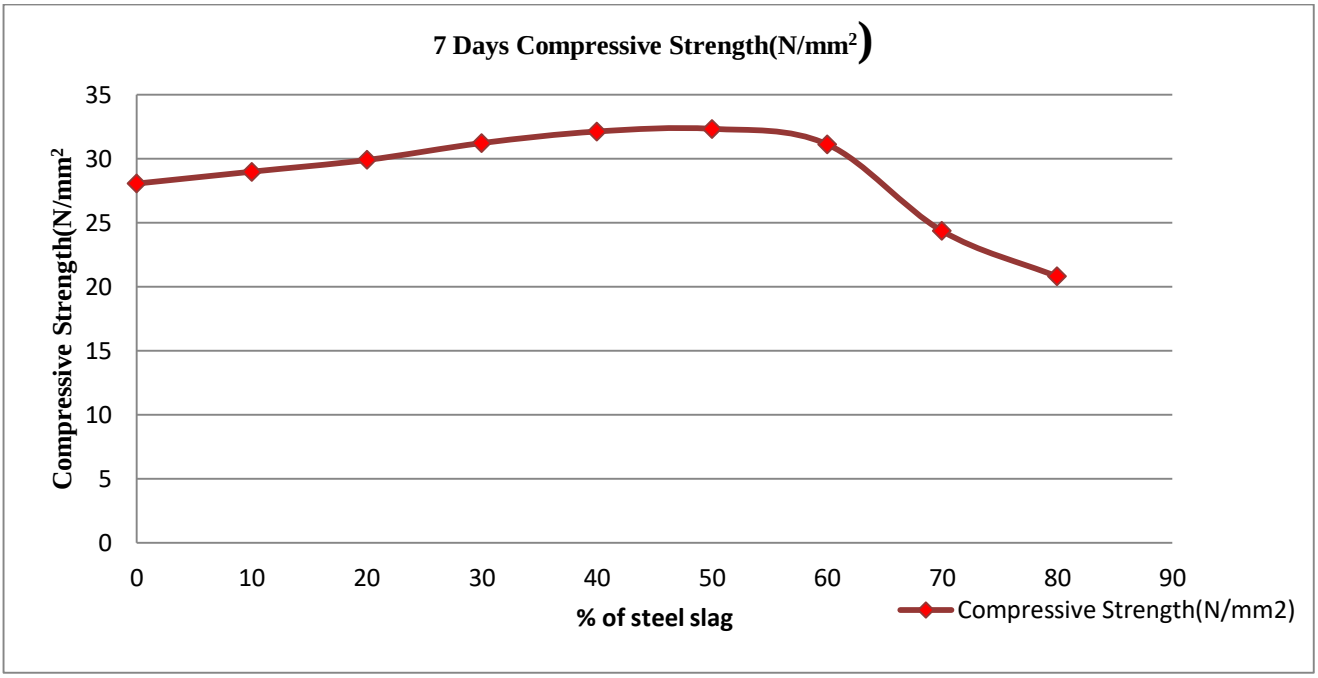
Sr. No	% of Glass powder	Weight of cubes (kg)	Failure load (KN)	Area (mm^2)	Comp. Strength (N/mm^2)
1	0	8.63	544.80	22500	24.31
2	10	8.57	565.26	22500	25.11
3	20	8.52	623.36	22500	27.70
4	30	8.45	466.56	22500	20.73

Table2. Compressive Strength of cubes for Steel slag replacement (7 Days)

