UTILIZATION OF WASTE MATERIAL IN THE CONSTRUCTION OF PARAPET

A

PROJECT REPORT

submitted in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

Under the supervision

of

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(Assistant Professor – Senior Grade)

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to

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

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HIMACHAL PRADESH, INDIA

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STUDENTS' DECLARATION

We hereby declare that the work presented in the Project report entitled **"UTILIZATION OF WASTE MATERIAL IN THE CONSTRUCTION OF PARAPET**" submitted in partial fulfillment of the requirements for the degree of Bachelor of Technology in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of our work carried out under the supervision of **Dr. Amardeep.**This work has not been submitted elsewhere for the reward of any other degree/diploma. We are fully responsible for the contents of this project report.

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Date ……

CERTIFICATE

This is to certify that the work which is being presented in the project report titled **"UTILIZATION OF WASTE MATERIAL IN THE CONSTRUCTION OF PARAPET"** submitted in partial fulfilment of the requirements for the degree of Bachelor of Technology in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of work carried out by **Gaurav Sharma (151605) & Gaurav Thakur (151677)** under the supervision of **Dr. Amardeep, Assistant Professor,** Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat, Solan, (H.P.).

The above statement made is correct to the best of our knowledge.

Date: ……

Dr. Amardeep	Dr. Ashok Kumar Gupta	Signature of External
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ABSTRACT

Boost in the demand and supply of conformist building materials and the call for providing a sustainable and green development in the construction field has motivated the designers and developers to go for ‘alternative materials’ viable for use in construction which are both eco friendly and highly efficient. For this purpose, the use of waste products, by products and agricultural by products are very constructive and specifically recommended.

In this study, Rice Husk Ash and Marble Powder have been used as admixtures to cement in concrete at their optimum percentage for the construction of parapet. For concrete with 0% RHA and marble powder, mix design based on IS (Indian Standard) method has been done and taking this as reference, mix design has been made for partial substitution of RHA and marble powder.

In the analysis, concrete is to be casted for optimum replacement of RHA and marble powder. Replacement at 5%, 10%, 15%, 20% and 25% is to be carried out. The strength of concrete is to be examined prior to replacement of cement by the above mentioned by products.

Keywords: Marble powder, Risk Husk Ash, Parapet

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LIST OF ABBREVIATION

RHA	Rice Husk Ash
IS	Indian Standard
CTM	Compression Testing Machine
OPC	Ordinary Portland Cement

CHAPTER 1
INTRODUCTION

1.1 GENERAL

It is expected that the usual call for "excessive-performance cement-based resources" has amplified and it is estimated that it is going to be broadly utilized in construction enterprise all through the initial twenty first century and will in due course boom with the passage of time. Economic and ecological concerns had a vital part in the complementary cementing material utilization in addition to elevated engineering and overall performance properties. Over the time numerous researches explained that, "mineral admixtures may be productively, thoughtfully and economically utilized to enhance a few renewed and toughened concrete properties." Marble powder is created/ manufactured from dispensation plants sawing, and sharpening of marble blocks.

Marble powder is one of the materials which severalty influences the surroundings and fitness tribulations on a small or hefty scale with admiration to the situations. It is fabricated from sawing, shaping, and polishing process.

Rice husk can be a agricultural residue broadly accessible in rice manufacturing nations. Even the husk environs the grain grain. Through the duration of grinding process of paddy sausage roughly 78 percent of weight is obtained like rice, broken rice and bran. Outstanding 22 percent of this burden of paddy is got as husk. This husk can be employed as gas within the assorted turbines to create steam to get the par-boiling technique. This husk comprises about five percent organic shaky thing and also the others 25 percent of this loading with this husk has been transformed in to ash in a certain time of this shooting system that this Ash is named rice husk ash.

1.2.1 PARAPET

A parapet is a barrier that is a porch of the wall at the edge of a top, terrace, balcony, walkway or other formation. In parapet an extending above a roof a parapet may clearly be the portion of an exterior wall that above the line of the roof floor or can be a prolongation of a vertical feature on the underside of the roof such as a fire wall or some other wall.

1.2.2 RICE HUSK ASH

Rice husk is generated from the rice processing industries as a huge agricultural byproduct in various sections of the world, mainly in budding or underdeveloped nations. Around 500 million heaps of paddies are produced worldwide each year but once the ignition takes place, about 20 percent of rice husk has been shifted to RHA. Yet there's not any helpful utility of RHA and can be normally thrown into water flows or even as landfills inflicting environmental pollution of atmosphere, soil and water. RHA contains non crystalline silicon dioxide using high precise surface area and high pozzolanic reactivity, hence as a result of rising environmental problem and the _ to save sources and electricity, using industrial and biogenic waste because supplemental cementing fabric is now an integral portion of cement manufacturing. Pozzolonas enhance energy since they might be nicer than the cement particles, which may package between the cement particles and also provide a nicer pore arrangement. RHA has two functions in concrete manufacturing, like a substitute for Portland cement, so reducing the cost of concrete at the manufacture of low value construction blocks, also as a admixture inside the Production of top energy concrete.

1.2.3 MARBLE POWDER

Marble is a metamorphic rock as a result of the transformation of pure lime stone. The stone is also among the critical substances utilized in constructional tasks since ancient occasions, particularly for ornamental uses. Turkey consists of the 40 percent of overall marble reserve on earth. 7,000,000 heaps of marble ends up being manufactured at Turkey annually and 75 percent of those constructions are processed in nearly 5000 plants. It might be apparently visible the waste chemicals of the flora reach thousands and tens of thousands of heaps. Stocking of those waste chemicals is impossible. These sorts of solid waste materials need to get inactivated very well without having damaging the environmental surroundings. The absolute most suited inactivating procedure now is currently recycling. Re-cycling delivers with a few benefits for example shielding the all-natural resources, energy conserving, causative to market, cutting back the waste materials along with earning an investment to future years.

Waste marble is traditionally utilized as untreated or admixture material and nice or rough mixture in various industries together with ceramic, brick and construction compounds. Inside this analysis, properties of hardened concrete generated waste marble powder utilized admixture or even quality/coarse combo inside the concrete were analyzed in same manner. Additionally, it has been ascertained the chances of use of those waste within the concrete as admixture fabric or mixture influenced optimistically at the hardened properties of concrete. Hence a study within the literature linked to toughened properties of concrete fashioned waste marble was analyzed.

1.3 NEED OF THE STUDY

This analysis tackles the problem of the waste which is generated from building areas, such as for instance demolished Marble powder along with RHA.

This re-cycling will not only help conserve "OUR NATURAL RESOURCES", but in addition will also help us solve the ever increasing "waste disposal crisis".

"A waste organization plan" directs the construction activities towards an eco friendly process by reducing and managing the amount of waste that is being discarded in the toxic waste sites. (Conservation of raw materials and efficient use of waste substances).

1.4 OBJECTIVE OF THE STUDY

The main objective of this study is the utilization of waste material in order to create a sustainable environment.

1. Substituting cement with the best possible alternative without compromising with the required strength.
2. To salvage the work in order to make the construction economical (i.e. parapet and can be used for other construction purposes).
3. Propose several guidelines regarding the use of different waste materials (i.e. as used in the present study) individually and in combined manner.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

First of all, the collective objective of this chapter is to attain the importance of the general study in this particular field. The majority of the volume of this chapter is on gravely examining the various methodologies and steps involved in this field so as to recognize the suitable approach for investigating the study.

