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Review on Use of Sea Sand and Bamboo As BuildingMaterials

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ABSTRACT
The fine aggregate and steel used as reinforcement are the at most important parts of the concrete structure.There are many essential roles of the fine aggregate during construction. Some of the main roles are – strength,workability,bonding,dimensionalstabilityandpreventionofsegregation.Thefineaggregatepl aysanimportantroleinreducingcrackformationintheconcretebyreducingshrinkage.Thesteelprovidest hatductile property requiredby the structure.The effect of seismic loadingand other heavy loadingare reduceddue to the ductile characteristics possessed by the steel. The steel act as an indicator to show the signs ofbuilding failure. It provides the occupants sufficient time for retrofitting. The growing demand for both riversandandsteelarecausingmajorenvironmentalissues.Thecontinuousextractionofsandfromtherive rleadstofloodinginthenearby areas.Thecontinuousextractionandmanufacturingprocessforsteelleadstoincreasedamountofreleaseo fcarbondioxidetotheatmospherewhichcausesglobalwarming.Globalwarmingisanseriousmatteraffec tingtheentireplanet.Theneedforanalternativeforbothriversandandsteel is essential. Sea sand and bamboo are the best-known alternative for both. The characteristics and thepropertiesofbambooandseasand are discussedinthispaper.
Keywords:Seasand,Bamboo,Globalwarming.

I. INTRODUCTION

Thefineaggregateprovideproperworkabilityrequiredinthemixandalsoprovideproperuniformityto themix. There are other important roles of the fine aggregate also these include providing strength, elasticand thermal properties. It also provide sufficient dimensional and volume stability. The proper filling of gapesbetween the mix. The segregation of the cement paste coarse aggregate is prevented by the fine aggregate. Thecontinuous use of river sand for construction has lead to many harmful effect to both aquatic ecosystem and ourenvironment as well. The mating pattern, migration and eating habits of many aquatic species are disturbed dueto the extraction of sand from the river bed. The continuous extraction has also lead to flooding of the nearbyareas during winter season. An alternative to the river sand is required to overcome the issue of the caused byusing it. The sea sand is an economical and effective option available for use as fine aggregate in construction.Sea sand is abundantly available in the nature and with simple treatment can be used as fine aggregate inconcretemix.
Steel is the main reinforcement provided to the concrete structure. It can take tensile loading withoutfailure. The steel can be used as warning indicator in the concrete structures. The steel shows signs of failurebefore the structure collapse or completely fails. The ductile characteristics of steel makes it better buildingmaterial in construction. Steel has capacity to regain its original shape without deformation. This allows steel tocarry heavy loads without failure of structure. The modulus of elasticity or young's modulus of steel is 200GPa.Due to the continuous use of steel in the construction, there is a huge demand for steel. The manufacture of steelis process which is causing harmful effect to the environment. Huge amount of carbon dioxide is released to theatmosphere during the manufacturing process of steel. The manufacturing process of 1 kg of steel produces 1.85tons of carbon dioxide that accounts for almost 8 percent of global carbon dioxide emissions, on consideringbamboo emits just 80 times less carbon dioxide. Alternative to steel found in nature is bamboo. The bamboo hassufficient flexural strength, an average of 20 GPa. The bamboo has lower specific weight compared to steel. Themodular ratioofbamboois6timesgreaterthansteel.

BAMBOO
TYPESOFBAMBOO
Thespecieswhichhascharacteristicsrequired forapplicationinconstructionare-

- BambusaLako–grows up to 50ftand 4inchdiameter.Ithasgood blackcolour.

- Bambusaoldhamii–tallestbamboospecieswhichcangrowupto65ftand4inchdiameter.Alsoknown asGiantTimberBamboo.
- DendrocalamusAsper–foundinsoutheastasiaandgrows65-100ftand3-8inchdiameter.
- DendrocalamusBrandisii-Thistypeofbamboogrowsto height60ftand6-8inchdiameter.
- DendrocalamusYunnanicus–Thisspeciesgrowsto70fttall.
- GigantochloaApus–

Itisatraditionallyusedbuildingmaterialin Asia.Thistypeofbamboogrows60ftheightand4inchdiameter.

