INVESTIGATION ON DURABILITY OF REINFORCED CONCRETE AS AGGREGATE REPLACEMENT COCONUT SHELL

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ABSTRACT

A wide assortment of materials utilized in street development for example soil, coarse totals, fasteners, bituminous materials, concrete and incidental for improved street execution under substantial traffic conditions. Various writing has been checked on and eventually the coconut shell has been featured for an assortment of capacity, for example, landfill, light weight concrete and auxiliary concrete and utilized in street development. This investigation gives a point by point assessment of the utilization of the coconut shell into basic concrete and used to somewhat supplant the coarse totals with the coconut shell in the development of streets, to limit the utilization of regular aggregates. The tests has been done in this extend has considered 7 days and 28 days compressive quality of solid utilizing coconut shell for unbending asphalts and different tests are performed for adaptable asphalt with fractional substitution of 5%, 10%, 15%, 20% and 25%. The tests which are performed for the adaptable asphalt are los scraped area test which are utilized for deciding the hardness of a total, sway test which are utilized for deciding the durability of a total and the devastating quality test which are utilized for check the devastating quality of a total.

Keywords— *Coconut shell aggregate, Aggregate Impact Value, Aggregate crushing Value*.

INTRODUCTION

One of the most significant characteristic filling things created in South-East Asian nations, for example, Malaysia, Indonesia, Sri Lanka and India, is the coconut shell. In the ongoing past, a great deal of work has been done to discover elective hotspots for the creation of a cover shell filler and due to its light weight and high module attributes new composites can be made. The totals are the key components of the structure business, which adds solidarity to the solid. Finding an option for the totals utilized today is a test worth investigating since it will undoubtedly hurt the earth to convey total from waterways and mountains. On the off chance that a trade for total can be gotten normally and if the asset is bountiful and can be recovered, getting that total would be extraordinary. As an end, 3R to be specific Reduce, Recycle, Reuse ideas assumes a key function in term of securing the common assets and upgrading the life span of landfill destinations around the globe. In a similar time, it will decrease an unnatural weather change and contaminations which is useful to general medical problems.

PROJECT OBJECTIVE

The viability of the coconut shell as a partial replacement for the traditional aggregate must be determined by the following points;
To check that coconut shell which are light in weight than conventional aggregates can be used as a M30 high strength concrete in rigid pavements.
To determine the sustainability of these material.

To check the hardness, toughness and crushing strength of coarse aggregate with the addition of different percentages of coconut shell for flexible pavement.
To design a prototype product 'Development material of the concrete mix by using Coconut Shell as an aggregate for PQC (Pavement Quality Concrete).
Usage of coconut shell with the partial substitution of coarse aggregates in structural and road construction to eliminate the use of natural aggregates.

USES OF COCONUT TREES

Coconut fruit may be the fruit of a single flower. The husk is on the skin, which is white at first, but when it is selected and drying it becomes brown. The monocarpus plant, packed with tube-shaped packages of construction, lies within the external layer of the fruit. This fiber is named fiber and is used to create mattresses and twines. What we're buying from the meat is that the "stone" of this fruit, which has a hard shell, the pericarp, and thus the seed, is inside the shell. The shell used for jars is commonly used by craftsmen to create garments and accessories. Next follows the perisperm, which is thin, and then the white meat or coconut meat and the "coconut milk." Growing coconut meat and milk is the endosperm of the crop. Yes, coconut is just for plants to abundant liquid endosperm, which bathes the young embryo, the next day the milk is quite tasty and thus the coconut meat is thin, but as the grain develops, the liquid is changed into a solid endosperm generated in oils (triglycerides). Solid endosperm, copra, is processed, dried and condensed for the manufacture of oil, commonly used for the key ingredients of soap and body conditioning systems.

Coconut Shell

Coconut shells are discarded by-products that can be recovered to dry food or substance for biomass purposes. The food that is dried with the coconut shell will also return with a distinctive coconut flavor. Coconut shell, an element of coconut fruit manufactures objects such as handicrafts, charcoal for change of state, brackets, bird feeder, bowls, and musical instruments as shown in Figure 1.6, tiny animal homes and even a weapon in Australia. In addition, they use it as a shelter.

