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Green Concrete

Adwait Agyey[1], Er. Sumit Sharma[2]

1M.Tech. Student of Structural Engineering, Department of Civil Engineering, RN COLLEGE IF ENGINEERING AND TECHONOLOGY- 132113, PANIPAT, INDIA

2Assistant Professor of Structural Engineering, Department of Civil Engineering, RN COLLEGE IF ENGINEERING AND TECHONOLOGY- 132113, PANIPAT, INDIA

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ABSTRACT :- Now a day's concrete is most commonly used construction material due to its good compressive strength and durability. During the production of concrete large amount of carbon dioxide gas is emitted which increases in greenhouse gases. Green concrete reduces carbon dioxide gas emission. Green concrete is not green in colour or not confused with fresh concrete. It means it reduces carbon dioxide emission and also decreases impact on environment. It also reduces disposal problem of industrial waste products which saves energy and cost. Use of waste materials and reduction in carbon dioxide emission makes it environment friendly so it is named green concrete. The concrete mixture tested by conducting compressive strength test and spilt tensile strength test at an interval of 7 days 14 days and 28 days. In M20 concrete mix percentage of cement (by weight) reduced by 10%, 15%, 20% by marble powder and fly ash in equal proportion and coarse aggregate by recycled coarse aggregate. The potential environmental benefit to society of being able to build with green concrete is huge. It is realistic to assume that technology can be developed, which can halve the CO2 emission related to concrete production. With the large consumption of concrete this will potentially reduce the world's total CO2 emission by 1.5-2%. Concrete can also be the solution to environmental problems other than those related to CO2 emission. It may be possible to use residual products from other industries in the concrete production while still maintaining a high concrete quality. During the last few decades' society has become aware of the deposit problems connected with residual products, and demands, restrictions and taxes have been imposed.

Key Words:- Green concrete, CO2 emission, recycled, environmental, realistic

I. INTRODUCTION

Green concrete is a revolutionary topic in the history of concrete industry, this was first invented in Denmark in the year 1998, green concrete nothing to do with colour it is concept of thinking into concrete considering every aspect from raw material manufacture over mixture design to structure design construction, and service life. Green concrete very cheap to produce because for example waste products are use a partial substitute for cement charge for the disposal of waste are avoided energy consumption in production is lower and durability is greater. Green is a type of concrete which resembles the conventional concrete but the production or usage of such concrete requires minimum amount of energy and causes least harm to the environment. The potential environment benefit to society of being able to build with green concrete is huge it is realistic to assume that technology can be developed which can halve the Carbon Dioxide emission related to concrete production with the large consumption of concrete this will potentially reduce the world total emission carbon dioxide by 1.5-2% concrete can also be the solution to environment problems other than those related to carbon dioxide emission, it may be possible to use residual products from other industries in the concrete production while still maintaining high concrete quality. During the last few decades society has become aware of the deposit problems connected with the residual products. Demands restrictions and taxes have been imposed, and known that several residual products have properties suited for concrete production there is a large potential in investigating the possible use of these for concrete production. The concrete industry realised it is a good idea to front with regard to documenting the actual environment. the being forced to deal with environment aspect due to demand from authority the costumer and the economic effects such as imposed taxes, more some companies in concrete industry have recognised that reductions in production cost often go hand in hand with reductions in environment impacts the environmental aspects are not only interesting from an ideological point of view but also from an economic aspect. Engineers and architects can be compare materials and choose one more sustainable or specify construction material in such a way to minimize environmental impact Recent focus on climate change and the impact of greenhouse gas emissions on our environment has caused many to focus on carbon dioxide emissions as the most critical environmental impact indicator, Life Cycle Assessment (LCA) is the parameter; the construction industry should look into, LCA considers materials over the course of their entire life cycle including material extraction, manufacturing, construction, operations. Concrete is one of the world most widely used structural construction material. High quality concrete that meets specification requires new standard of process control and materials optimization. Increasingly concrete is being recognized for its strong environmental benefits in support of creative and effective sustainable development. Concrete has substantial sustainability benefits. The main ingredient in concrete is cement and it is consists of Limestone (Calcium Carbonate $CaCO_3$) During manufacture of cement, its ingredients are heated to about 800-10000C, During this process the Carbon Dioxide is driven off, Approximately 1kg of cement release about 900gms of Carbon Dioxide into the atmosphere.

