AN EXPERIMENTAL STUDY ON STRENGTH CHARACTERISTICS OF M25 GRADE CONCRETE BY PARTIAL REPLACEMENT OF CEMENT AND FINE AGGREGATE BY WOOD WASTE ASH AND QUARRY DUST

A Major Project Report Submitted in Partial Fulfillment of the Requirement for the Degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

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CERTIFICATE

This is to certify that the Major Project Report entitled "AN EXPERIMENTAL STUDY ON STRENGTH CHARACTERISTICS OF M25 GRADE CONCRETE BY PARTIAL REPLACEMENT OF CEMENT AND FINE AGGREGATE BY WOOD WASTE ASH AND QUARRY DUST " that is being submitted by

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Signature of the Guide
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Dr. G. Sreenivasulu Ph.D (IISC),
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Examiner:
Date:

Dedicated to my beloved parents, and teachers who have worked hard throughout my education.

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ABSTRACT

In recent years, the use of industrial waste materials as partial replacements for conventional construction materials has gained significant attention due to its economic and environmental benefits. This study aims to investigate the strength characteristics of M25 grade concrete by partially replacing cement and fine aggregate with wood waste ash and quarry dust, respectively . In this experimental study, M25 grade concrete mix was prepared with partial replacement of cement with 10%, 20%, 30%, 40%, and 50% of wood waste ash, and fine aggregate with 10%, 20%, 30%, 40%, and 50% of quarry dust. The compressive strength of the concrete specimens were tested at 3, 7, and 28 days of curing.

KEYWORDS:

Cement,Fine aggregates,Coarse aggregates,Quarry dust,wood waste ash

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Chapter 1

INTRODUCTION

Concrete is one of the most widely used construction materials, and its production contributes to a significant amount of carbon dioxide emissions. Therefore, there is a need to find alternative materials that can replace some of the conventional materials used in concrete production, without compromising its strength and durability. The use of industrial waste materials as partial replacements for conventional materials is gaining popularity due to its economic and environmental benefits . This study focuses on the partial replacement of cement and fine aggregate with wood waste ash and quarry dust, respectively, in M25 grade concrete. Wood waste ash is a by-product of the combustion of wood waste, and quarry dust is a by-product of stone quarries. Both these materials are abundant and readily available in many parts of the world.The aim of this experimental study is to investigate the strength characteristics of M25 grade concrete with partial replacement of cement and fine aggregate with wood waste ash and quarry dust, respectively. The study will involve preparing concrete specimens with varying percentages of replacement for both materials and testing their compressive strength, at different curing periods.

Chapter 2

LITERATURE REVIEW

1.B.krishna rao and s.rajasekhar[2015] an experimental study using different percentages of quarry dust as replacement for the aggregate in concrete specimens.The study objective is investigate the use of quarry dust as a replacement for fineaggregate in concrete
2.D.Vijayakumar,N.Natarajan[2017]The paper is based on experimental studying using different percentages of quarry dust as replacement for sand in concrete specimens.
3.M.L.Abdulwahab,T.M.Abdulrahman[2018] to evalute the effect of using woodash as partial replacement for cement in concrete.The tittle as use of woodash as paritial replacement for cement in concrete.
4.S.Kisku,k.k.singh[2019]to investigate the potiential of using wood ash as a sustainable alternative to cement in concrete as for study tittle is sustainable concrete with woodash. The key finding Wood ash can be replace up to 30% of cement in concrete without significantly effect strength or durability.
5.A.A.Ramezanlanpour,S.A.sahebi[2019]To evalute th eeffect lof woodash on the strength and workability of cement mortars.
6.G.Balamurugan and Dr.p.perumal[2019] to evalute the sutability of quarry dust as replacement for sand in concrete.The aim experimental study using different percentage of quarry dust as replacement for sand in concrete specimens.

OBJECTIVE

1.Determine the optimal replacement levels of wood ash and quarry dust that can be used without significantly reducing the strength of concrete.

Chapter 3

MATERIALS USED

3.1 CEMENT

Cement is the mixture of calcareous , siliceous, argillaceous and other substances. Cement is used as a binding material in mortar, concrete, etc. Ordinary Portland Cement (OPC) is the basic Portland cement and is best suited for use in general concrete construction. It is of three types of grades, 33 grade, 43 grade, 53 grade. One of the important benefits is the faster rate of development of strength. Portland slag cement is obtained by mixing Portland cement clinker, gypsum and granulated blast furnace slag in suitable 6 proportion and grinding the mixture to get a thorough and intimate mixture between the constituents. This type of cement can be used for all purposes just like OPC. It has lower heat of evolution and is more durable and can be used in mass concrete production. In this we are using 53 grade of cement.

Figure 3.1: CEMENT (ORDINARY PORTLAND CEMENT)

3.2 FINE AGGREGATE

Fine aggregate is material passing through an IS sieve that is less than 4.75mm gauge beyond which they are known as coarse aggregate. The most important function of the fine aggregate is to provide workability and uniformity in the mixture. The fine aggregate also helps the cement paste to hold the coarse aggregate particle in suspension. According to IS 383:1970 the fine aggregate is being classified in to four different zone, that is Zone-I, Zone-II, Zone-III, Zone-IV.