Properties of coconut shell
Coconut shells are one of the most precious environmental fillers generated in tropical countries such as Malaysia , Indonesia , Thailand and Sri Lanka.. Several studies have been devoted to the use of useful organic fillers in composites in recent years, and the coconut shell filler may be a potential candidate in the case of the most recent composites due to the requirement for high strength and modulus characteristics, along with the additional benefit of high polymer content.
The high polymer capabilities make the composites generated with these fillers more weather resistant and hence the Coconut shell is one of the most precious environmental fillers generated in tropical countries such as Malaysia , Indonesia , Thailand and Sri Lanka. Coconut shell flour is also commonly used for the manufacture of products like furniture, rope, etc.

LITERATURE REVIEW

Pravin V. Khandve1 et al in 2014 presented a paper in which he suggested that the vital ingredient of the concrete is coarse aggregate. Nowadays, several of the researchers are researching the material which might cut back the value of construction likewise as increase the value. In developing countries, the chance of using some agricultural

wastes likewise as industrial by-products from totally different industries as construction materials are going to be desirable and has been found to own many sensible things. It had been ascertained that the coconut shell includes a nice potential as a partial replacement of the mixture within the concrete. The current work is just associate degree accumulation of data regarding GFRGC and therefore the research work that is already administered by different researchers.

Damre Shraddha et al in 2014 presented a that deals with the study of the sustainable buildings over a wide range of parameters such as carbon emission, materials used and water use. It also concerns on the involvement of economic feasibility, environmental health and social equity in it. The papers keep stressing on the point of using recyclable materials such as coconut shells which is a agricultural waste in order to provide new vision to contractors and developers in construction materials. It can be used in housing construction as an ingredient for concrete. It can also be used as landfills and if approved by government of India it can drastically decrease the cost of construction.

Daniel Yaw Osei et al in 2013 presented a paper that paper concerns with the study of M20 concrete with partial replacement of aggregate with coconut shell in an increasing fashion which is 20%, 30%, 40% and 50% and 100% and the & day compressive strength were found out to be 19.7 Nmm^{-2}, 18.68 Nmm^{-2},17.57Nmm^{-2},16.65 Nmm^{-2} and 9.29 Nmm^{-2} . This shows that concrete replaced by 20% gives the closest value to desired value. Hence it could be used as an alternative to concrete used in structural members as well as lightweight materials.

Tomas U. Ganiron Jr et al in 2013 presented a paper that addresses a great deal of stress given on using alternative material in construction industry in order to reduce burden on the natural resources. The study tested the hollow concrete blocks with coconut shell fibers as substitute for aggregates. The workability test were conducted on the basis of ASTM136 and ASTM 137. Compressive strength were also conducted. It was discovered that these substitutions were workable as well as gives satisfactory strength.

In 2012, Maninder Kaur et al published an article in which she examined the use of cocoa shell, because the findings obtained from an extensive literature review were accompanied by a rough combination. We all tend to want our buildings to be robust and to build affordable development materials. Every industry relies entirely on cement, sand and concrete aggregates. Today, most analysts perform research on the fabric that may reduce the value of the building even as the strength increases. Any of the waste materials per property are used in concrete. For example, after treatment, waste materials such as power plant ash, rice, sludge can be used as an alternative to concrete aggregates. The coconut shell can be a material that can replace aggregates. The coconut shell is generally used as an ornament and as a carbon supply. The shell is also used in the plastics, glues and abrasive materials industries. The use of cocoa covers together will encourage and economically interfere with the environment. Before its combination with concrete, sun dry shell should be careful to verify the perishable materials decay. It also contributes to the construction of buildings. The aim of this paper is to raise awareness of the use of coconut shells as building materials in civil engineering.