2.2 LITERATURE REVIEW

S**adek et al., (2013)** conducted a research on consequences and the usage of the using Crushed Ceramic squander at pavements. The goal of this exploration was supposed to test the results of"using smashed porcelain in generation of interlocking emitting parts. 'Nine mixtures' ended up throw. The combination was at which aggregates had been employed lower and upper levels the controller mixture. At the third and second combinations crushed ceramic hasbeen utilised in the level substituting a hundred percentage of stone and 50 percent . From the fifth and fourth combinations ceramic hasbeen utilised in the level substituting a hundred percentage of sand and 50 percent, respectively. By the mix, fine and coarse ceramic are employed in the coating substituting 50 percentage of stone and fifty percentage of sand, respectively. Fundamentally, at the coating and completely of sand smashed ceramic was employed at the and eighth combinations whereas the sand has been utilized in the very surface. Tests were also performed to inspect the qualities of those fabricated specimens after 28 days of healing. The norm that is Egyptian is the same with all all the standard. The outcomes indicate that it is potential to utilize waxed ceramic in cubes' Creation

Wahyuni et al., (2014) ran a research on cement together with RHA's structure, sea tree bamboo and ash fiber accumulation. "Concrete has very excellent compressive but suprisingly low electrical power. The accession of fiber into concrete may upsurge that the ductility of this clay matrix. This analysis intends to examine the electric strength of concrete with 0.50per cent

addition of bamboo fiber (predicated on latest excess fat). The alternative is divided to four proportions 40 percent, 20%, 30 percent, and 10 percent. These proportions are predicated on"the burden of nice mixture". Even the investigational campaign consisted of casting 1-3 different kinds of cement to be contrasted in relation to"dividing tensile power" in age 28 and ninety times. Ordinarily the energy of bamboo fiber fortified concrete is corresponding to the of Concrete.

Christopher etal (2016) Conducted a record on properties of mortar and concrete utilizing rice husk ashes such as fractional surrogate of ordinary Portland cement. As a way to seize the occurrence of global warming due to the release of greenhouse gases especially CO2 into the air, the use of materials their use has been promoted. Some is rice husk ash (RHA) which has been demonstrated ideal by researchers to mildly substitute common Portland cement from the manufacture of concrete. This newspaper delivers forth a comprehensive and additionally an greater level assessment of this project of many researchers in body and options which arrive with tangible containing rice husk ash (RHA) as fractional substitute for ordinary Portland cement. Lots of those findings include: (I) controlled ignition needs to make RHA with construction which could influence in nuclear infantry, (ii) the using RHA triggered enlarged water requirement, (iii) approximately 10 percent substitution with RHA is going to lead to strength growth equivalent to this control specimens, and (iv) the using RHA in true cause resistant RHA-concrete microstructure to agent of degradation such as for example, sulphate strikes, chloride ingress, etc., in addition to fine shrinkage qualities, and so make solid concrete in case used. However, some areas such as the bending and shear replies (and perceptible belongings) of fortified concrete slabs and beams together with RHA are now not insured by researchers; they truly have now been therefore indicated for future identification.

Talah et al. (2015) ran a study to the end of Marble Powder on Concrete conduct. Report an experimental investigation with this impact of marble powder called a partial substitute for Portland cement (computer) on the mechanical properties along side also permanence of top performance concretes. The research that the experimental results of tangible bat 15 percent material of granite powder working with a fineness modulus of the 11500 cm2/g, at a darkened environment, revealed it contributes positively in to the validity of its very own perfunctory faculties, its own durability connected to migration of chromium ions and oxygen permeability.

On the grounds of those experiments completed, it may be ascertained that the masonry powder is more correct for formulation of top performance concretes (HPC) and their possessions are much better in contrast together using the benchmark concrete (RC).

Gulden Caging Ulubeylia et al. (2015) conducted a study (two) Self-compacting concrete combination (3) Polymer concrete mixture. Throw away marble powder has been created out since it might boost several aspects of their concrete, which the employment of squander marble from the concrete combination within combination or a material is matching. Usage of squander marble at the plastic and self-compacting concrete blends within accumulative or a chemical is maybe perhaps not influenced with regard to properties of concrete. Using squander marble powder has, also lessens the porosity in matrix that is real. If trimming marbles has been completed in businesses throw away marble powder stems. Throughout the procedure that is very, 20 30 percent of the marble block becomes more stain corrode powder. Powder has been just really a materials. Waste causes a ecological catastrophe. Ergo, using throw away marble at the manufacture within aggregate or a material has become a critical matter. Granite powder contains diverse houses by assessing all of consequences,"the masonry waste may be utilized from the creation of real". Hence squander marble powder can be Utilised in (1)) Traditional concrete mixture "throw away Granite powder provides us Compressive energy Flexural energy Splitting energy and Modulus of Elasticity, compressive power could possibly be as a result of this the busy SiO2 in throw away marble powder may react together using the Ca (OH)2 at cement to produce secondary calcium silicate hydrate and also make it digitally secure and dense.

Ramesh Babu et al (2016) conducted a report on concrete on analysis of admixture effect and also volume class F fly ash concrete. F fly ash is used as Substitution of cement. Jaya Sankar et al. utilized egg yolk powder because substitution of cement in Concrete and created for M25, M20 & M-30 level of concrete. Specific Performance of fly ash 2.1, pH 11.52, Sponsored articles 0.81percent And Substance possessions Element Weightpercent CaO-5.97, SiO2-61.00, Al2O3-18.901, Fe2O3- 4.903, M-Go - 1.991, Na2O- 2.48, K2O-1.13, TiO2- 1.08. Class F fly ash combinations were created together with the engineered M 25 caliber of CC by replacing of the cement together with FA at Many Different degrees of 0%, 25%, 35%, 45% and 55 percent by weight. In FA and CC concrete that is blended.

Marta Giaretton et Al(20-16) Conducted a report on Unreinforced masonry (URM) parapets are freestanding components located over the perimeter walls of URM buildings and also pose an important decreasing threat which has caused frequent accidents and expensive maintenance in late earthquakes across Earth. Various mortar combinations and recycled clay bricks were useful for its parapets. A parapet can be a URM Unit situated with the role of steering clear of the stretch of flame at locations that are opaque, provided that guardrails on roof terraces above the masonry border walls.

Derakhshan et al. Ran a report that followed previous job by Griffith et al and proposed that a procedure to value the lively out-of-plane equilibrium of broken URM walls and parapets located in multi storey URM buildings utilizing specimens derived from original principles and representative single-degree-of freedom (SDOF) models. Clay bricks got from the URM building were pre arranged with depth of approximately 10 -- 15 mm at a bond blueprint. Brick size were of normal dimensions (230L 110W 75H M M) for legacy masonry structure. Three corresponding mortar combinations were utilized, being 1:2:9 (known as combination 'A', together with all the highest compressive strength), 1:3:12 (noted as combination 'B'), also 0:1:3 (known as combination 'C 'together with all the dollar compressive strength) (cement: lime: sand) with quantity to simulate the Frequent area.

Requirements of antique mortar with varying potency which range from fairly powerful (A) to badly slowed because of weathering (C).