1.1.1 Why green concrete:

- During this proces

s the carbon is driven off.

- Huge impact on sustainability.
- Approximate 1 kg of cement releases about 900gms of co2 into the

atmosphere.

- Most widely used material on earth about 30% of all material flows

on the planet.

- 70% of all materials flows in

the built environment.

In modern era, the problem is of waste material dumping. This problem can be solved by the phenomenon Green Concrete. In which waste material could be used in construction and environment can also be protected.

1.1.2 Need of green concrete:

Cement based materials are the most abundant manufactured materials in the world. Today`s exciting trend is the Green building is in our country, The potential environmental benefit to society of being able to build with green concrete is huge, Green concrete the name suggests is eco-friendly and saves the environment by using waste products generated by industries in various forms like rice husk ash, micro silica, etc.. to make resource saving concretes tructures. Use of green concrete helps in saving energy with emissions, waste water, Green concrete is very often also cheap to produce as it uses waste products directly as a partial substitute for cement, thus saving energy consumption in production of per unit of cement, Over and above all green concrete has greater strength and durability than the normal concrete, It is realistic to assume that the technology can be developed, which can reduce the CO_2 emission related to concrete production. the construction industry accounts for a massive environmental impact due to its high demand of energy, As a result of the awareness built during the past few years about greenhouse effect and damage to the nature, more people and countries became conscious about their future, Traditional ready mix concrete is a significant cause of production of greenhouse gases but in particular in regards to the high quantity produced worldwide. New available technologies allow the use of different types of concrete and advanced ways of production which represent a lesser hazard to the environment green concrete capable for sustainable development is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment. Marble sludge powder can be used as filler and helps to reduce the total voids content in concrete. Natural sand in many parts of the country is not graded properly and has excessive silt other hand quarry rock dust does not contain silt or organic impurities and can be produced to meet desired gradation and fineness as per requirement, this contributes to improve the strength of concrete. An attempt has been made to durability studies on green concrete compared with the natural sand concrete by usage of quarry rock dust and marble sludge powder as hundred percent substitutes for natural sand in concrete recent focus on climate change and the impact of greenhouse gas emissions on our environment has caused many to focus on carbon dioxide emissions as the most critical environmental impact indicator, These issues made researchers to put efforts to reduce greenhouse gas emissions.

1.1.3 Evaluation of inorganic wastes:

Inorganic residual products from the concrete industry and products which pose a huge waste problem to society and which are in political focus (combustion ash from water-purifying plants, smoke waste from waste combustion and fly ash from sugar production) have been given highest priority, stone dust is a residual product from the crushing of aggregates, It is an inert material with a particle size between that of cement and sand particles, stone dust is expected to substitute part of sand. Concrete slurry is a residual product from concrete production, i.e. washing mixers and other equipment, the concrete slurry is can be either dry or wet substance, and can be recycled either a dry powder or with water. In the case of recycling of dry material, it is necessary to process to powder. The concrete slurry can have some pozzolanic effect, and therefore be used as substitute for part of the cement or for other types of pozzolanic materials such as fly ash, combustion ash from water purifying plants has the same particle size and shape as fly ash particles, the content of heavy metals in the slurry is expected to be approximately at the same level as for fly ash, the slurry can also have some pozzolanic effect, smoke waste from waste combustion has some pozzolanic effect, the content of the heavy metals is significantly higher than of ordinary fly ash, the contents of chlorides, fluorides and sulphates can result in negative effects in connection with reinforcement corrosion, retardation and possible reactions, Further processing will be necessary before its use in the concrete.

1.1.4 Ways to produce green concrete:

 To increase the use of conventional residual products and to minimize the clinker content, by replacing cement with fly ash, micro silica in larger amounts than are allowed.

 By developing new green cements and binding materials, by increasing the use of alternative raw materials and alternative fuels, and by developing or improving cement with low energy consumption.

 Concrete with inorganic residual products, stone dust, crushed concrete as aggregate in quantities are used along with cement stabilized foundation with waste incinerator slag, low quality fly ash or other inorganic residual products, An information screening of potential inorganic residual products is carried out, the products are described by origin, amounts, particle size and geometry, chemical composition and possible environmental impacts.

1.2 Environmental goals

The goal of the Centre for Green Concrete is to reduce the environmental impact of concrete.
To enable this, new technology is developed. The technology consider all phases of concrete construction life cycle, i.e. structural design, specification, manufacturing and maintenance, and it includes all aspect of performance, Mechanical properties.