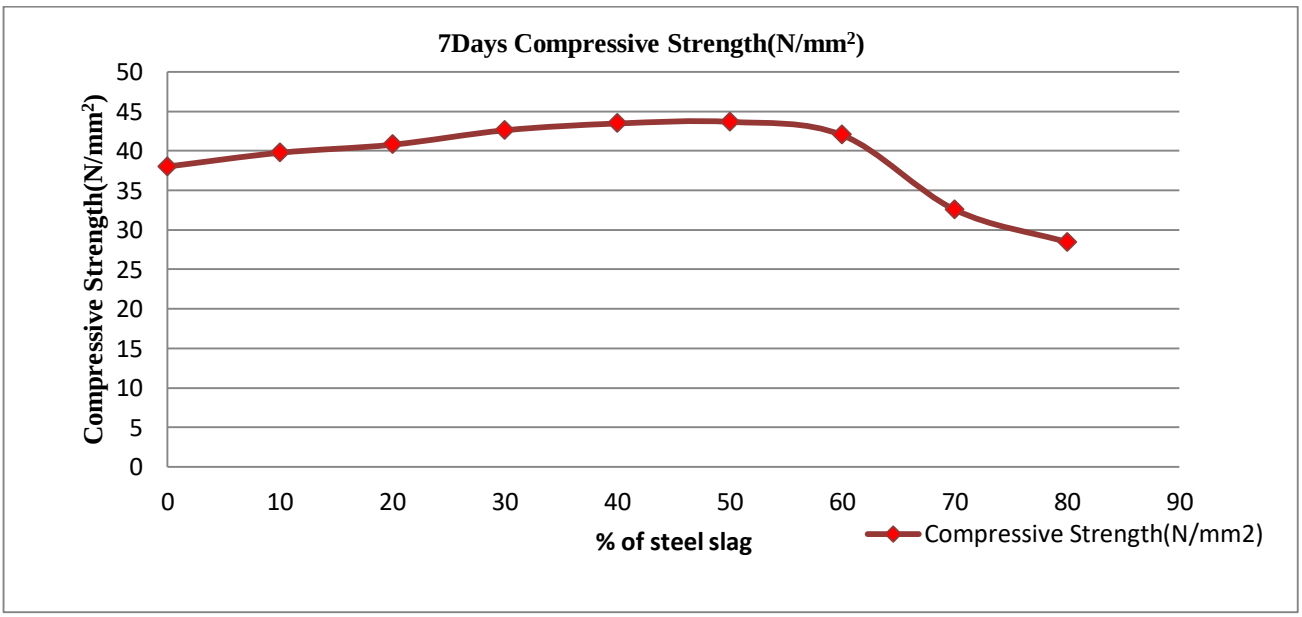
Sr. No	% of Steel slag powder	Weight of cubes (kg)	Area (mm^2)	Failure load (KN)
1	0	586.75	22500	26.08
2	50	668.50	22500	29.71
3	60	699.50	22500	31.08
4	70	620.50	22500	27.54

Table3: Compressive Strength of cubes for combined Glass powder and Steel slag replacement (28Days)

Sr. No	% of powder	Weight of cubes (kg)	Area (mm^2)	Failure load (KN)
1	10	855.66	22500	38.03
2	20	918.00	22500	40.80
3	30	959.33	22500	42.63
4	40	988.66	22500	43.49
5	50	983.33	22500	43.70
6	60	945.33	22500	42.01
7	70	732.33	22500	32.56