Bina Patel et al.. ran a Study regarding optima substitute of concrete from rice husk ash in concrete, Rice husk soon immediately right following ingestion that continues to be is considered a great deal easier than many several some other beneficial supplies like slag, and silica view the. As a materials as of gravity decreases the fill at the structure, RHA is effective. Power increases together using the increase in the percentage of Rice Husk Ash replacement 20 percent RHA to find. The proportion of plain water cement ratio is dependent on amount of RHA since RHA can be utilized in concrete. Even the work ability of concrete was located to function as decrease together with growth RHA in the concrete. At Rice husk ash's substitute amounts there is increase in energy in 3 weeks to 7 weeks. None the less there's significant increase in energy in seven days to 28 times.

Kashyap Rishab et al. Conducted a report impacts of partial substitution of cement by Rice Husk Ash in cement he partially exchange cement from using RHA by 5 percent, 10% & 15 percent & 20 percentage from the weight of cement from four split up experimentation to determine the most effectiveness and assess it together with most of the current effectiveness of concrete working with the caliber of M 30 from the times of 7days,14weeks &28 times. The mix proportioning IS 10262:2009. The target me-an energy was 38.25MPa for OPC get a handle on mixture, the entire binder information material 398.648kg/m3, nice mixture is accepted 669.847kg/m3 demanding combination is obtained 1175.243kg/m3 the drinking water into cement ratio has been retained steady 0.45, the Super-plasticizer material inch percentage by weight of cementitious substance was retained seized a downturn of (75- 100mm) for each mixture. He concluded as substitution A mount of RHA escalates the power rises, in the ages. The optimal/optimally potency is got in the sum of ten percentage of OPC traded by RHA. Employing RHA the emission of greenhouse gases could be decreased as a larger degree. OPC alternative of price of production of concrete from RHA by the wide range of seven to ten percentage final outcomes.

M. Castellino et al (2016) ran a study to describe 2 d numerical simulations of velocity and pressure fields generated by non-breaking waves onto a vertical breakwater with a recurred parapet wall. Large part of this perpendicular wall is affected by an impetuous augment in pressure caused by pulsating wave, in comparison with the instance. The values of these impulsive pressures are restricted beneath the recurred parapet. Kiscik et al(2012) arrangement, which may possibly be classify because of sea wall, is produced from a vertical wall using an over hanging horizontal cantilever slab whose role is to lower wave overtopping. Jolt pressure characterized most of the evaluations. The very first impact occurs on the part that is vertical, as the 2nd one occurs underneath the area.

Paramveer Singh et al.. [3] Analyzed That the"mechanical components of cement by half way supplanting of cement with rice husk fiery particles. The m 40 evaluation of cement had been useful to examine flexure and also quality quality after 28 days of the and a week. The concrete will be always to become supplanted (by weight) with rice husk fiery continues to be by 5 per cent, 10 percent, 15 percent and 20 percentage to receive compact results. Techniques/Statistical Assessment: Through this specific examination feature, accentuation was manufactured on

having a peek in the increased amount of RHA employed as supplanting with tangible (by weight) from the car or truck of evaluation assessment. Due to the fact RHA has occupation compared standard and at increment of quality because split that's rigidity along with flexure. Price tag of advancement will decrease. The end result might be pulled out. RHA is affliction well disposed employed for advancement rationale, it offers advantage and accessible. Because it's been found to establish that a increment when compared and dominate combination that is tangible RHA mainly simply since substitution of bond remains your measurement. The split will increment utilizing increment quantities of RHA up-to mix decrease, Once substitution will be more than control combine. On enlarging the rate supplanting of bail with RHA there's really actually just a drop from the esteem that is eyebrow. S O 5 percentage RHA substitution is good for portion rigidity. Flexure quality is realized at RHA substitution caliber drop in manage mix caliber nonetheless for RHA substitution of linking RHA. Perfect material for grade that is flexure along with excellent quality is 10-percent supplanting utilizing rice husk cinder caliber begin adhering to that is beginning declining with increment of all RHA information and also decreasing all a surprising, for divide elasticity substance that is ideal is just 5 per cent.

T.P. Meikandaan et al. [4] Conducted a record on rice husk that could be very"only waste link between vegetation. This really can be definitely an admixture that's incredibly responsive. The fineness is of the petition of / gm. The incorporation of rice husk continues to be in effect the different parts of concrete. As part of this combo which contours the mass that is fantastic, the Rice husk slag behaves to some tiny extent as overall as well as like truly being fully truly a component. This analysis can affirm superior ampleness and the implementation of using rice husk slag within an substitution of bond in these own different in grade cement with a material that is identical. Solid combinations were installment using bail substitution dimensions of 0 per cent, 5 percent, 10 percent, and 15 percentage from rice husk fiery continues to be.

Seyed Alireza Zareei et al.. [5] conducted a Study over the"inevitable and fundamental excitement for employing fractional substitutions or - goods since key pozzolanic substances was commonly initiated by implementation of atmosphere pollution manage emerge as of bail manufacturing market. Boost husk is sideeffect eliminated at temperatures that it reduces roughly the proportion of 200 kilogram for each ton of rice, also into 40 kg with from rice mill course of action. This newspaper presents positive aspects came as a consequence of one-of-a-kind

proportions of rice husk ash(RHA) on sound pointers during 5 mix strategies with extents of 5, 10, 15, 20 and 25 percentage RHA by means of concrete not surpassing 10% Nominal scale noodle (MS) to be contrasted and a standard combination together with 100 percent Portland concrete. Tests consequences revealed the positive connection amongst 1-5 percentage supplanting of both RHA using increment in compressive properties by approximately 20 per cent. An ideal measurement of solidarity and also sturdiness possessions to its huge role benefit with grow upto 20 percentage, ago that's associated with slight decreasing in caliber parameters by roughly 4.5 percent. Results obtained for proportions that were water-retention. Chloride particles infiltration expanded with increment in bond substitution by roughly 25 per cent with regard for the underlying traits (roughly in short supply of what one-fifth). During the decades, implementation put together assessments determined by materials entered types of evaluation plans. It truly is more often than not believed that usefulness of extra substances to concrete may be the make mechanical and professional mechanical elements of this may be spring of natural and conservative benefits, more substantial amounts of blood flow stream, attachment of clean new combo, what is a lot far much more, a lot additional feature amid solidified state. Prompt increasingly and viewpoints misused to improve . This 6 strategies excels from 0-25% who are approximately also in RHA extents. there is a variety of a investigation focused on efficacy and also software of substitution of vitamin augmentations in cement, and also the analysis intended to introduce an evaluation reliant upon advantages.

N Kaarthik Krishna et al.. [6] conducted a report that's increment at the sake of ordinary advancement substances and also the dependence on committing a supportable development from the evolution field has triggered the engineers and planners to decide on'optional materials' practical for use within evolution. With this goal, the using waste items and side effects that are rural are all productive. Outcomes and these squanders, as an instance, Fly Ash," Rice Husk Ash Slag could be supplanted instead of tangible at perspective in their behavior, which necessitates tract such as ditching of terrains. Rice Husk Slag was employed to bond from cement as a admixture as well as its particular properties was analyzed. An effort has been done to have a take a look at the functionality and good product quality parameters of cement. For average solid, blend configuration is completed determined by Indian Standard (IS) plan and accepting this reference, blend configuration was designed for substitution of Rice Husk Ash. Four

substitution levels 5 percent, 10%, 15% and 20 percent concentrated and are chosen the substitution technique.