Figure 3.2: FINE AGGREAGATE (PASSING 2.36MM SIEVE)

3.3 COARSE AGGREGATE

Concrete is a mixture of cementious material, aggregate, and water. The aggregate strength is an important factor in the selection of aggregate. The shape and texture of aggregate affects the properties of fresh concrete more than hardened concrete. Concrete is more workable when smooth and rounded aggregate is used instead of rough angular or elongated aggregate. Two sizes of course are used one 16 mm passing through 12.5 mm retained and other 25 mm passing through 20mm retained. As per IS: 2386 - 1963 recommendations the properties of coarse aggregates were determined.

Figure 3.3: COARSE AGGREAGATE (20MM)

3.4 WOOD WASTE ASH

Wood waste ash (WWA) is a byproduct of the combustion of wood waste. It is a powdery material that contains high amounts of silica and alumina, which makes it suitable for use as a partial replacement for cement in concrete production. Several studies have investigated the use of WWA as a cement replacement in concrete, and most have reported that it enhances the strength characteristics of concrete.

Figure 3.4: WOOD ASH

3.5 QUARRY DUST

One of the key components of concrete is fine aggregate, which typically makes up 30-40% of the total volume of concrete. However, the demand for fine aggregate is increasing rapidly, which is leading to a shortage of this material in many parts of the world. In addition, the extraction and transportation of fine aggregate can have significant environmental impacts, including soil erosion, water pollution, and air pollution.

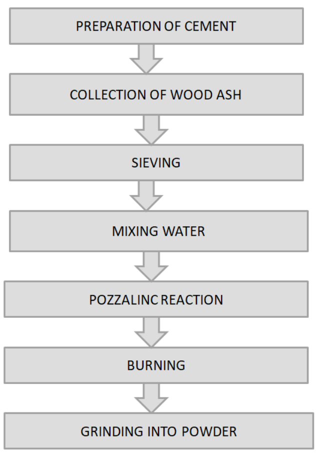
Figure 3.5: QUARRY DUST

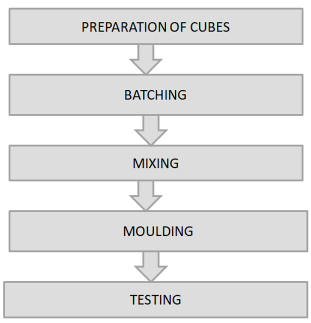
Chapter 4

METHODOLOGY:

1.Collection and preparation of wood ash: Wood ash is collected from the burning of wood in a controlled environment to avoid contamination. The collected ash is then sieved to remove any large particles and to obtain a consistent particle size.
2.Mixing and buring and crushing : After sieving of wood ash we can mix wood ash with water and prepared for drying wood ash we can burn the wood ash balls in batti .
3.Preparation of concrete mixtures: Concrete mixtures are prepared by mixing the desired proportions of cement, aggregates, water, and wood ash and Quarrey dust.The type and proportion of aggregates used can vary depending on the specific application and requirements of the concrete.
4.Testing of concrete properties: The fresh and hardened properties of the concrete are then tested. Fresh properties include workability, slump, and setting time, while hardened properties include compressive strength.

4.0.1 FLOW CHARTS





Chapter 5

M-25 MIX DESIGNS AS PER IS-10262-2019

1. This standard provides the guidelines for proportioning concrete mixes as per the requirements using the concrete making materials including other supplementary materials identified for this purpose. The proportioning is carried out to achieve specified characteristics at specified age, workability of fresh concrete and durability requirements.
2. This standard is applicable for ordinary, standard and high strength concrete grades. The standard also covers provisions for the mix proportioning of self compacting concrete and mass concrete.
3. All requirements of IS 456 in so far as they apply,shall be deemed to form part of this standard.

PERCENTAGE REPLACEMENT OF CEMENT AND FINE AGGREGATE BY WOOD ASH:

Partical	10 % Replacement kg/m^3	20 % Replacement kg/m^3	30 % Replacement kg/m^3	40 % Replacement kg/m^3	50 % Replacement kg/m^3
Cement content	1.116	0.99696	0.87234	0.74272	0.6231
Wood ash content	0.124	0.24924	0.37386	0.49848	0.6231
Fine aggregate content	2.2257	1.7784	1.7131	1.4838	1.2365
Quarry dust content	0.2473	0.4946	0.7419	0.9892	1.2365