 Mechanical properties (strength, shrinkage, creep, static behaviour etc.)
 Fire resistance
 Workmanship (workability, strength development, curing etc.)
 Durability (corrosion protection, frost, new deterioration mechanisms etc.)

- Thermodynamic properties (input to the other properties)
- Environmental aspects (carbon dioxide -emission, energy, recycling etc.)

Green concrete is expected to fulfil the following environmental obligations.

- Reduction of carbon dioxide emission by 21% this is in accordance with the protocol 1997.
- Reduce the fossil fuels by increasing the use of waste derived fuels in the cement industry.
- Increase the inorganic residual products from industries other than the concrete industry by approx. 20%.
- the recycle capacity of the green concrete not be less compared to existing concrete types
- The production and use of green concrete not deteriorate the working environment.
- The structure do not impose much harm to the environment during their service life.
- To avoid the use of materials which contain substances on the Environmental

Protection Agency's list of unwanted materials, not to reduce recycling ability of green concrete compared with conventional concrete and not to increase, content of hazardous substance in waste water from concrete production compared with waste water from production of existing concrete types. Different concrete types are tested for workability, changes in workability after 30 min., air-content, compressive strength development, E-modulus, heat development, homogeneity, water separation, setting time, density and Furthermore, chloride penetration and air void analysis are carried out for the concretes in the aggressive environmental class.

- The water/cement ratio, the chloride content are calculated from the mixing report of the precise mixture proportion and from the chloride content in the different raw materials.

1.3 Genesis of green concrete

Considering the time elapsed since the commencement of the use of concrete. The green concrete is very young a material. It was invented in1998 in Denmark. Increasing awareness and activity to conserve the environment and realisation that concrete production also releases a considerable amount of carbon dioxide in the atmosphere were strong initiatives to catalyse the genesis of green concrete. In 1997 the Kyoto conference took place in which several countries. After deliberating over then environmental condition laid down several guidelines. Which would be directive principle the participating countries on their environmental related practices. The guidelines Kyoto protocol are called needed countries to cut down emissions to a certain degree as assigned. The given goal has to be achieved by carbon dioxide year 2012. Since then several countries started to focus on several available options but Denmark focused the cement and concrete production because approximately 2% of Denmark total carbon dioxide emission stems from cement and concrete, carbon dioxide emission as previously mentioned. the proposal cover following environmental aspects-Greenhouse effect, depletion of the ozone layer, photochemical oxidation, acidification, materials harmful to the environment and health, water and resources. Other participating countries that is Greece, Italy, Netherlands, Europe and the international world. Five environmental impacts given highest priority.

- carbon dioxide
- energy
- water
- waste
- pollutants

1.3.1 Suitability of green concrete in structures:

- Reduce the dead weight of a facade from 5 tons to about 3.5 tons.
- Allow handling, lifting flexibility with lighter weight.
- Good thermal resist ance.
- Sound insulation than the traditional granite rock.
- Improve damping resistance of building.
- Speed of construction, shorten overall construction period.

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1.4 Production of green concrete

1.4.1 Desirable properties in green concrete:

Today, it is already possible to produce and cast very green concrete. Even a super green type of concrete without cement but with, for example, 300 kg of fly ash instead can be produced and cast without any changes in the production equipment.

- Mechanical properties (strength, shrinkage, creep, static behaviour.
- Fire resistance
- Workmanship (workability, strength development, curing
- Durability (corrosion protection, frost, new deterioration mechanisms, etc..
- Environmental impact

Meeting these requirements is not an easy task, and all must be reached at the same time if constructors are to be tempted to prescribe green concrete. A constructor would not normally prescribe green concrete if the performance is lower than normal.