The current work investigates the appropriateness of utilizing Rice husk fiery debris for being a substitution of bail. The appropriateness of rice husk fiery debris because being a cementitious material was assessed by directing the physio-chemical evaluation of this fixings and also the effect of RHA on solid possessions (fresh condition and solidified state). By the chemical assessment it had been detected it comprises nearly 80 percent silica. To examine the sharp stage possessions, the helpfulness esteems so much as Slump (mm), Vee-- honey-bee Levels (sec.) And compaction variable for varying RHA degree of strong mix in a temperatures of 320 ^{O}C had been performed as well as the results have been analyzed. Land such as high superior possessions along with also quality, divide rigidity were evaluated. Water-retention think of has been led to inspect the efficacy of evaluation so far as water consumption. By the evaluation examination it had been detected in bail has been near 10 percent so far as quality and functionality, the the substitution of Rice Husk remains. The use of Rice husk slag for a swap to get concrete in concrete may decrease the emanation of both gases to some degree which increases the chances for number of carbon monoxide.

Awoyera et al. (20-16) ran a study on the usage of Ceramic Waste Aggregate (CWA). This study evaluated the mechanical categorization of porcelain garbage aggregate (CWA) concrete, so in an effort to ascertain its structure structure. CWA concrete's workability was comparable to this hands cement, which pitted between higher and medium work ability. This for CCA-100 mix (ceramic coarse aggregate using 100% ceramic crude), has been an exception. In general, the perfunctory recital of the CWA concretes was much better. The greatest compressive strength and split electrical power were achieved by substituting 100% of this natural aggregate together with CCA and ceramic nice aggregate (CFA) independently. CWA concretes' components increased since the substitution percentage of aggregates amplified. It can be accomplished as a replacement for part of the natural aggregates can be thought of as an appropriate alternate for ordinary concrete, within the scope of the experiments performed in this particular investigation, concrete made with CWA. In reality, where strength is more concerned, it is even more suitable than conservative concrete.

2.3 SUMMARY

After thoroughly going through a number of research papers and previous studies, we came up to conclude that the use of RHA and marble powder could actually improve the strength and other important parameters of concrete. The easy availability of these by products also was a defining factor in the selection of material. Recent trends have shown that both RHA and marble powder have acted as very useful admixtures.

CHAPTER -3

METHODOLOGY

3.1 GENERAL

In this chapter, we lay light on the methods to be used so as to utilize wastes such as RHA and marble powder in the construction of parapet and any other civil engineering structure. We will try to replace cement with the above-mentioned wastes without hindering the properties of the mix design and the parapet eventually; rather we will look for improvements in the design mix and its properties caused by the wastes.

3.2 MATERIALS USED

The three main materials used in the study are Ordinary Portland Cement (OPC 43), marble powder and Rice Husk Ash (RHA) which was manufactured in ACC Limited, Barmana plant, Distt. Bilaspur, Himachal Pradesh. Marble Powder was collected from Chintapurni Marble Co. Pvt. Ltd in Mehatpur, Distt. Una, Himachal Pradesh and RHA was ordered online from Amazon.in.

1. Concrete

In our project, we are using amalgamation of the following substances as the concrete:-

- Cement
- Coarse aggregate
- Fine aggregates
- Water

All these are exactly the ones used from the concrete that is conventional. But we've substituted cement and the aggregate. To be sure of concrete's effectiveness inside our endeavor we now track proportioning and the choice controller of the ingredients at quantities that are optimum.

2. Cement

By the studies use of Forty Three Tier OPC is best to get a concrete that is durable and robust. Hence, grade forty three OPC is currently preferred. Taking in to account the previous researches, for a concrete with high strength, OPC of 43 grade is appropriate.

3. Fine aggregates

This constituent is majorly secured from the type. It is beautifully written of the river sand which is formed by the natural disintegration of rocks. This chiefly consists of protein plus it is inactive inert substance. It's essential it passes via 4.75 IS sieve

4. Coarse aggregates

This fixing can also be naturally-occurring material to get either e.g. gravel or so also the remains accessed right soon immediately following disintegration of stones. The contaminants come in angular form. The dimensions are much over 4.75millimeters and also inside our cement we've utilized the rough combination of highest magnitude of 20mm.

5. Rice husk ash

Different chemical composition of rice husk ash has been tabulated in table 3.1 below.

Table 3.1 Chemical composition of rice husk ash

Chemical composition	Percentage
SiO_2	77.58
Al_2O_3	0.34
Fe_2O_3	0.76
CaO	1.10
MgO	0.30
Na_2O	0.09
K_2O	2.58
C	7.73

Fig. 3.1 Rice Husk Ash

6. **Marble powder**

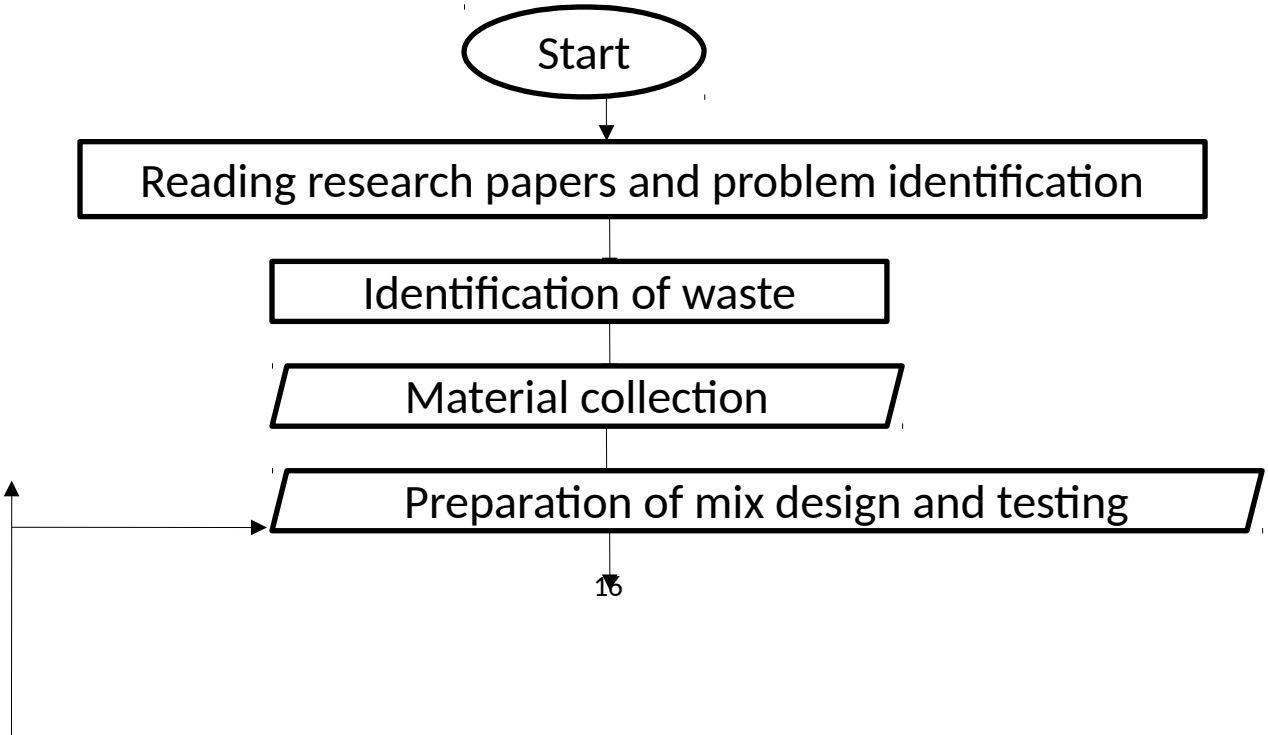
Different chemical composition of rice husk ash has been tabulated in table 3.2 below.