5.1 M-25 CONCRETE MIX DESIGN

5.2 TARGET STRENGTH FOR MIX PROPORTIONING

In order that not more than the specified proportion of test results are likely to fall below the characteristic strength, the concrete mix has to be proportioned for higher target mean compressive strength f'ck The margin over characteristic strength is given by the following relation:

f'ck =fck + 1.65 S or f'ck = fck + X

f'ck = target mean compressive strength at 28 days,in N/mm^2

fck = characteristic compressive strength at 28days, in N/mm^2

S = standard deviation, in N/mm^2

X = factor based on the grade of concrete, as per Table

M-25 CONCRETE MIX DESIGN		
As per IS 10262-2019		
A-1	**Stipulations for Proportioning**	
1	**Grade Designation**	**M25**
2	Type of Cement	OPC 53 grade confirming to IS-12269-1987
3	Maximum Nominal Aggregate Size	20 mm
4	Minimum Cement Content (IS-456-2000)	300 kg/m^3
5	Maximum Water Cement Ratio (IS-456-2000)	0.5
6	Workability (IS-456-2000,Pg.No-17) Beam and column	25-75 mm (Slump),we take 50 mm
7	Exposure Condition	Normal
8	Degree of Supervision	Good
9	Type of Aggregate	Crushed Angular Aggregate
10	Maximum Cement Content	540 kg/m^3
A-2	**Test Data for Materials**	
1	Cement Used	OPC 53 grade
2	Sp. Gravity of Cement	3.10
3	Sp. Gravity of Water	1.00

5.3 SELECTION OF WATER-CEMENT RATIO

Different cements, supplementary cementitiousmaterials and aggregates of different maximum size,grading, surfacetexture, shape and other characteristics may produce concrete of different compressive strengthfor the same free water-cement ratio. Therefore, the relationship between strength and free water-cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free water-cement ratio (by mass) (w/c) corresponding to the compressive strength at 28 days may be selected from the relationship shown in Fig.1,for the expected 28 days strength of cement. The final w/c is arrived at, based on the results of all the trials and any change in strength of cement shall get adjusted in the trials. In case, the actual strength of cement is known, the curve corresponding to the actual strengthof cement may be used

4	Chemical Admixture	BASF Chemicals Company
5	Sp. Gravity of 20 mm Aggregate	2.74
6	Sp. Gravity of Sand	2.8
7	Free (Surface) Moisture of 20 mm Aggregate	nil
8	Free (Surface) Moisture of Sand	nil
9	Sieve Analysis of Individual Coarse Aggregates	Separate Analysis Done
10	Sieve Analysis of Combined Coarse Aggregates	Separate Analysis Done
11	Sp. Gravity of Combined Coarse Aggregates	2.74
12	Sieve Analysis of Fine Aggregates	Separate Analysis Done
A-3	**Target Strength for Mix Proportioning**	
1	Target Mean Strength	31.6N/mm^2
2	Characteristic Strength @ 28 days	25N/mm^2

5.4 ESTIMATION OF COARSE AGGREGATE PROPORTION

Aggregates of essentially the same nominalmaximum size, type and grading will produce concrete of satisfactory workability when a given volume of coarse aggregate per unit volume of total aggregate is used. Approximate values for this aggregate volume are given in Table 5 for a water-cement/watercementitious materials ratio of 0.5, which may be suitably adjusted for other ratios, the proportion of volume of coarse aggregates to that of total aggregates is increased at the rate of 0.01 for every decrease in water-cement/cementitious materials ratio by 0.05 and decreased at the rate of 0.01 for every increase in watercement ratio by 0.05. 1. For more workable concrete mixes which is sometimes required when placement is by pump or when the concrete is required to be worked around congested reinforcing steel, it may be desirable to reduce the estimated coarse aggregate content determined using Table 5 up to 10 percent. However, caution shall be exercised to assure that the resulting slump, water-cement/cementitious materials ratio and strength properties of concrete are consistent with therecommendations of IS 456 and meet projectspecificationrequirements as applicable.

A-4	**Selection of Water Cement Ratio**	
1	Maximum Water Cement Ratio (IS-456-2000)	0.5
2	Adopted Water Cement Ratio	0.5
A-5	**Selection of Water Content**	
1	Maximum Water content (10262-table-2) 20 mm aggregate	186 kg/m^3 .
2	Estimated Water content for 50-75 mm Slump	186 kg/m^3.
A-6	**Calculation of Cement Content**	
1	Water Cement Ratio	0.5
2	Cement Content (186/0.5)	372 kg/m^3
		Which is greater then 310 kg/m^3
A-7	**Proportion of Volume of Coarse Aggregate & Fine Aggregate Content**	
1	Vol. of C.A. as per table 3 of IS 10262	62.00%
2	Adopted Vol. of Coarse Aggregate	62.00%
	Adopted Vol. of Fine Aggregate (1-0.62)	38.00%

5.5 ESTIMATION OF FINE AND COARSE AGGREGATE CONTENTS

Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Water-Cementitious Materials Ratio of 0.50

(*Clause* 5.5)

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.54	0.52	0.50	0.48
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.73	0.72	0.71	0.69

NOTES

1 Volumes are based on aggregates in saturated surface dry condition.

2 These volumes are for crushed (angular) aggregate and suitable adjustments may be made for other shape of aggregate.

3 Suitable adjustments may also be made for fine aggregate from other than natural sources, normally, crushed sand or mixed sand may need lesser fine aggregate content. In that case, the coarse aggregate volume shall be suitably increased.

