EFFECT OF LIME STONE WASTE AS PARTIAL SAND REPLACEMENT AND FLY ASH AS PARTIAL CEMENT REPLACEMENT ON CONCRETE

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***Abstract*: Limestone waste is obtained as a derivative from the process of making of aggregates in rubble crusher unit through the crushing process of rocks. Use of Limestone waste as a substitute of sand in construction work materials would resolve the environmental teething troubles caused by the large-scale depletion of the natural sources of river and mining sands. Fly ash is a bonded remainder of clay mineral deposits existing in coal. Transforms the clay mineral deposits into coal powder into a variety of merged fine particles of mainly aluminum silicate composition occurs due to generation of high temperature during coal burns in thermal plants. Fly ash can be utilized as cement replacement in Portland cement concrete to improve the properties of the concrete. The experimental study carry out to investigate the impact of fractional replacement of sand with limestone waste (LSW) and cement with fly ash on the concrete properties. The impact of limestone waste as aggregate and fly ash as partial replacement of cement on several fresh and hardened properties of the concrete are to be examined. The investigations will include testing of compressive strength, water absorption test, unit weight test etc.**

Keywords: Fly ash, Lime stone waste, OPC, compressive strength.

Introduction and literature review

Concrete could be a material employed in building construction, consisting of a tough, with chemicals inert particulate substance, called associate degree mixture (usually made up of differing types of sand and gravel), that's warranted along by cement and water. The Assyrians and Babylonians used clay because the bonding substance or cement. The Egyptians used lime and mineral cement. In 1756, British engineer, John Smeaton created the primary trendy concrete (hydraulic cement) by adding pebbles as a rough mixture and mix hopped-upbrick into the cement.

In 1824, English artificer, Joseph Aspdin fictional cement, that has remained the dominant cement employed in concrete production. Joseph Aspdin created the primary true artificial cement by burning ground rock and clay along. The burning method modified the chemical properties of the materials and Joseph Aspdin created a stronger cement than what exploitation plain crushed rock would turn out.

Objectives of study

1. To explore and assess the likelihood of exploitation rock waste and ash in concrete in terms of its building material properties i.e. strength.
2. Recover associate degree industrial byproduct through useful use once incorporated into concrete.
3. To access the sturdiness of the concrete combine.
4. To possess a comparative study of workability and alter in weight density of concrete.
5. Cut back cement content in concrete, leading to attenuated emission of greenhouse emission and attenuated use of natural raw materials.
6. Cut back sand content in concrete, leading to attenuated sand extraction and preservation of natural resources.
7. To assess the role of rock waste as a partial replacement to sand and ash as a partial replacement to cement
8. To check the look parameters of rock waste concrete and ash concrete with plain cement concrete.
9. To possess a comparative study of rock waste concrete and ash concrete

Composition of Concrete

There area unit many varieties of concrete on the market, created by variable the proportions of the most ingredients elow. During this method or by substitution for the building material and combination phases, the finished product are often tailored to its application with variable strength, density, or chemical and thermal resistance properties.
Aggregate consists of huge chunks of fabric during a concrete combine, typically coarse gravel or crushed rocks like sedimentary rock, or granite, along side finer materials like sand.
Cement usually hydraulic cement, and alternative building material materials like ash and dross cement, is a binder for the mixture.
Water is then mixed with this dry composite that produces a semi-liquid that employees will form (typically by gushing it into a form). The concrete solidifies and hardens to rock-hard strength through a natural action known as association. The water reacts

with the cement that bonds the opposite parts along, making a strong stone-like material.
Chemical admixtures area unit another to realize varied properties. These ingredients might speed or weigh down the speed at that the concrete hardens, and impart several alternative helpful properties.
Reinforcements area unit usually another to concrete.

Cement

Cement could be a binder, a substance that sets and hardens because the cement dries and conjointly reacts with carbonic acid gas within the air dependently, and might bind alternative materials along. The word "cement" traces to the Romans, WHO used the term piece caementicium to explain masonry resembling fashionable concrete that was made up of gravel with lime as binder. The volcanic ash and small-grained brick additives that were else to the lime to get a hydraulic binder were later named as solid body substance, cementum, cäment, and cement. Cements utilized in construction will be characterized as being either hydraulic or non-hydraulic, relying upon the flexibility of the cement to be utilized in the presence of water Non-hydraulic cement won't set in wet conditions or underwater, and is attacked by some aggressive chemicals when setting.
Hydraulic cement is created by substitution a number of the cement in an exceedingly concrete combine with activated metallic element silicates, pozzolanas, like ash, to activate cement setting in wet condition or underwater and any protects hardened concrete from chemical attack (e.g., Portland ce-ment).