Amarnath Yerramala et al in 2012 presented a paper to demonstrate on the how coconut shells can be partially replaced as conventional aggregates. The study has replaced 10% to 20 % aggregates with coconut shell with 5% increment and a constant water/cement ratio of 0.6. The density of concrete decreases as we increase coconut shell percentage as well as compressive strength. Absorption percentage and permeable voids were also higher than the conventional samples.

P.S. Kumar et al in 2012 that deals with the long-term performance of coconut shell as aggregate concrete which has been studied under scanning electron microscope (SEM) in order to determine the pore structure of the concrete. It was found that the pore structure acts as a reservoir and continuous curing produced highest strength in concrete. The biological decay was not seen in the sample even after 365 days. Till the age of 90 days all the sample shows improvement in pulse velocity with a minor drop. The ultimate bond strength appears to be good between cement paste and coconut shell as SEM shows that with time the fissure between them narrows down with time.

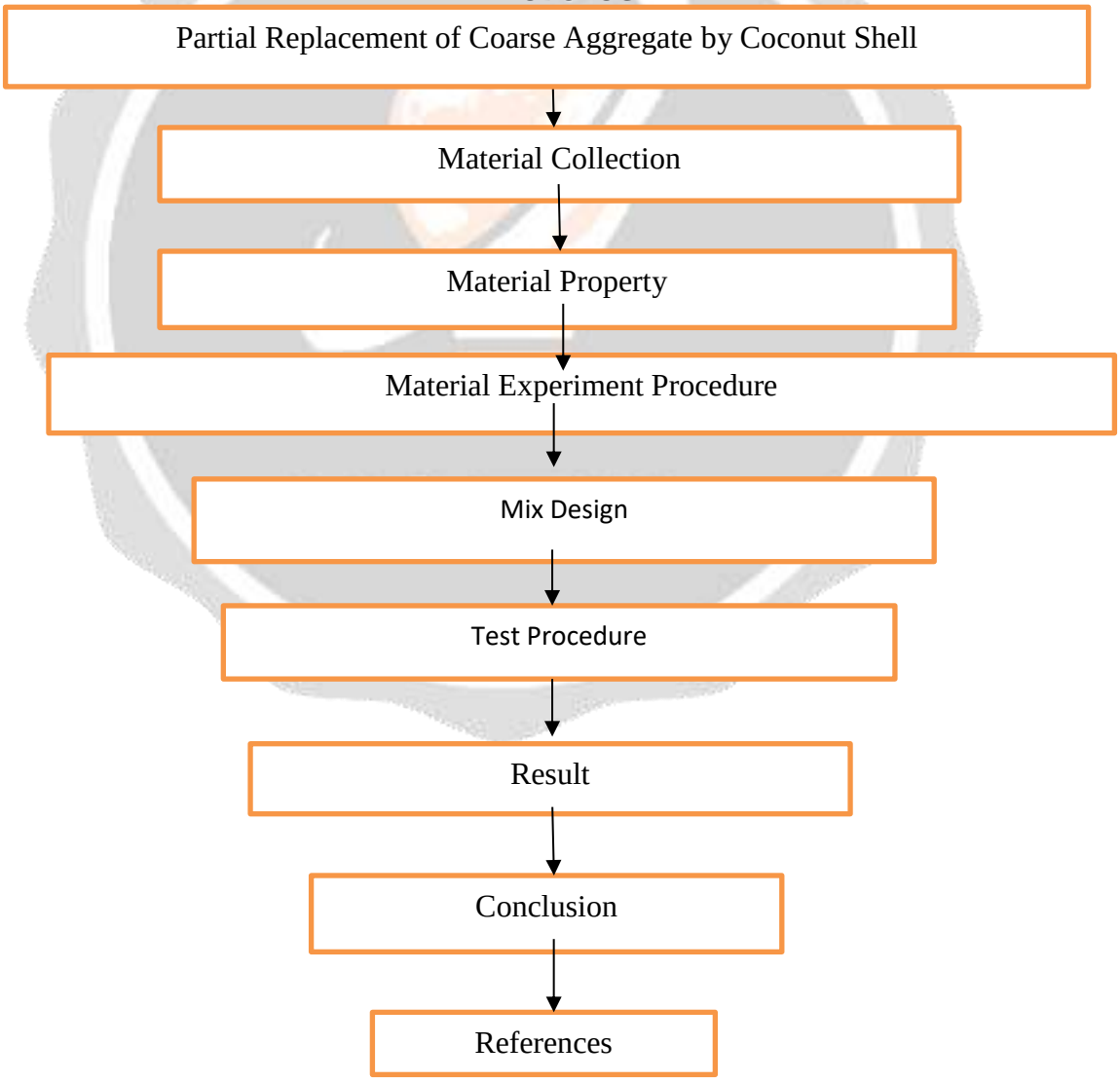
A.Anbuvel et al in 2016 published a paper that examines the variety of properties of coconut shells as aggregate replacement. A concrete sample with Natural aggregate replacement of 0-20% was provided. There were two design mix i.e. fly ash and coconut shell that were investigated for properties such as water absorption, compressive strength, moisture content and split tensile strength. It was reported that as % shell increases density decreases.