4 It is recommended that fine aggregate conforming to Grading Zone IV, as per IS 383 shall not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions.

A-8	**Mix Calculations**	
1	Volume of Concrete in m^3	1.00
2	Volume of Cement in m^3	0.12
	(Mass of Cement) / (Sp. Gravity of Cement)x1000	
3	Volume of Water in m^3	0.186
	(Mass of Water) / (Sp. Gravity of Water)x1000	
5	Volume of All in Aggregate in m^3	0.694
	Sr. no. 1 – (Sr. no. 2+3)	
A-9	**Mix Proportions for One Cum of Concrete (SSD Condition)**	
1	Mass of Cement in kg/m^3	**372**
2	Mass of Water in kg/m^3	**186**
3	Mass of Fine Aggregate in kg/m^3	**738.46**
4	Mass of Coarse Aggregate in kg/m^3	**1178.96**
6	Water Cement Ratio	0.5

. The values so obtained are divided into coarse and fine aggregate fractions by volume in accordance with coarse aggregate proportion already determined in 5.5

Chapter 6

MATERIALS USED AND CUBE PREPARATION

6.1 ORDINARY PORTLAND CEMENT

Portland cement is by far the most common type of cement in general use around the world. This cement is made by heating limestone (calcium carbonate) with small quantities of other materials (such as clay) to 1450℃in a kiln, in a process known as calcination, where by a molecule of carbon dioxide is liberated from the calcium carbonate to form calcium oxide, or quicklime, which is then blended with the other materials that have been included in the mix. The resulting hard substance, called ‘clinker´, is then ground with a small amount of gypsum into a powder to make ‘Ordinary Portland Cement´, the most commonly used type of cement (often referred to as OPC). Portland cement is a basic ingredient of concrete, mortar and most non-specialty grout.

Type of cement is 53 grade OPC

6.2 FINENESS OF CEMENT

Procedure:

1. Weigh accurately 100 grams of the cement and transfer it to the clean, dry I.S. Sieve breaking ant air lumps.

2. Holding the sieve and pan in hands, sieve until most of the materials has throughout and the residue is fairly clean.

3. Place the cover on the sieve and remove the pan. Holding the sieve and cover firmly in one

hand trap the other side of the sieve with the handle of the cleaning brush. Sweep cleans the underside of the sieve.

4. Empty the pan clean replace the sieve in the pan and remove the lid carefully return any coarse materials that has been caught in the lid to the sieve(during tapping).

5. Continue the sieve for 15 minutes, rotating the sieve continuously through without spilling the cement.

6. Weigh the residue.

Observations and Calculations:

- Weight of cement taken in to the sieve (gm)= 100gm
- Weight of residue after sieving (gm) =2 gm

$$\text{Quantityof cementretained} = \frac{weightofresidue}{weightofcementtaken} = 98\%$$

Result:$Finenessofthegivencement = 98\%$

6.3 SPECIFIC GRAVITY TEST ON CEMENT

1. Dry the Le-chatelier flask and fill with kerosene oil or Naphtha to a point on the stem between 0 to 1 ml.

2. Dry the inside of the flask above the level of the liquid.

3. Immerse the flask in a constant temp water bath maintained at room temp for sufficient time.

4. Record the level of the kerosene oil in flask as initial reading.

5. Introduce about 64gm of cement into the flask so that the level of kerosene rises to about say 22 ml mark. Splashing should be avoided and cement should not be allowed to adhere to the sides of the flask above the liquid.

6. Insert the glass nipple into the flask and roll it gently in a inclined position to free the cement from air until no future air bubbles rises to the surface of the liquid.

7. Keep the flask again in constant temp water bath and note down the new liquid level as final reading.

8. The difference between the first and final reading represents the volume of liquid displaced by the mass of cement used in test.

9. The density of calculated as per the below mentioned formula to the second place of decimal.

$$\text{Density} = \frac{Mass}{DisplacedVolume} = 2.808$$

Result:$Specificgravityofcement = 2.808$

6.4 STANDARD CONSISTENCY OF CEMENT

Normal consistency is defined as that percentage water required of the cement paste the viscosity of which will be such that the Vicat plunger penetrates up to a point 5 to 7 mm from the bottom of the Vicat mould. When water is added to cement, the resulting paste starts stiffening and gaining strength simultaneously losing its consistency. Two stiffening states are identified as initial and Final setting time respectively. Initial setting time is defined as the time taken by the paste to stiffen to an extent such that Vicat needle is not permitted to move down through the paste within 5 +/-0.5 mm measured from the bottom of mould. Final setting time is the time when the paste becomes so hard that the annular attachment to the needle under standard weight fails to leave mark on the hardened cement paste. Thus normal consistency and setting times are archeological properties since these concepts are defined corresponding to standard flow of cement paste under standard force exerted by the weight of relevant plunger.
Standard consistency of cement=32

6.5 PRACTICAL RELEVANCE

The water requirement for making specimens for the determinations of initial and final setting times and of tensile and compressive strength of cement sand mortars and for soundness tests depends upon the normal consistency of cement to be used. This normal consistency or water demand of cement depends upon the compound composition and fineness of the cement.