1.4.2 Energy consumption during the production:

The energy consumption of cement production make up more than 90% of the total energy consumption of all constituent materials and approximately one-third of the total life cycle energy consumption. By selecting a cement type with reduced environmental impact, and by minimizing the amount of cement, the environmental properties of the concrete are drastically changed. This must, however, be done while still taking account of the technical

II. LITERATURE REVIEW

Garg Jain (2014), studied on green concrete: efficient & eco-friendly construction materials, It presents the feasibility of the usage of by product materials like fly ash, quarry dust, marble powder granules, plastic waste and recycled concrete and masonry as a aggregates in concrete, It concluded that, it focuses on known benefits and limitations of range manufactured and recycled aggregates. Use of concrete product like green concrete in future will not only reduce the emission of CO2 in environment and environmental impact but it is also economical to produce. Dhoka (2013), carried out green concrete using industrial waste of marble powder, quarry dust and paper pulp. The green concrete is prepared by using industrial waste of marble powder, quarry dust with proper proportions. The versatility of green concrete & its performance derivate will satisfy many future needs. Wangchuk (2013), studied that green concrete for sustainable construction. It is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment, Replacement of materials over nominal concrete is what makes green concrete more environmental friendly concrete. Marble sludge powder, quarry rocks, crushed concrete and fly ashes are some of the materials used for making green concrete. Green concrete is very often and also cheap to produce, because for example, waste products are used as a partial substitute for cement, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. This concrete should not be confused with its color. Waste can be used to produce new products or can be used as admixtures so that natural resources are limited and used more efficiently and the environment is protected from waste deposits. Inorganic residual products like stone dust, crushed concrete, marble waste are used as green aggregates in concrete. Further, by replacing cement with fly ash, micro silica in larger amounts, to develop new green cements and binding materials, increases the use of alternative raw materials and alternative fuels by developing or improving cement with low energy consumption. Considerable research has been carried out on the use of various industrial products and micro-fillers in concrete. The main concern of using pozzolanic wastes was not only the cost effectiveness but also to improve the properties of concrete, especially durability engineers and architects have choices of the material and products they use to design projects – when it comes to a building frame the choice is typically between concrete, steel and wood; for paving applications the choice is generally between concrete and asphalt. Material choice depends on several factors including first cost, life cycle cost and performance for a specific application. Due to growing interest in sustainable development engineers and architects are motivated more than ever before to choose materials that are more sustainable. However this is not as straight forward as selecting an energy star rated appliance or vehicle providing high gas, engineers and architects compare materials and choose one that is more sustainable or specify a material in such a way as to minimize environmental impact. Life Cycle Assessment (LCA) seems to offer a solution. LCA considers materials over the course of their entire life cycle including material extraction, manufacturing, construction, operations, and finally reuse or recycling. LCA takes into account a full range of environmental impact indicators including embodied energy, air and water pollution and potable water consumption, solid waste and recycled content. Just to name a few. Building rating systems such as LEED and Green Globes, are in various stages of incorporating LCA so that they can help engineers and architects select materials based on their environmental performance and specify materials in such a way as to minimize environmental impact one potential drawback of LCA however is that the person conducting the analysis often has discretion to set. Which environmental impact indicator is most important? And often times conducting a full LCA is so complex that only a partial LCA is conducted with a focus on one or two phases of the life cycle. Recent focus on climate change and the impact of greenhouse gas emissions on our environment has caused many to focus on carbon dioxide emissions as the most critical environmental impact indicator. The problem with this approach is that it forces engineers, architects and product manufacturers to focus their efforts on reducing greenhouse gas emissions without regard to other sustainable practices Every 1 ton of cement produced leads to about 0.9 tons of carbon dioxide emissions and a typical cubic yard (0.7643 m3) of concrete contains about 10% by weight of cement. There have been a number of articles written about reducing the carbon dioxide emissions from concrete primarily through the 21 use of lower amounts of cement and higher amounts of supplementary cementanious material (SCM) such as fly ash and slag. The following observations can be made: Since a cubic yard of concrete weighs about 2 tons, carbon dioxide emissions from 1 ton of concrete varies between 0.05 to 0.13 tons. Approximately 95% of all carbon dioxide emissions from a cubic yard of concrete is from cement manufacturing and it is no wonder that much attention is paid to using greater amounts of SCM. However, focusing entirely on carbon dioxide emissions will result in the following unintended consequences.