Workability also decreases. Both the compressive strength and spilt tensile strength also decreases. The permeable voids and absorption were recorded more than the sample with conventional aggregate. Fly-ash replacement had no notable effect.

Kulkarni Parag Pramod et al in 2016 published a paper that emphasizes that the cost of conventional building material is too high this paper reflects that there is a huge expense that has to be paid why using conventional building materials. The paper mainly emphasizes on casting M30 grade concrete while using coconut shell as a partial replacement material for the conventional coarse aggregate. Hymns were casted and tested on the basis of their flexural strength and compressive strength and the results were reported. It was found that as we increase the percentage coconut shell the density, compressive strength and flexural strength decreases.

Apeksha Kanojia et al in 2015 published a paper that reviews a variety of waste material such as silica fumes, copper slag, fly ash etc. These are mainly used as primary ingredients to make plywood, flush door etc. For the concrete the main ingredients are aggregate which covers 70%-80% as its constituents. The growth on construction industry is greatly reducing the available natural resources, hence the papers shows that by applying these waste materials to the main constituents of the concrete as partial replacement in order to economize the whole project cost.

METHODOLOGY



FLOW CHART

TEST ON MATERIALS

1, Specific gravity: Through using a Le Chatelier flask, the specific gravity is determined. Kerosene is used instead of water as a tool when deciding the specific gravity of the cement, because the water is hydrated with concrete, but not kerosene. The specific gravity of OPC is generally around 3.1

Procedure:

Note the specific gravity of empty bottle and assign it W1.
Now fill the bottle with water and note it weight and assign it W2.
Clean and dry it and then fill it with kerosene. Let this mass be W3.
Weigh the dry cement sample. Let this mass be W4.
Place some cement (about 50g) that has been weighted and place some kerosene and tilt the bottle till all bubbles disappear. Weight it and let this mass be W5.

Fig 1.17 Lechatlier's flask

Table 1.4 Specific gravity of cement

Description	Trial 1	Trial 2
1.Mass of empty bottle W1 gm.	67	67
2.Mass of bottle +water W2 gm.	161	164
3.Mass of bottle +kerosene W3 gm.	144	137
4.Mass of cement W4 gm.	50	50
5.Mass of bottle + cement + kerosene W5 gm.	181	175
6.Specific gravity of cement $S = \frac{W4\ (W3-W1)}{(W4+W3-W5)(W2-W1)}$	3.12	3.16
Average of two is = 3.14		

2, Standard Consistency of Cement: Standard consistency is described as the percentage water demand of cement paste, which is such that the paste 's viscosity penetrates a 5 to 7 mm thickness measured from the bottom of the

mold, in a specially built device (known as Vicat 's apparatus). The standard consistency value is of practical importance to determine how much water must be used for paste for other cement tests.
Apparatus: Vicat's Apparatus with plunger, needles, stop watch etc.
Procedure:
To start with prepare a 400 g of cement and add about 20-25% of water and mix it for about 3-5 minutes but keeping in mind that mixing should be finished before any sign of setting.
Pour the paste in mould with the help of trowel and level it.
Place it under the apparatus and gently lower the plunger.
Note the settlement of plunger which is the difference between the height of mould and reading on the apparatus. If it is 5-7 mm then the paste is correctly prepared otherwise repeat the process.