Procedure

• Take 400gms of cement and prepare a paste of weighed quantity of water taking care that time of mixing [gauging] is between 3 to 5 minutes and shall be completes before any signs of setting become visible. The time of gauging shall be counted from the time of adding water to the dry cement until the commencement of filling mould.

• Fill the Vicat mould with the paste of the mould resting on a non-porous plate and then smooth off the surface of the paste making it level with the top of the mould.

• Plan the test block in the mould together with the mom-porous resting plate under the rod bearing the plunger lower the plunger [c] gently to touch the surface of the test block and quickly release allowing it to sink into the paste. The operation shall be carried out immediately after filling the mould and at room temp prepare trial paste with varying percentages of water and test as described above and measures the penetration of the needle.This test is to be carried out until the specified penetrations is obtained.

• Repeat till a paste which allows the plunger to settle to a point with in 5mm to 7mm from bottom of vicat mould is got.

Weight of cement taken: 400gm

6.6 INTIAL AND FINAL SETTING TIME OF CEMENT

Normal consistency is defined as that percentage water required of the cement paste the viscosity of which will be such that the Vicat plunger penetrates up to a point 5 to 7 mm from the bottom of the vicat mould. When water is added to cement, the resulting paste starts stiffening and gaining strength simultaneously losing its consistency. Two stiffening states are identified as initial and final setting time respectively. Initial setting time is defined as the time taken by the paste to stiffen to an extent such that vicat needle is not permitted to move down through the paste within 5±0.5 mm measured from the bottom of mould. Final setting time is the time when the paste becomes so hard that the annular attachment to the needle under standard weight fails to leave mark on the hardened cement paste. Thus normal consistency and setting times are archeological properties since these concepts are defined corresponding to standard flow of cement paste under standard force exerted by the weight of relevant plunger.

6.7 PARTICAL RELEVANCE

The water requirement for making specimens for the determinations of initial and final setting times and of tensile and compressive strength of cement sand mortars and for soundness tests depends upon the normal consistency of cement to be used. This normal consistency or water demand of cement depends upon the compound composition and fineness of the cement. The initial setting times of the a cement is limiting time beyond which paste mortar of concrete made from it cannot be placed or compacted without loss of useful properties e.g. strength. The final setting time is the time limit beyond which mould can be removed. For generally available cements the normal consistency varies from 30 to 35 percentage initial setting time 30 minutes initial setting and final setting time 10 hours.

6.7.1 FINAL SETTING TIME

The mould is prepared as for the determination of initial setting time. The cement shall be considered is finally set, when upon applying the attachments [F] gently to the surface of the test block, the needle makes an impression there on where as the attachments fails to do so.The time elapsed since adding water is called final setting time.

Weight of cement taken =400 gm.

Weight of water taken for making specimen = 0.85 X P=0.85 x 400= 108.8 ml

Where p is the consistency

Initial setting time of cement: 40 minutes

Final setting time of cement: 405 minutes

6.8 SOUNDNESS OF CEMENT

Le-chatelier apparatus is used for the determination of soundness of cement.It consists of a small split cylinder of spring brass of 0.5mm thickness, forming a mould 30mm internal diameter and 30mm high. On either side of the split are attached two indicators with pointed ends AA the distances from ends to the center of the cylinder being 165mm. the mould shall be kept in good condition with the jaws more than 0.5mm apart.

Procedure:

1. Place the mould on a glass sheet and fill it with cement paste formed by gauging cement with 0.78 times the water required to give a paste of normal consistency.

2. Cover the mould with another piece of glass sheet, place a small weigh on this covering glass sheet and immediately submerge the whole assembly in water at a temp of 27℃keep there for 24 hours.

3. Measure the distance separating the indicator points.

4. Submerge the mould again in water at the temp prescribed above. Bring the water to cooling, the mould kept submerged for 25 to 30 minutes, and keep it there for three hours.

5. Remove the mould from the water, allow it to cool and measured the distance between the indicators points. The difference between these two measurements represents the expansions of cement.

Here fineness modulus of sand = and Using IS code: (IS: 383-1970) zone of fine aggregate is zone II.

Observations:

Type of cement: OPC cement

Normal consistency: P=28%

Water required for soundness test= 0.78 x P = 0.78 x 28 = ml

Initial distance = 1.5cm

Final distance= 1.7cm

Expansion of cement= 2 mm

Result: Soundness of the given cement: 2 mm

6.9 FINENESS MODULUS OF FINE AGGREGATE

Fineness modulus of sand is an index number which represents the mean size of the particles in sand. It is calculated by performing sieve analysis with standard sieves. The cumulative percentages retained on each sieve is added and divide by 100 gives the value if fineness modulus.

Procedure: Take a 500 gm sample of fine aggregate.