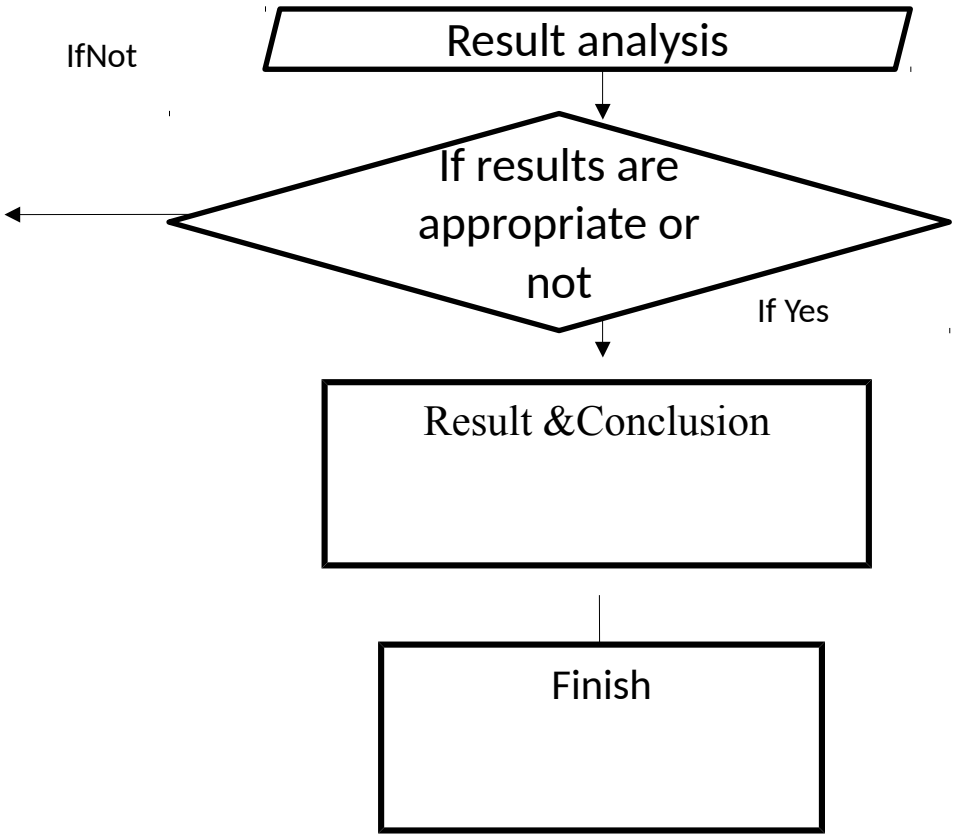
Table 3.2 Chemical composition of marble powder

Oxides compound	Percentage
CaO	42.45
Al2O3	0.520
SiO2	26.35
Fe2 O3	9.40
MgO	1.52

Fig. 3.2 Waste Marble powder

3.3 WORK PLAN





3.4 METHODOLOGY

Different tests for cement were carried out so as to obtain the optimal usage of waste materials; marble powder and rice husk ash in the concrete mix. Replacement of cement was done by weight considering all the standardized specifications and norms. First of all strength on various parameters was calculated for pure concrete mix without any kind of replacement, i.e., at 0%. After that by weight replacement of cement was done at increasing proportions starting from 5%, up to 25% for both RHA and marble powder.

3.4.1 SUITABLE TESTING

The testing of cement, marble powder and RHA is to be carried out structurally by means of the following parameters:

- Specific Gravity of Cement
- Specific gravity of Rice Husk Ash
- Specific Gravity of marble powder

- Compressive strength tests
- Flexural strength tests
- Universal strength tests

3.4.2 TESTING OF CONSTRUCTION MATERIAL

Different tests were carried out to examine the properties of cement, which are as follows:

1. **Specific gravity of cement**
   The test to determine the specific gravity of cement was according to IS 4031 (11) – 1988. Specific Gravity Bottle and kerosene were used for determining the specific gravity of cement. The specific gravity is calculated as:

   Specific gravity = $w5 \times (w3 - w1) / (w5 + w3 - w4) \times (w2 - w1)$

   Where, w_1 = weight of empty bottle

   w_2 = weight of empty bottle + weight of water.

   w_3 = weight of bottle + weight of kerosene.

   w_4 = weight of bottle + weight of water + weight of kerosene.

   w_5 = weight of cement.

Fig. 3.3 Specific gravity bottle

2. **Specific gravity of RHA**

The test to determine the specific gravity of RHA was done according to IS 4031 (11) – 1988. Le-Chatelier flask was used for determining the specific gravity of rice husk ash. It too was done using kerosene. 64 gm of cement was taken. The specific gravity was calculated as follows:

$$\text{Specific gravity} = w_5 \times (w_3 - w_1)/(w_5 + w_3 - w_4) \times (w_2 - w_1)$$

Where, w_1 = weight of empty bottle

w_2 = weight of empty bottle + weight of water.

w_3 = weight of bottle + weight of kerosene.

w_4 = weight of bottle + weight of water + weight of kerosene.

w_5 = weight of RHA.

3. **Specific gravity of marble powder**

The test to determine the specific gravity of marble powder was done according to IS 4031 (11) – 1988. Le-Chatelier flask was used for determining the specific gravity of rice husk ash. It was done using kerosene. 64 gm of cement was taken. The specific gravity was calculated as follows:

Specific gravity = $w_5 \times (w_3 - w_1)/(w_5 + w_3 - w_4) \times (w_2 - w_1)$

Where, w_1 = weight of empty bottle

w_2 = weight of empty bottle + weight of water.

w_3 = weight of bottle + weight of kerosene.

w_4 = weight of bottle + weight of water + weight of kerosene.

w_5 = weight of marble powder.

4. **Specific gravity of fine aggregates**

Procedure:-

Approximately 2 kg of total example is washed altogether to expel fines, depleted and put in wire container and drenched in refined water at a temperature between 22-32º C and a front of in any event 5cm of water over the highest point of crate. Following drenching the captured air is expelled from the example by lifting the crate containing it 25 mm over the base of the tank and enabling it to drop at the rate of around one drop for every second. The container and total ought to remain totally drenched in water for a time of 24 hour a short time later. The bin and the example are gauged while suspended in water at a temperature of 22° – 32°C. The weight while suspended in water is noted = W_1

The bin and totals are expelled from water and permitted to deplete for a couple of minutes, after Cool the Sample and weight it as W_2.The unfilled crate is then come back taken surface dried
Total is then= W_3 g
Specific Gravity = W_3/ (W_2-W_1) off by this material. At that point the total exchanged to the second dry total is then gauged.

5. **Specific Gravity of Fine Aggregates**

Procedure

1. Take around 500g of sample and put it in the pycnometer.
2. Discharge distilled water into it until it is full.
3. Eradicate the entrapped air by rotating the pycnometer on its side, the hole in the apex of the cone being covered with a finger.
4. Wipe out the outer surface of pycnometer and weigh it (W)
5. Transfer the contents of the pycnometer into a tray, care being taken to guarantee that all the aggregate is transferred.