- Gigantochloaatroviolacea–Bestfor makingfurniture.Itgrows60ftand4inchdiameter.
- GigantochloaAtter–Thistypeofbambooarestraight.Itcangrow60 ftheightand4 inchdiameter.
- GigantochloaPseudoarundinacea–ItisgrowninIndonesiaandgrows40ftheight&4inchdiameter.

BONDSTRENGTH

The bamboo has been tested and known to have bond strength similar to that of steel. The bamboo culms areused as reinforcement in concrete and have sufficient bond strength. The bamboo is treated boric acid for 72hours to prevent insect and pest attacks. The treated bamboo found to have 6-16 times more bond strength thanuntreated one.

SHEARSTRENGTH

Theadhesivesusedforfindingshearstrength are- emulsion polymeriso-cyanate(EPI), hybridpolymeradhesive(HPA), melamine- urea formaldehyde (MUF), polyurethane (PUR), and polyvinyl acetate (PVA). Theshearstrengthof glue laminated bamboo is1.0 MPaand clampingpressureoffoundas0.6 MPa.

WATERABSORPTIONCAPACITYOFBAMBOO

Bamboo has high water absorption capacity. The bamboo absorbs water during curing and expands causingradial cracks in concrete. Once curing is completed, bamboo starts shrinking and looses contact with theconcrete. This problem can be solved using bitumen kerosene mixture paints, oil paints, readymade bituminouspaintsetc.

STRENGTH

Under reinforced condition is preferred while using steel as it indicates the signs of failure on the concreteinforming the occupants regarding damage. The bamboo isbrittle material and over reinforced condition ispreferred in which limited ductility is achieved by concrete crushing or working stress is kept lower than that ofultimatestrength for reinforced sectionto provideclear informationbefore failure.

REINFORCEMENTREQUIRED

For bamboo to achieve the strength like the steel, the area of reinforcement materials that is bamboo is increasedso that the modular ratio is also increased. To control cracks minimum 3.5% of bamboo reinforcement isrequired.The steel andbamboo have similar bond strength.

DURABILITY

Durability is major part when dealing with bamboo. The bamboo durability can be improved by eliminatingsugar and carbohydrate content that attract insects and other fungi. For smaller constructions the bamboo isplastered , whitewashed,smokedandsoakedin water.

SEA SANDCOMPOSITION

The various chemicals on the sea sand has both favorable and unfavorable effect on the concrete. The main ionsin sea water consist of chloride ions, sulphate ions and magnesium ions. The sea water consist of average saltcontentof35g/l.

EFFECTOFCHLORIDESALTONCONCRETE

Chloride ions enters the concrete structure exposed to chloride salt through diffusion, absorption and wicking. Inthis process, some chloride ions are present in cement matrix and some in pore solution and the ions are alsofound trappedinCSH.

The chloride ions present in sodium chloride, magnesium chloride, calcium chloride and potassium chloridereactswithcalciumaluminate(C3A)andmono-sulfoaluminate(AFm)toformFriedel'ssalt($Ca_4Al_2(OH)_{12}Cl_2 \cdot 4H_2O$) and Kuzel's salt ($Ca_4Al_2(OH)_{12}Cl(SO_4)_{0.5} \cdot 5H_2O$) . When concrete is exposed toNaCl or KCl solution, microstructure changes and forms friedels salt.Friedels salt formation includes twoprocess – adsorption and anion exchange. In some cases calcium ions are substituted by magnesium ions whichleads to transformation of CSH to MSH , where MSH can only be stabilized at low pH. Concrete exposed tocalciumchloride solutionshoweddamagedue to formationofcalciumoxychloride.

EFFECTOFSULPHATE SALTSONCONCRETE

Themaineffectofsulphateattackonconcreteisduetothepresenceof Portlandite(Ca(OH2)whichisa hydration product. Sulphate content present in sea water as Na2SO4 solution. The sulphateions enters theconcrete and interact with hydration products. Portlandite (Ca(OH2)) can absorb sulphate ion and forms gypsum(CaSO4·2H2O) . Formation of gypsum leads to expansion and cracking. Due to these reasons the use of seawater in construction ismostly avoided. The sea sand can be used for construction afterwashingwith freshwaterfor 4-5times.