• Take set of IS sieve 4.75, 2.36, 1.18, 0.6, 0.425, 0.3, 0.15, 0.075 mm etc.,

• Grading pattern of a sample F.A is passed by sieving a sample successively throughout all the sieves mounted one over the other in order of size, with larger sieve on the top.

• The material retained on each sieve after shaking, sieve can be done either manually or mechanically.

• Operation should be continued such time that almost no particle is passing throughout.For assessing the gradation by sieve analysis the quantity of materials to be taken on the sieve is given in table.

• From the sieve analysis the particle size distribution in a sample of aggregate in found out.

• All the retained material should weighted individual.

6.10 COMPACTION FACTOR TEST

Apparatus

1. Compacting factor apparatus,

2. trowel,

3. Balance.

Procedure

1. The sample of concrete to be tested shall be placed gently in the upper hopper, using the hand scoop.

2. The hopper shall be filled level with its brim and the trap door shall be opened so that the concrete falls into the lower hopper.

3. Certain mixes have a tendency to stick in one or both of the hoppers. If this occurs, the concrete may be helped by pushing the rod gently into the concrete from the top.

4. Immediately after the concrete has come to rest, the cylinder shall be uncovered, the trap door of the lower hopper opened, and the concrete allowed to fall into the cylinder.

5. The excess concrete remaining above the level of the top of the cylinder shall then be cut off by holding a trowel.

6. Weight the cylinder with concrete to the nearest 10 g. This weight is known as the weight of partially compacted concrete (W1).

7. Empty the cylinder and then refill it with the same concrete mix in layers approximately 5 cm deep, each layer being heavily rammed to obtain full compaction.

8. Level the top surface.

9. Weigh the cylinder fully compacted. This weight is known as the weight of fully compacted concrete (W2).

10. Find the weight of the empty cylinder (W).

Calculations:

$$\frac{weight of partically compacted concrete wt}{Weight of fully compacted concrete wt}$$

$$\frac{18.94}{19.96} = 0.948$$

Result:

$The Compaction factor of the concrete sample = 0.948$

$= 0.94 High workability$

6.11 AGGREGATE IMPACT TEST APPARATUS

The impact test is a type of quality control test for highway pavements and is used to check the suitability of aggregates to be used in the construction of highway pavements.

Apparatus

1. Tamping rod,

2. IS sieve,

3. Balance,

4. Oven,

5. impact testing machine,

5.cylindrical measure.

Procedure

1. Sieve the material through 12.5mm and 10.0 mm IS sieves. The aggregates passing through 12.5 mm sieve comprises the test material.

2. Then, just 1/3 rd depth of measuring cylinder is filled by aggregate by pouring.

3. Compact the material by giving 25 gentle blows with the rounded end of the tamping rod in the cylinder.

4. Two more layers are added in a similar manner, to make cylinder full.

5. Strike off the surplus aggregates.

6. Determine the net weight of the aggregates to the nearest gram (W1).

7. Bring the impact machine to rest without wedging or packing upon the level plate, block or floor, so that it is rigid and hammer guide columns are vertical.

8. 25 gentle strokes with tamping rod are used to compact the test sample by fixing the cup firmly in position on the base of the machine with placing the whole of the test sample in it.

9. After that raise the hammer until its lower face is 380 mm above the surface of the aggregate in the cup and allow it to fall freely on the aggregate sample. 15 such blows at an interval of not less than one second between successive falls are acted on it.

10. Remove the crushed aggregate from the cup and sieve it through 2.36 mm IS sieves until no further significant amount passes in one minute. Weight the fraction passing the sieve to an accuracy of 1 gm (W2). The fraction retained in the sieve is weighted.

Results

Aggregate Impact Value= $\frac{100xw3}{w1} = \frac{100x52}{314} = 16.56\%$

6.12 AGGREGATE CRUSHING TEST

The aggregate crushing value gives a relative measure of the resistance of an aggregate to crushing under a gradually applied compressive load. With aggregate of aggregate crushing value 30 or higher, the result may be anomalous, and in such cases the ten percent fines value should be determined instead.

Apparatus

1. Steel cylinder,

2. Tamping rod,

3. Balance.

Procedure

1. The material for the standard test shall consist of aggregate passing a 12.5 mm IS Sieve and retained on a 10 mm IS Sieve, and shall be thoroughly separated on these sieves before testing.
2. The aggregate shall be tested in a surface-dry condition. If dried by heating, the period of drying shall not exceed four hours, the temperature shall be 100 to 110°C and the aggregate shall be cooled to room temperature before testing.
3. The appropriate quantity may be found conveniently by filling the cylindrical measure in three layers of approximately equal depth, each layer being tamped 25 times with the rounded end of the tamping rod and finally leveled off, using the tamping rod as a straight-edge.
4. The weight of material comprising the test sample shall be determined (Weight A) and the same weight of sample shall be taken for the repeat test.
5. The cylinder of the test apparatus shall be put in position on the base plate and the test sample added in thirds, each third being subjected to 25 strokes from the tamping rod. The surface of the aggregate shall be carefully levelled and the plunger inserted so that it rests horizontally on this surface, care being taken to ensure that the plunger does not jam in the cylinder.
6. The apparatus, with the test sample and plunger in position, shall then be placed between the platens of the testing machine and loaded at as uniform a rate as possible so that the total load is reached in 10 minutes. The total load shall be 400 kN.
7. The load shall be released and the whole of the material removed from the cylinder and sieved on a 2.36 mm IS Sieve for the standard test. The fraction passing the sieve shall be weighed (Weight B).