3.4.3 CONCRETE MIXTURE

The system for collection of appropriate contents of concrete & examination of their comparative proportions with the objective of producing a concrete of explicitly required strength is known as concrete mix design. Ratios of Concrete mix design (Cement: Sand: Aggregate) is 1:1.5:3. The following table represents mix proportions of concrete for varying RHA and marble powder substitution by weight of cement.

Fig. 3.4 Mix Design

The control concrete without RHA or marble powder was also made-up along with above mentioned mixes. The design mix for M30 grade is done with respect to IS 10262: 2009. The design mix of each material for the preparation of design mix for OPC 43 grade cement, zone II gradation sand, 20 mm coarse aggregate along with 0.45 water to cement ratio (design of M30 grade of concrete) are described below:

Description of grade - M30

Cement type - Ordinary Portland Cement 43 grade conforming to IS 8112

Specific Gravity of OPC 43 cement - 3.15

Maximum cement content (kg/m3) - 450 kg/m^3

Minimum cement content(kg/m3) - 320 kg/m^3

Maximum nominal size of aggregate (mm) - 20 mm

Specific Gravity of Coarse Aggregate (20 mm) - 2.8

Type of coarse aggregate - Crushed Angular Type

Type of Fine Aggregate - Zone II

Specific Gravity of Fine Aggregate - 2.6

Workability (mm)- 20 mm to 50 mm (slump)

Exposure Condition - Severe

Table 3.3 Mix Design for M30 Concrete

Percentage of RHA replaced	Coarse aggregate in Kg/m^3	Fine aggregate in Kg/m^3	Cement in Kg/m^3	Rice husk in Kg/m^3	Water in Kg/m^3
0%	1186.688	674.804	413	0	186
5%	1186.688	674.804	392.35	20.65	186
10%	1186.688	674.804	371.7	41.3	186
15%	1186.688	674.804	351.05	61.95	186
20%	1186.688	674.804	330.4	82.6	186

Fig. 3.4 Concrete Mix Design

Table 3.4 – Required properties for M30 concrete

Parameters	**Required characteristics**
Characteristic Compressive Strength required at the end of 28 days (N/mm2)	30 N/mm2
Maximum size of Aggregate(mm)	20mm
Type of Exposure	Severe
Degree of Quality Control	Good

1. **Selection of water/cement ratio:**

   Water cement ratio = 0.45 (From table 5 of IS 456: 2000)

2. **Determination of water content:**

   Extreme water content for 20 mm coarse aggregate = 186 liter (From table 2 of IS 10262 : 2009)

3. **Selection of cement content:**

   Water/cement ratio = 0.45
   Hence, Cement content = 186/0.45
   = 413.33 kg/m^3
   (From table 5 of IS 456 : 2000 minimum cement content for 'severe' exposure condition is 320 kg/m^3)
   413 mm kg/m^3>320 kg/m^3, hence ok.

4. **Proportion of volume of coarse aggregate and fine aggregate content:**

   From table 3 of IS 10262: 2009, volume of coarse aggregate and fine aggregate (Zone II) corresponding to 20 mm size aggregate = 0.62

   Volume of coarse aggregate/Volume of fine aggregate = 0.62
   Volume of fine aggregate/Volume of fine aggregate = 1 – 0.62 = 0.38

Hence, Mix Calculations:

For per unit volume of concrete, the mix calculations are:

a) Volume of concrete = $1m^3$

b) Volume of cement = $\frac{Massofcement}{Specificgravityofcement} * \left(\frac{1}{1000}\right)$

= 413.33/3.15 x 1000
= 0.131 m^3

c) Volume of water = $\frac{Massofwater}{Specificgravityofwater} * \left(\frac{1}{1000}\right)$

= 186/1 x 1000
= 0.186 m^3

d) Volume of total aggregate = [Volume of cement – (Volume of water + Volume of cement)]
= [1 – (0.131 + 0.186)]
= 0.683 m^3

e) Mass of coarse aggregate = Volume of total aggregate x Volume of coarse aggregate x Specific gravity of coarse aggregate x 1000
= 0.683 x 0.62 x 2.8 x 1000
= 1186.688 kg/m^3

f) Mass of fine aggregate = Volume of total aggregate x Volume of fine aggregate x Specific gravity of fine aggregate x 1000
= 0.683 x 0.38 x 2.6 x 1000

$= 674.804 \text{ kg/m}^3$

g) Hence, the proportion of mix = Cement : Fine aggregate : Coarse aggregate

= 1: 1.6: 2.87

TESTING OF CEMENT

So as to obtain the desired specification of the concrete mix, we performed some of the basic, standardized tests for concrete. Namely, these tests include:

1) Compressive Strength of Concrete
2) Flexural strength of concrete
3) Split tensile strength of concrete

LIST OF CONCRETE CAST

- Three cubes, three cylindrical and three beams at 0% RHA.
- Dimension of cube is 150X150X150, dimension of beam is 100X100X500 & radius of our cylinder is 5 cm & height is 13 cm.

(Cubes give us compressive strength; beams are used to determine flexural strength and cylinder for the determination of split tensile strength value.)

Fig. 3.5 Concrete casting apparatus

3.4.6 Compressive strength of concrete

The following steps are involved in determining the compressive strength of concrete:

1) Concrete cubes as per the mix design are casted and the dimension of these cubes is 150mm x 150mm x 150mm.
2) The cubical mould should be cleaned properly before oiling it.
3) After 24 hours, the concrete blocks are taken out of the mould, and left for curing.
4) The specimen is then removed from water after specified curing time and excess water is wiped off from the surface.
5) The cubes are placed in the compression testing machine for testing.
6) The maximum load and any unusual failures are finally noted.

Fig. 3.6 casting of cubes

Fig. 3.6 Compression testing machine

Flexural strength of concrete:

The test for the flexural strength of concrete blocks can be done by flexural testing machine after 7, 14 and 28days of curing. The concrete beams of dimensions 100 mm x 100 mm x 150 mm were prepared. It is performed to determine the modulus of rupture, which is given by

Modulus of rupture = Pl/bd^2

Where, P = maximum applied load applied to specimen.

l = max length of span on which specimen is being supported.

b = max width of specimen.

d = max depth of specimen.