EFFECTOFSEAWATER

The first stage of corrosion is the attack of preventive layer of steel. When the preventive layer of steelis damaged, concrete becomes highly reactive for the electro chemical corrosion process. The corrosion does notoccur evenly on the reinforcement as the ion concentrations are different due to environmental conditions anddue to difference in cross section. Due to the corrosion process, the cations and anions are formed at differentparts of the reinforcement, this provides full circuit for current supply between cathode end and anode end. Dueto the presence of ions, salts reacts with oxygen to produce a heterogenous environment and water solution.Theseactsaselectrolyte andstartselectrochemical reaction.

USINGSEASANDASFINEAGGREGATE

The sea sand can be used for replacement of fine aggregate in construction. With proper washing thesalt content of the sea sandcan be reducedto.015%. afterwashing as the level of saltcontent are reduceditdoes not pose a potential threat to the concrete structure. The washing with fresh water or river water and propersievingoftheseasand to removethecoralsfragmentsshould bedonebeforepreparingthemix.

STRENGTHOFSEASANDASFINEAGGREGATE

In strength of the sea sand replacement is a section yet to be explored. The optimum rate for the seasandwithotherbuilding materialsimprovetheoverall strengthoftheconcretestructure.

A test was done in order to find the optimum replacement of M sand with sea sand. In this test, therewere 5 specimens of different replacement value. The standard specimen of size 150X150X150 is used for thecompression test. The first cube made completely with M sand, second cube made with 30% replacement of Msand with sea sand, third cube of 50% replacement, fourth cube of 70% replacement value and finally last cubespecimen of 100% or complete replacement of M sand with sea sand. The compression test is performed in eachcase as per IS code specifications. The cubes were casted in M25 grade and tested for compression strengthvalue.

Fig1.Cubesamplesfor30%and70%replacement

II. RESULT

The result of the test showed some different results. It was found that the 30% replacement of the Msand with sea sand showed the greatest compression value among other specimens. The 30% replacement is theoptimum value for the increased value of compression strength. In this 30% replacement, the sea sand and Msand blends with less pores or gaps inside the structure. The overall density of the specimen is increased in thisvalue.The 70% replacementshowed the lowestvalue and other specimens showed appreciable results in thetest.

Fig2.Cubestrengthfor30%replacement withseasand

COMBININGSEASANDANDBAMBOO

Theseasandandbambooarebothunexploredbuildingmaterialswhichhasgreatpotential.Withproper treatment the combination of the both materials are possible. The bamboo treated before using becausethe bamboo is made up of fibers and the fibers have tendency to absorb water. The treating of bamboo preventsthe absorption of water by the fiber. In some studies, it was found that the sea water has seasoning effect on thebamboo. The salts left overs even after washing with fresh water does not have any negative effects on bamboo.The combination of sea sand and bamboo is a better option for low weight structures. The bamboo is known forits ability to withstand during earthquake since ancient times. The structures with bamboo reinforcement hasgood performance against the actions of ground motion. The sea sand at optimum replacement also showngreater value of 42 MPa at M25 grading. The result shows the potential of using bamboo and sea sand asbuilding materials.

III. Conclusion

The sea sand and bamboo is better option as building material. It has greater potential and unexploredapplication in the construction sector. The properties of the bamboo and sea sand are suitable when combinedand does not have any negative affect on the structure. The bamboo and seasand has huge potential in thetourist sector. The sea shore resorts made of bamboo is of great demand. The store houses for industries,shipyards, auditoriums, gymnasiums and other facilities can also be made using bamboo and sea sand buildingmaterials. The application can be unlimited with proper study of the material and providing proper treatmentbeforeapplication.Thereviewcanbeconcludedasthebambooandseasandhassuitablepropertiestobeusedasbuildingmaterial.

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