Water

Combining water with a building material material forms a cement paste by the method of hydra-tion. The cement paste glues the mixture along, fills voids at intervals it, and makes it flow a lot of freely.
A lower water-to-cement magnitude relation yields a stronger, a lot of sturdy concrete, whereas a lot of water provides a free-flowing concrete with the next slump. Impure water accustomed build concrete will cause issuesonce setting or in inflicting premature failure of the structure.Hydration involves many various reactions, typically occurring at an equivalent time. because the reactions proceed, the product of the cement association method bit by bit bond along the individual sand and gravel particles and alternative parts of the concrete to create a solid mass.

Aggregates

Fine and coarse aggregates compose the majority of a concrete mixture. Sand, natural gravel and crushed stone arused in the main for this purpose. Recycled aggregates (from construction, demolition and excavation waste) arprogressively used as partial replacements of natural ag-gregates, whereas variety of factory-made aggregates, as well as cool furnace dross and bottom ash are permissible.
The presence of combination greatly will increase the sturdiness of concrete on top of that of cement, that could be a brittle material in its pure state. therefore concrete could be a true stuff Redistri-bution of ggregates whencompaction typically creates in homogeneity thanks to the influence of vibration. this will cause strength
gradients ornamental stones like rock, little watercourse stones or crushed glass ar generally else to the surface of concrete for an ornamental "ex-posed aggregate" end, common among landscape designers. additionally to being ornamental, exposed combination adds hardiness to a concrete private road.

Reinforcement

Concrete is robust in compression, because the combination expeditiously carries the compression load. However, it's weak in tension because the cement holding the mixture in situ will crack, allow-ing the structure to fail. ferroconcrete adds either steel reinforcing bars, steel fibers, fiber, or plastic fiber to hold tensile masses.

Chemicaladmixtures

Chemical admixtures ar materials within the type of powder or fluids that ar else to the con-crete to present it surecharacteristics not gettable with plain concrete mixes. In traditional use, admixture dosages ar but five-hitter by mass of cement and ar else to the concrete at the time of batching/mixing. The common kinds of admixtures ar as follows. Accelerators speed up the association (hardening) of the concrete. Typical materials used ar CaCl2 Ca (NO3)2 and NaNO3. However, use of chlorides might cause corrosion in steel reinforcing and is prohibited in some countries, so nitrates could also be favored. Retarders slow the association of concrete and ar utilized in giant or tough pours wherever partial setting before the pour is complete is undesirable. Typical polyolretarders ar sugar, sucrose, metalgluconate, glucose, acid, and acid. Air adds and board small air bubbles within the concrete, that reduces harmthroughout freeze-thaw cycles, increasing sturdiness. However, entrained air entails a trade off with strength, as every I Chronicles of air might decrease compressive strength five-hitter.Plasticizers increase the workability of plastic or "fresh" concrete, permitting it's placed a lot of simply, with less consolidating effort. A typical plasticiseris lignosulfonate. Plasticizers will be accustomed cut back the water content of a concrete whereas maintaining workability and ar generally known as water-reducers thanks to this use. Such treatment improves its strength and sturdiness characteristics. Super plasticizers (also known as high-range water-reducers) ar a category of plasticizers that have fewer harmful effects and might be accustomed increase workability over is sensible with ancient plasticizers. Compounds used as super plasticizers embody sulfonated hydrocarbon gas condensation, sulfonated base gas condensation, resolvent gas condensation and polycarboxylateethers. Pigments will beaccustomed modification the colour of concrete, for aesthetics. Corrosion is employed to reduce the corrosion of steel and steel bars in concrete. Bonding agents ar accustomed produce a bond between recent and new concrete (typically a kind of polymer) .Pumping aids improve pump ability, thicken the paste and cut back separation and hurt.

General Study of Waste Materials

1. Limestone waste
2. Fly ash

Overview of Limestone Waste

Limestone may be a stone found close to the surface of the layer. It tends to acidify and erode once connected with water containing dissolved carbonic acid gas or a weak acid. The most constituent
of rock is carbonate. rockexhibits many distinctive physical properties.

.Constituents of rock

Limestone is Associate in Nursing combination. the most constituent is carbonate, or calcite. Shells, bones, and alternative calcium-laden materials sink to the lowest of the ocean and decide on prime of every alternative. Years of pressure from the buildup of fabric and also the water pushing down on the layers causes the lowest material to solidify and type rock.

Physical Properties

Limestone is mostly impermeable, rather onerous, and compact. it's typically comparatively fine-grained and contains a density that sometimes ranges from two.5 to 2.7 kg/cubic centimetre. Some lime-stone is ready to be polished and so becomes marketable. rock ranges from white to off-white in color.

Natural Characteristics

There ar several visually apparent characteristics of rock. Streaks of spar, preserved fossils, or shells and pits or holes ar usually gift. The rock might also contain iron stains, open-textured areas, and reedy formations. every of those character traits lends to the use-fulness and marketability of rock.