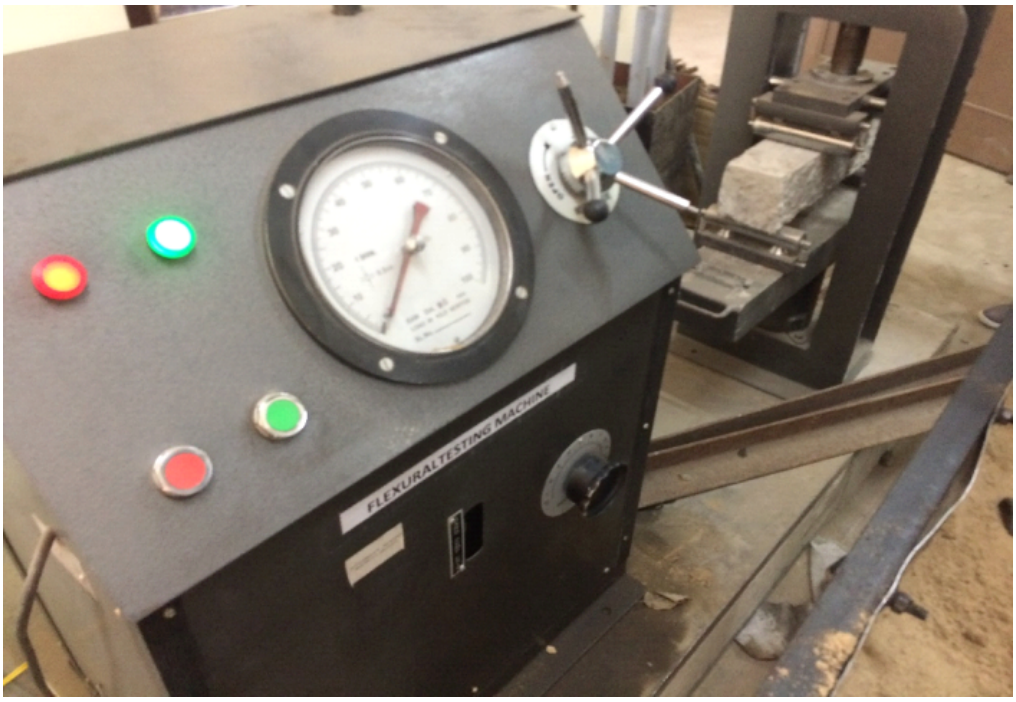


Fig. 3.7 Flexural testing machine

Split tensile strength of concrete:

The test for split tensile strength of concrete can be evaluated by universal testing machine (UTM) after 7 days and 28 days of curing. The concrete cylinder is of dimension 150 mm diameter & 300 mm long were prepared. The split tensile strength is then given by

$T = 2P/\pi DL$

Where, P = maximum load applied in N to specimen.

D = diameter of specimen in mm.

L = length of specimen in mm.

Fig. 3.8 Universal Testing Machine

CHAPTER 4

RESULTS AND CONCLUSIONS

4.1 GENERAL

Different tests were performed for cement, marble powder and RHA and replacement of cement with RHA and marble powder and the results were compared.

4.2 RESULTS

The results which were obtained from different testing are considered in this chapter. The result part consists of result from the testing of concrete samples like compressive strength, flexural strength, split tensile strength and the basic cement tests.

4.2.1 Material testing results:

The specific gravity of both OPC and RHA were determined. Following are the results of specific gravity test for Ordinary Portland Cement, Marble Powder and Rice Husk Ash:

Table 4.1 various results of cement

Sr. No.	Specific gravity	Results
1.	Cement	3.157
2.	RHA	1.97
3.	Marble powder	2.15

4.2.2 Concrete testing results

Using compression-testing machine after 7 and 28days, the compressive strength of concrete at various proportions of RHA and marble powder samples was calculated. The results for the replacement of cement by RHA at 7 and 28 days have been shown in table 4.2.

Table 4.2 Compressive strength results for replacement of cement by RHA at different proportions over a period of 7 days and 28 days.

Sr. No.	Days(Replacement)	Compressive strength(MPa)

1.	7(0%)	12 MPa
2.	7(5%)	12.7 MPa
3.	7(10%)	13.3 MPa
4.	7(15%)	12.2 MPa
5.	7(20%)	11.1 MPa
6.	7(25%)	10.9 MPa
7.	28(0%)	30 MPa
8.	28(5%)	30.7 MPa
9.	28(10%)	31.2 MPa
10.	28(15%)	30.3 MPa
11.	28(20%)	28.6 MPa
12.	28(25%)	27.3 MPa

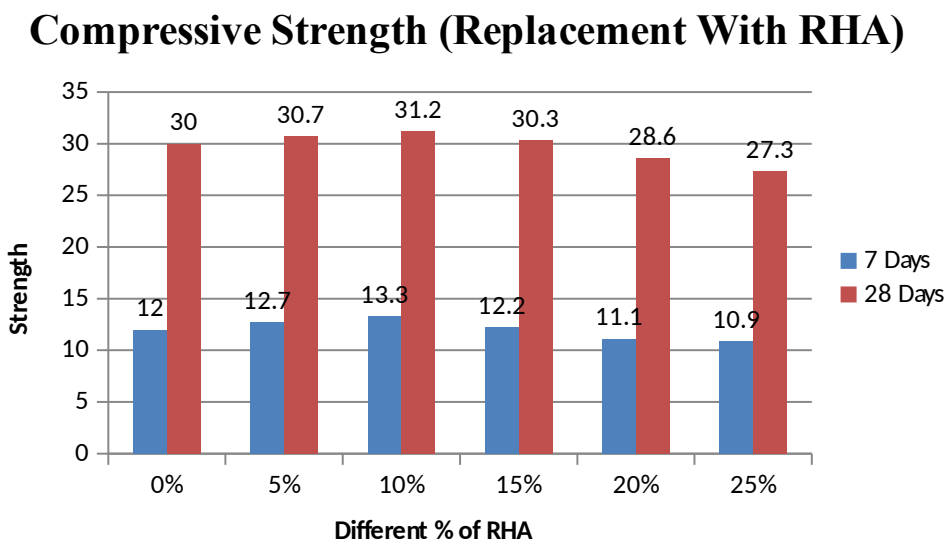


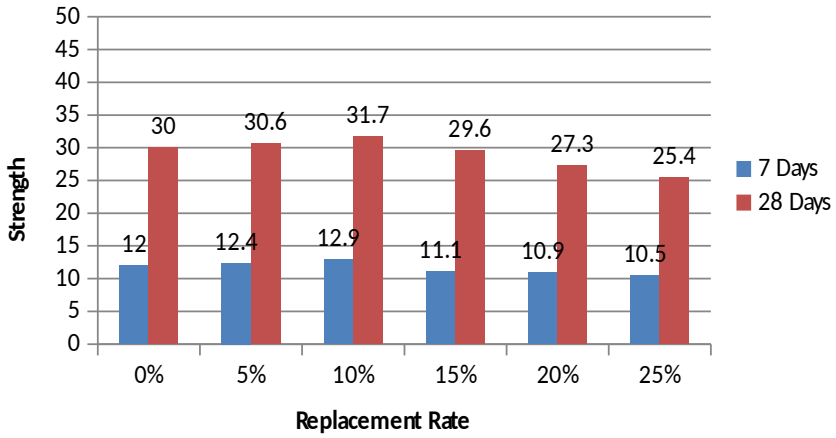
Fig. 4.1 cracking of cubes while determining the compressive strength

The results for the replacement of cement by marble powder at 7 and 28 days have been shown in table 4.3.

Table 4.3 Compressive strength results for replacement of cement by marble powder at different proportions over a period of 7 days and 28 days.

Sr. No.	Days(Replacement)	Compressive strength (MPa)
1.	7(0%)	12
2.	7(5%)	12.4
3.	7(10%)	12.9
4.	7(15%)	11.1
5.	7(20%)	10.9
6.	7(25%)	10.5
7.	28(0%)	30
8.	28(5%)	30.6
9.	28(10%)	31.7
10.	28(15%)	29.6 MPa
11.	28(20%)	27.3 MPa
12.	28(25%)	25.4 MPa

Compressive Strength (Replacement with Marvel Powder)



Flexural testing results:

Using flexural testing machine after 7 and 28 days, the flexural strength of the concrete at various proportions of RHA samples was calculated. The results are depicted in table 4.4.

Table 4.4 flexural strength results for replacement of cement by RHA at different proportions over a period of 7 days and 28 days.