Fig 1.18 Vicat Apparatus

Fig 1.18(a) Vicat Apparatus along with mould

Observations:

Mass of cement taken= 400 gm

Table 1.5 Normal Consistency of cement

S. No	% water	Initial reading	Final reading	Height not penetrated(mm)
1.	20	40	38	2
2.	24	40	37	3
3	28	40	10	30

4.	30	40	5	35

Standard consistency of cement = 30%

3, Setting time of cement: Two stiffening states of cement are initial and final setting time.

Intial setting time can be defined as the time taken by the Vicat's Apparatus needle to penetrate only 5 ± 0.5 mm measured from the bottom of the mould. Start noting the time when the water has been added

Final setting time can be defined as the time taken by the annular collar to make an impression on the hardened cement paste.

Original Time Setting:

(1) Take roughly. 400 gm of dry cement and add 0.85 P when P is the weight of the water for the normal strength of the cement.

(2) Growing the paste in the mold and add the square needle to the

RESULTS AND DISCUSSION

After finding all the different proportions of cement, fine aggregate, coarse aggregate and coconut shell in trial 1 and trial 2, now we check the compressive strength of coarse aggregate with different percentages of coconut shell by using compression testing machine.

PROCEDURE:

Organize the concrete mixture in the appropriate proportions and, by loading the concrete in the desired shape of 15 cm x 15 cm x 15 cm cube with internal fixation, put the specimen in the water for cure after 24 hours.

Extract the specimen from the water as the residual water is drained from the layer, such as the natural cycle time.

Seek to cast a specimen with a diameter similar to 0.2 m.

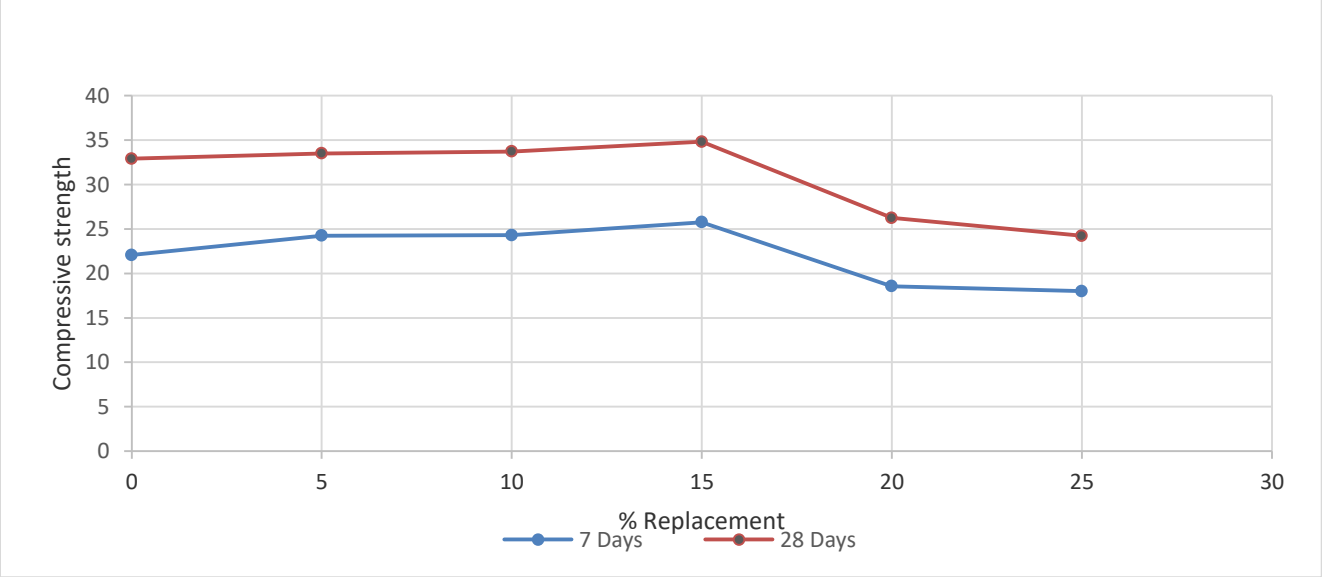
Check the surfaces of the unit carefully.