Calcuations

Aggregate Crushing Value= $\frac{100xw3}{w1} = \frac{100x480}{2784} = 17.24\%$

Result

$AggregateCrushingValue = 17.2\%$

6.13 SHAPE TEST AND ELONGATION TEST

Particle shape and surface texture influence the properties of freshly mixed concrete more than the properties of hardened concrete. Rough-textured, angular, and elongated particles require more water to produce workable concrete than smooth, rounded compact aggregate.

Consequently, the cement content must also be increased to maintain the water-cement ratio. Generally, flat and elongated particles are avoided or are limited to about 15% by weight of the total aggregate.

Apparatus

1. Standard thickness of gauge,

2. Balance

Procedure

1. A quantity of aggregate shall be taken sufficient to provide the minimum number of 200 pieces of any fraction to be tested.

2. Separation of Flaky material- Each fraction shall be gauged in turn for thickness on a metal gauge

3. The total amount passing the gauge shall be weighed to an accuracy of at least 0.1 percent of the weight of the test sample.

4. The Flakiness Index is the total weight of the material passing the various thickness gauges or sieves, expressed as a percentage of the total weight of the sample gauged.

5. Separation of Elongated Material- Each fraction shall be gauged individually for length on a metal length gauge of the pattern shown in Fig. 4. The gauge length used shall be that specified in co1. 4 of Table 1 for the appropriate size of material.

6. The total amount retained by the length gauge shall be weighed to an accuracy of at least 0.1 percent of the weight of the test sample.

7. The elongation index is the total weight of the material retained on the various length gauges, expressed as a percentage of the total weight of the sample gauged.

Calculations

Flakiness Index= $\frac{w1+w2+w3+\dots}{w1+w2+w3}100$

$= \frac{W3}{W1}100$

$$= \frac{7220}{297844} = 24.24\%$$

Results

$The flakiness Index of the given sample = 24.24\%$

6.14 SPECIFIC GRAVITY OF AGGREGATE

6.14.1 OBJECTIVE

Specific Gravity is defined as the ratio of Weight of Aggregate to the Weight of equal Volume of water. The specific gravity of an aggregate is considered to be a measure of strength or quality of the material. Aggregates having low specific gravity are generally weaker than those with high specific gravity. This property helps in a general identification of aggregates.

6.14.2 APPARATUS REQUIRED

1.Wire Mesh Bucket:Wire basket of not more than 6.3 mm mesh or a perforated container of convenient size with thin wire hangers for suspending it from the balance.
2.Setup of Specific Gravity Test (To be used for Aggregate ¿ 6.3 mm):The setup consists of container for filling water and suspending the wire basket in it and an airtight container of capacity similar to that of basket, a shallow tray and two dry absorbent clothes. Pycnometer:Pycnometer of 1000 ml for aggregates finer than 6.3 mm

6.14.3 PROCEDURE

Procedure For Specific Gravity Determination For Aggregate Coarser Than 6.3mm:
1. About 2 kg of aggregate sample is taken, washed to remove fines and then placed in the wire basket. The wire basket is then immersed in water, which is at a temperature of 220 degree celsius to 320 degrees celsius
2. Immediately after immersion the entrapped air is removed from the sample by lifting the basket 25mm above the base of the tank and allowing it to drop, 25 times at a rate of about one drop per second.
3. The basket, with aggregate are kept completely immersed in water for a period of 24 $\pm$ 0.5 hour.
4. The basket and aggregate are weighed while suspended in water, which is at a temperature of 220 degree celsius to 320 degree celsius.
5. The basket and aggregates are removed from water and dried with dry absorbent cloth.
6. The surface dried aggregates are also weighed.
7. The aggregate is placed in a shallow tray and heated to about 1100 in the oven for 24 hours. Later, it is cooled in an airtight container and weighed.

Procedure For Specific Gravity Determination Of Aggregate Finer Than 6.3mm:

1. A clean, dry pycnometer is taken and its empty weight is determined.

2. About 1000g of clean sample is taken into the pycnometer, and it is weighed.

3. Water at 270 degree celsius is filled up in the pycnometer with aggregate sample, to just immerse sample.

4. Immediately after immersion the entrapped air is removed from the sample by shaking pycnometer,placing a finger on the hole at the top of the sealed pycnometer.

5. Now the pycnometer is completely filled up with water till the hole at the top, and after confirming that there is no more entrapped air in it, it is weighed.