Sr. No.	Days(Replacement)	Flexural Strength (MPa)
1.	7(0%)	2.12
2.	7(5%)	2.32
3.	7(10%)	2.69
4.	7(15%)	2.22

5.	7(20%)	1.99
6.	7(25%)	1.35
7.	28(0%)	3.88
8.	28(5%)	4.00
9.	28(10%)	4.10
10.	28(15%)	3.97
11.	28(20%)	3.23
12.	28(25%)	2.19

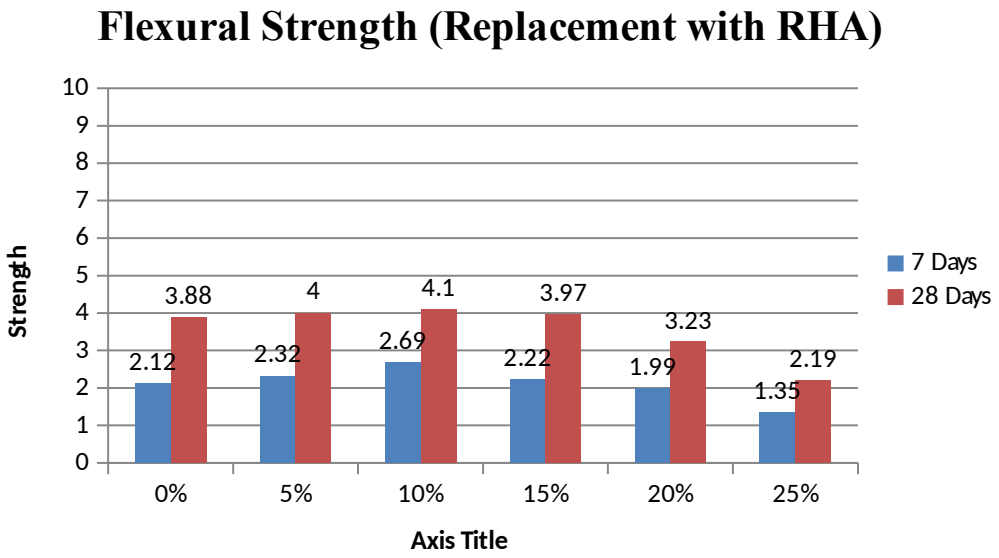
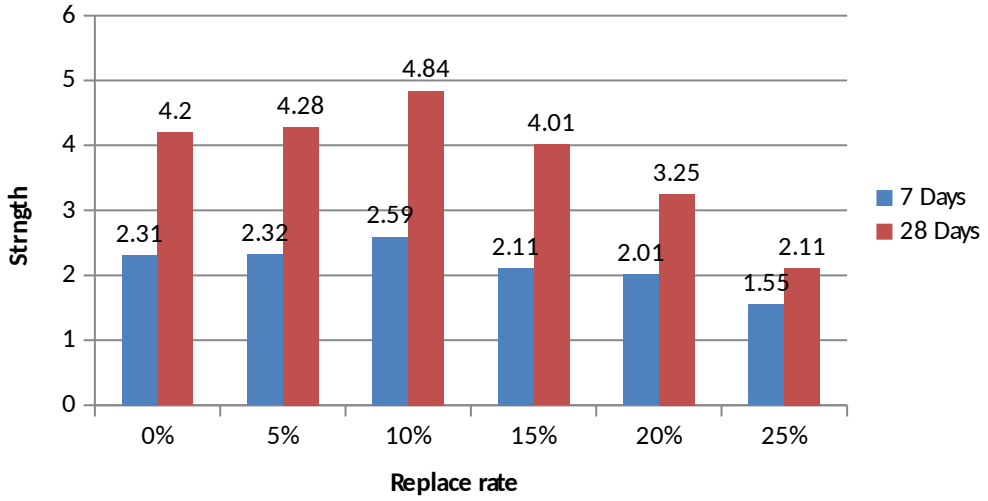


Fig. 4.2 Flexural Testing Machin

Table 4.5 Flexural strength results for replacement of cement by marble powder at different proportions over a period of 7 days and 28 days.

Sr. No.	Days(Replacement)	Flexural Strength (MPa)
1.	7(0%)	2.31
2.	7(5%)	2.32
3.	7(10%)	2.59
4.	7(15%)	2.11
5.	7(20%)	2.01
6.	7(25%)	1.55
7.	28(0%)	4.20
8.	28(5%)	4.28
9.	28(10%)	4.84
10.	28(15%)	4.01
11.	28(20%)	3.25
12.	28(25%)	2.11

Flexural Strength (Replacement with Marvel powder)



Split tensile results:

Using universal testing machine after 7 days and 28 days, the split tensile strength of concrete at 0%, 5%, 10%, 15%, 20% and 25% RHA samples was calculated. The results are as follows:

Table 4.6 Split Tensile strength results for replacement of cement by RHA at different proportions over a period of 7 days and 28 days.

Sr. No.	Days(Replacement)	Split Tensile Strength (MPa)
1.	7(0%)	2.23
2.	7(5%)	2.34
3.	7(10%)	2.34
4.	7(15%)	2.19
5.	7(20%)	2.07
6.	7(25%)	1.41
7.	28(0%)	3.35
8.	28(5%)	3.46
9.	28(10%)	3.50
10.	28(15%)	3.10
11.	28(20%)	3.01
12.	28(25%)	2.11

Table 4.7 Split Tensile strength results for replacement of cement by marble powder at different proportions over a period of 7 days and 28 days.

Sr. No.	Days(Replacement)	Split Tensile Strength (MPa)
1.	7(0%)	2.23
2.	7(5%)	2.24
3.	7(10%)	2.50
4.	7(15%)	2.11
5.	7(20%)	2.05
6.	7(25%)	1.67
7.	28(0%)	3.35
8.	28(5%)	3.41
9.	28(10%)	3.67
10.	28(15%)	3.15
11.	28(20%)	2.99
12.	28(25%)	2.81

Fig. 4.3 Universal Testing machine

CHAPTER 5

CONCLUSIONS

5.1 DISCUSSION

The main objective of the study was the optimum replacement of cement by means of waste materials or by products which in this case came up to be Rice Hush Ash(RHA) and Waste Marble powder, which in itself is a by-product of the construction industry. Cement is known to have some adverse implications on the environment and issues with the health. In order to tackle this situation, researchers have taken a more environmental friendly approach.

5.2 CONCLUSION

Based on the results and findings it is safe to say that the replacement of cement by RHA and waste marble powder did saw some positive steps towards a more eco-friendly approach towards the environment and surroundings. The total cost of one parapet was also seen to decrease by some margin that was evaluated to be around 15-20%. Hence, this study also proved to be more economic. As far as the performance is considered, the replacement of RHA saw a healthy increase in the compressive strength and split tensile strength for replacement up to 15%, maximum at 10% and a moderate change in the flexural strength. The replacement of marble powder did not prove to be as efficient as expected with the strength parameters rising only till 10% of replacement, that too mildly and thereafter, decreasing rapidly.

5.3 FUTURE SCOPE

For hilly areas such as Shimla, parapet is more or less a necessity. With the hard gradient of roads, it becomes important to design parapet and with abundance, the quality often tends to decrease. In order to have an economical yet, conventional approach the use of products such aas RHA and Marble Powder is recommended. On the completion of this study, it was found that the total cost was decrease by 15-20% per parapet and more so if the numbers is huge.

The strength parameters also indicate green light, with optimum usage being 10% of cement being replaced by both RHA and Marble Powder separately.

With the addition of Silica, the same can be increased to some other extent.

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