Put the cube on the machine in such a way that all the cube is connected to the center of the plate at the base of the slide.

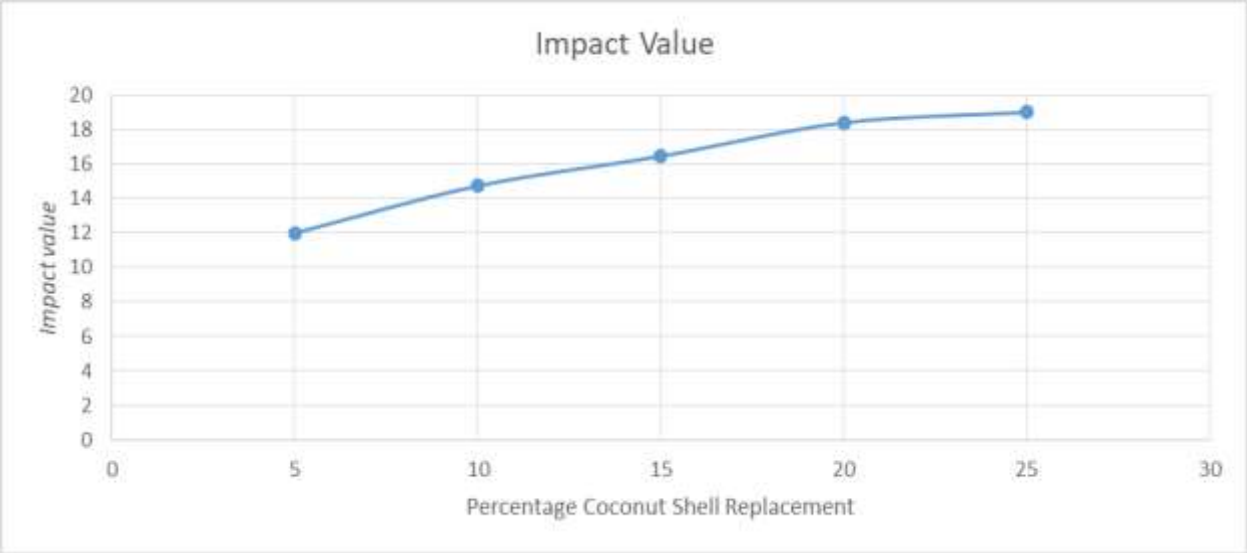
Analysis should be firmly positioned seen in the middle of plates so that the full surface area is reached.

Extend the charge step by step, not shock and constantly at a speed of 140kg / cm2 / minute, till the material breaks.