Limestone waste is obtained as a by- product throughout the assembly of aggregates through the crushing method of rocks in junk device units. victimisation rock waste as a substitute of sand in construction materials would resolve the environ-mental issues caused by the large-scale depletion of the natural sources of watercourse and mining sands

Utilization of sedimentary rock waste

The use of sedimentary rock waste as fine mixture in concrete has become fashionable in present time, with massive scale analysis being meted out atSuez Canal University, Egypt. Recent re-search findings have shown that concrete created with sedimentary rock waste as fine mixture have shown higher future strength thanks tohigher building material properties of sedimentary rock waste.

Environmental Impact of Sand Extraction (River Sand Mining)

Construction grade stream sand sometimes includes the fine mixture a part of concrete. Excessive in stream sand mining lowers the stream bottom, which can cause bank erosion. Depletion of sand within the stream bed and onthe coastal areas causes the deepening of rivers which can cause saline – water intrusion from close ocean. Excessive in stream sand mining could be a threat to bridges, stream banks, and close structures. In stream sand mining ends up in the destruction of aquatic and bank surround through massive changes in channel morphology. Impacts embody bed degradation, bed coarsening, down water tables close to steam bed and channel instability. These physical impacts cause degradation of bank and aquatic aggregation and should cause undermining of bridges and different structures. If waste glass is employed in situ of sand in some proportion, it'll scale back the issues ensuing from stream sand mining.

Overview Of Fly ash

Fly ash, conjointly referred to as flue-ash, is one in all the residues generated in combustion, and includes the fine particles that rise with the flue gases. Ash that doesn't rise is termed bottom ash. In associate industrial context, ash typically refers to ash made throughout combustion of coal. ash is usually captured by electricity precipitators or different particle filtration instrumentation before the flue gases reach the chimneys of coal-fired power plants, and at the side of bottom ash aloof from rock bottom of the chamber is during this case conjointly referred to ascoal ash. relying upon the supply and makeup of the coal being burned, the elements of ash vary significantly, however all ash includes substantial amounts of silica (SiO_2) (both amorphous and crystalline) and unslaked lime(CaO), each being endemic ingredients in several coal-bearing rock strata

Utilization of Fly Ash

A large range of technologies are developed for profitable utilization and safe management of ash underneath the cooperative efforts of ash Mission of the GOI since 1994. As a result, the employment of ash has magnified to over seventy three million tonnes in 2010-12. ash was moved from “hazardous industrial waste” to “waste material” class throughout the year 2000 and through Gregorian calendar month 2009, it became a marketable artifact ash utilization has started gaining acceptance, it being fifty five.79% throughout 2010-12.

Fly ash has non heritable the standing of a “useful commodity” that parades many opportunities in terms of birthing & fine calibration policies, conducting profitable businesses and R&D efforts, and addressing the considerations of atmosphere at an equivalent time. we tend to achieved the very best level of ash utilization of sixty three in 2009-10 and it absolutely

was concerning fifty six in 2010-12. However, it might need heaps of efforts to succeed in the target of 100% ash utilization. to realize this Mission Energy Foundation, a persistent, private, not-for-profit endeavor that strives to unfold information within the globalizing energy sector; in robustsupport from varied Indian Ministries is proud to announce its ordinal International summit FLYASH Utilization 2013.

Various Lab Test on Cement

There are many tests which are conducted to check the quality of cement. Fineness test

1. Soundness test
2. Standard consistency test
3. Setting time test

Various Lab Tests on Aggregates

Various tests which are done on aggregates are listed below.

1. Sieve Analysis
2. Aggregate impact value
3. Aggregate crushing value
4. Aggregate abrasion value

Conclusion

After careful and elaborate study of effect of various waste materials on concrete properties, it can be concluded that:

1. Limestone waste can be used in concrete as a replacement of sand up to 40% and above from strength and durability point of view.
2. Fly ash can be used in concrete as a partial replacement of cement up to 30% from strength point of view.
3. A combined use of limestone waste and fly ash in concrete has shown positive result for 30% to 40%.
4. Use of limestone and fly ash in concrete can prove to be economical as it is non useful waste.
5. Use of limestone waste in concrete will eradicate the disposal problem of limestone waste and prove to be environment friendly thus paving way for greener concrete.
6. Use of limestone waste in concrete will preserve natural resources particularly river sand and thus make concrete construction industry sustainable.
7. Use of fly ash will eradicate its disposal problem and reduce carbon emissions (CO_2), thus prove to be environment friendly thus paving way for greener concrete.

In order to be sustainable for future generations we must fully exploit by-product materials like limestone waste and fly ash. Both current production and stockpiled material should be fully utilized. This will reduce both the greenhouse gas emissions and the use of naturally occurring aggregates. It is our duty to take sensible engineering judgments based on facts about byproducts and not on the prejudice of assuming a 'WASTE' is somehow inferior or less suitable.

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