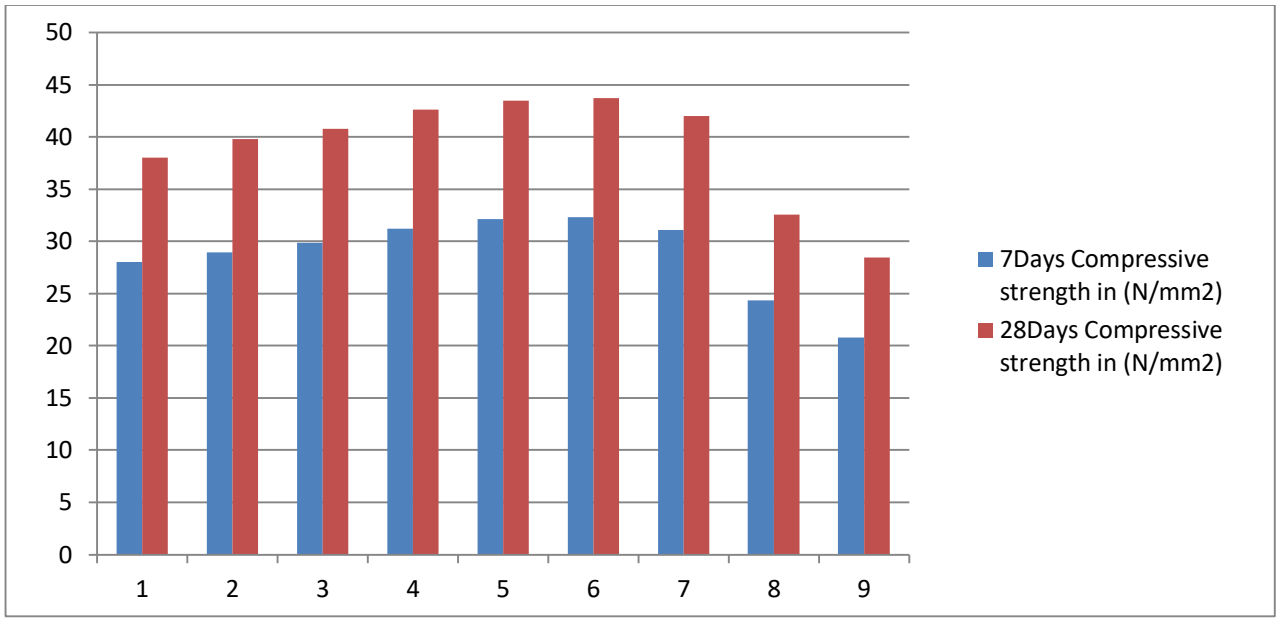


Graph1.0 Compressive Strength of cubes for combined glass powder and steel slag replacement (7Days)



Graph2.0 Compressive Strength of cubes for combined glass powder and steel slag replacement (7Days)

Above Graph 1.0 & 2.0 Shows that the optimum percentage of replacement of steel slag in concrete at 7 and 28-days compressive strength is 50% with 20% replacement of glass powder.



Graph3.0 28 -Days concrete Compressive Strength vs. Replacement of Coarse and fine aggregates by Steel slag and Waste glass Powder

3.4 SUMMARY & CONCLUSION

Figuring out the most beneficial waste glass and metallic slag content to be covered in the concrete blend as a partial replacement, testing on the concrete mixes with premier waste glass and metal slag contents through checking out compressive strength. These goals have been reached by means of carrying out a standard series of compressive strength test. The output effects obtained from laboratory application confirmed dependable facts factors and further studies area the following conclusions can be highlighted from the output of this research and can be summarized as follows:

- This file summarizes the conduct of concrete alternative of the pleasant mixture at 10%, 20%, 30%, 40% and 50% by means of waste glass powder.
- 20% top-rated alternative of pleasant aggregate confirmed 94% increase in compressive Strength in comparison with normal concrete mix with curing of 7 days.
- The concrete mixes containing 30%, 40% & 50% of waste glass powder, there was a reduction in compressive strength.
- The concrete mixes containing 10%, 20%, 30%… up to 70% of metal slag, there was an increase in compressive strength of concrete by 27.84% with 60% most reliable alternative in comparison with the normal concrete mix for 28 days curing.
- The concrete mixes containing more than 60% of metal slag as coarse aggregates suggests there was a reduction in compressive strength.
- For blended substitute of waste glass powder and metal slag, while retaining the waste glass powder 20% regular at some stage in and varying in % of metal slag as a rough aggregates partial alternative and located most excellent consequences at 50%
- Use of waste substances in concrete can show to be economical as it's miles non-beneficial and free of cost.
- Use of waste materials in concrete can prove to be low-budget as it is non-beneficial and free of price. Environmental consequences from wastes and the most quantity of sand mining may be reduced via using alternatives.

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