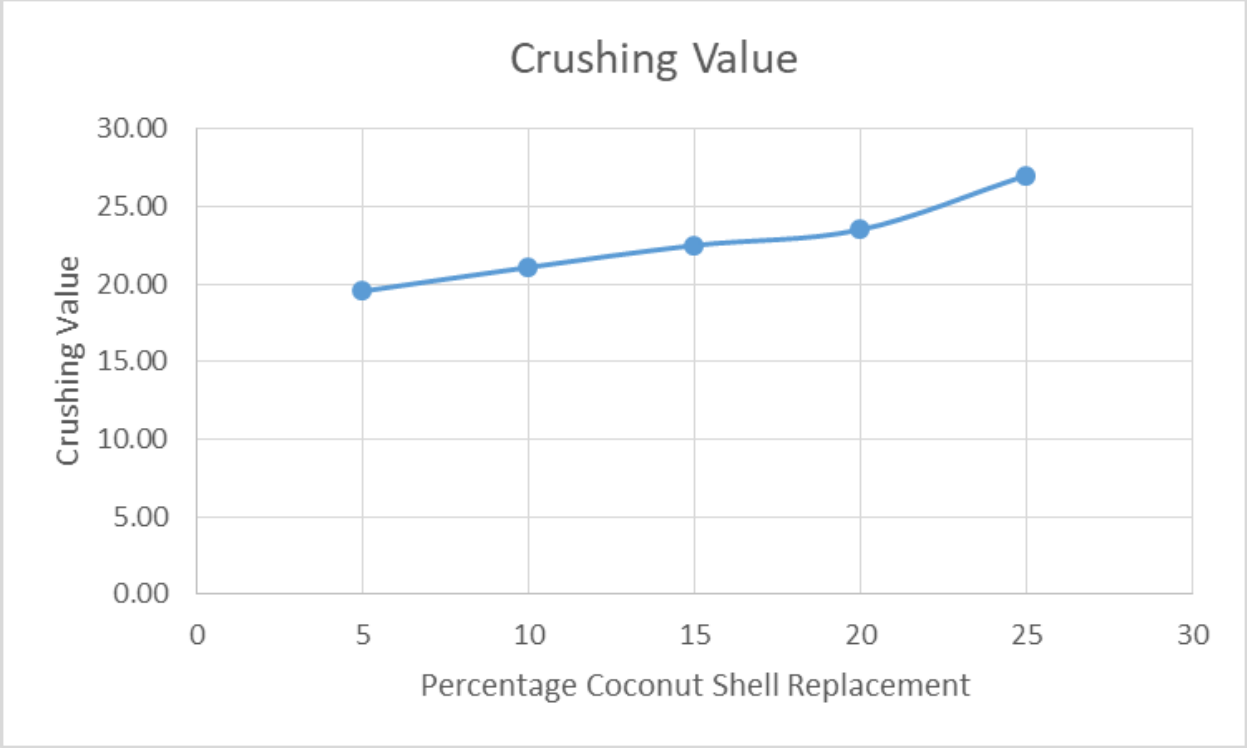
Report the total capacity and note any unusual choices in the case of failure.



Compressive strength vs Percentage replacement of coarse aggregates with coconut shell



Impact value vs Percentage replacement of coarse aggregate with coconut



Crushing value vs Percentage replacement of coarse aggregate with coconut shell

CONCLUSIONS

1, As on account of unbending asphalt the compressive quality worth continues expanding upto 15% of use of coconut shell in coarse totals. The compressive quality worth upto 15% utilization of coconut shell in coarse totals at 7 days and 28 days is about 25.75MPa and 34.8Mpa individually and as per IRC the base estimation of compressive quality at 28 days is about 30MPa for low volume streets and for different streets it is upto 40 MPa. In this manner for unbending asphalts we can utilize coconut shell in coarse total upto 15%.

2, In the water ingestion test the worth continues expanding in the event that we increment the measure of coconut shell in coarse totals. According to IRC water retention esteem ranges from 0.1 to about 2% for total ordinarily utilized in street surfacing. Stones with water ingestion upto 4% have been utilized in base course. In the water ingestion test the resultant worth is 1.7 in the event of use of 10%of coconut shell in coarse total. In this manner it utilized for street surfacing. Above 10% utilization of coconut shell in coarse total, the worth lies between 2-4% which is appropriate for base course.

3, In the particular gravity test the worth continues diminishing on the off chance that we increment the measure of coconut shell in coarse totals. According to IRC the particular gravity of coarse total ordinarily utilized in street development ranges about 2.5 to 3.0, however high explicit gravity of a total is considered as a sign of high quality. For our situation the resultant worth is 2.49 if there should arise an occurrence of utilization of 5% use of coconut shell in coarse total. Thusly it is utilized for street surfacing upto 5% substitution.

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