6. The contents of the pycnometer are discharged, and it is cleaned.

7. Water is filled up to the top of the pycnometer, without any entrapped air. It is then weighed.

8. For mineral filler, specific gravity bottle is used and the material is filled upto one-third of the capacity of bottle. The rest of the process of determining specific gravity is similar to the one described for aggregate finer than 6.3 mm.

Result: specific gravity of fine aggregates = 2.808

Chapter 7

RESULTS

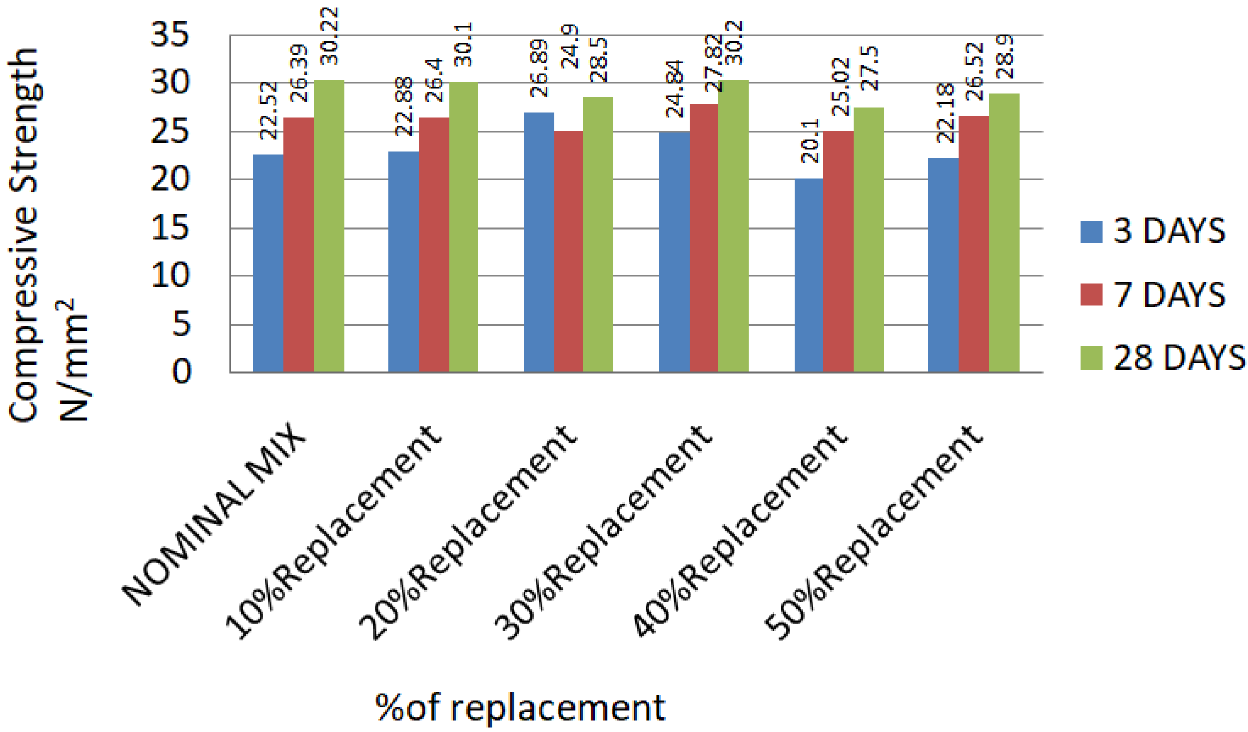
7.1 COMPRESSIVE STRENGTH OF CONCRETE WITH VARIOUS PROPORTIONS OF WOOD ASH AND QUARRY DUST

Compressive strength of cubes :

%Replacement	3days(N/mm^2)	7 days(N/mm^2)	28 days(N/mm^2)
Nominal mix	22.52	26.39	30.22
10% Replacement	22.88	26.4	30.1
20% Replacement	26.89	24.9	28.5
30% Replacement	24.84	27.82	30.2
40% Replacement	20.1	25.02	27.5
50% Replacement	22.18	26.52	28.9

The replacement percentage was 10% 20% 30% 40% 50% by weight of cement. Tests were conducted on 7 days, 28 days and 56 days using the digitalized CTM (compression Testing Machine), so the accumulation of errors can be said to be minimum in this research. The results are provided in Table

7.2 GRAPHS



Chapter 8

CONCLUSION

1.The Concrete cubes with different proportions of concrete by partial replacement of cement and fine aggregate by wood waste ash and quarry dust. Concrete cubes with different proportions of wood waste ash and quarry dust are tested for their compressive strength and found that.

2.The Workability properties of concrete is increases with increasing of percentage of different proportions of wood waste ash and quarry dust.

3.The Compressive Strength of concrete cubes for all mix increases with age of concrete. Compressive strength of concrete cubes is different for different proportions of wood waste ash and quarry dust.

4.From now, the present investigation it is clear that replacement of 30 precent of wood waste ash and quarry is best suitable for concrete cubes.

Chapter 9

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