- Does not encourage the use of recycled or crushed returned concrete aggregates since use of virgin aggregates constitutes only 1% of all carbon dioxide emissions from a typical cubic yard of concrete, Even replacing all virgin aggregates with recycled aggregates will reduce carbon dioxide emissions by only 1%. But the use of recycled aggregates is important as it can reduce landfills and support sustainable development. So there is a need to incentivize its use. Several local governments are requiring less land filling and making land filling more expensive. Also prescriptive specification restrictions on the use of recycled aggregates should be removed. Focus on performance will encourage producers to recycle.
- Does not encourage the use of water from ready mixed concrete operations since use of mixing water constitutes a negligible amount (<< 1%) of all emissions from a typical cubic yard of concrete. Use of recycled water should carbon dioxide be encouraged since fresh water is becomingly increasingly scarce. This can be accomplished by removing specification restrictions that require the use of only potable water.
- Does not encourage the use of sustainable practices such as energy savings at a ready mixed concrete plant since carbon dioxide emissions from plant operations constitutes only 1% of all carbon dioxide emissions from a cubic yard of concrete.
- Does not encourage the use of sustainable practices such as energy savings during transport of the materials to the ready mixed concrete plant since carbon dioxide emissions from transport constitutes only about 3% of all carbon dioxide emissions from a cubic yard of concrete. 22
- Focusing solely on carbon dioxide emissions from cement and concrete production does not encourage the use of recycled or crushed returned concrete aggregates, use of water from ready mixed concrete operations; use of sustainable practices such as energy savings at a ready mixed concrete plant and use of sustainable transport practices. This is because only 5% of carbon dioxide emissions from a cubic yard of concrete is due to use of virgin aggregates, water, plant operations and material transport to the plant.
- Removal of prescriptive specification restrictions and focusing on performance and the use of incentives is an effective way to encourage sustainable concrete with low carbon dioxide emissions.

2.2 Problems solved by green concrete

Selected international experience has been outlined here which has relevance for the Indian situation:

Scotland – About 63% material has been recycled in 2000, remaining 37% material being disposed in landfill and exempt sites.

- The Government is working out on specifications of recycling and code of practice.

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- Attempts are being made for establishing links with the planning system, computerizing transfer note system to facilitate data analysis and facilitating dialogue between agencies for adoption of secondary aggregates by consultants and contractors.

Denmark – According to the Danish Environmental Protection Agency (DEPA), in 2003, 30% of the total waste generated was Construction & Demolition waste.

- According to DEPA around 70 -75% waste is generated from demolition activity, 20-25% from renovation and the remaining 5-10% from new building developments.
- Because of constraints of landfill site, recycling is a key issue for the country. 23
- Statutory orders, action plan and voluntary agreements have been carried out, e.g., reuse of asphalt (1985), sorting of Construction & Demolition waste (1995) etc.

Netherlands – More than 40 million Construction & Demolition waste is being generated out of which 80% is brick and concrete.

- A number of initiatives taken about recycling material since 1993, such as prevention of waste, stimulate recycling, promoting building materials which have a longer life, products which can be easily disassembled, separation at source and prohibition of Construction & Demolition waste at landfills.

USA – Construction & Demolition waste accounts for about 22% of the total waste generated in the USA.

- Reuse and recycling of Construction & Demolition waste is one component of larger holistic practices called sustainable or green building practice.

Green building construction practices may include salvaging dimensional number, using reclaimed aggregates from crushed concrete, grinding drywall scraps, to use as soil amendment at the site. e being the main motive.

Japan – Much of the R&D in Japan is focused on materials which can withstand earthquake and prefabrication

- 85 million tons of Construction & Demolition waste has been generated in 2000, out of which 95% of concrete is crushed and reused as road bed and backfilling material, 98% of asphalt + concrete and 35% sludge is recycled.

Singapore – Construction & Demolition waste is separately collected and recycled. A private company has built an automated facility with 3, 00,000 ton per annum capacity.

Hong Kong – Concrete bricks and paving blocks have been successfully produced impregnation of photo catalyst for controlling Nox in ambient air. 24

India – Use for embankment purpose in bridges, roads etc. up to 3% to 4% of total production. Akmal Sami (2011) insist that the available resources should be used appropriately & whenever recycled it should be done at the national level with the help of GULF COOPERATION COUNCIL (GCC) & ENVIRONMENT PROTECTION INDUSTRIAL CO (EPIC). They observe that GCC countries produce more than 120 million tons of waste every year out of which 18.5% is related to solid construction waste. Results from Dubai municipality indicate that out of 75% of 10,000 tons of general waste produced, 70% is of concrete demolition waste. The author strongly advocates that a strong commitment & investment by government bodies as well as private bodies make this necessary for sustainability. Some materials are reused for recycling such as plastic, glass etc. In the same way concrete can also be used continuously as long as the specification is right. Recycling solid waste materials for construction purposes becomes an increasingly important waste management option, as it can lead to environmental and economic benefits. Conservation of natural resources, saving of energy in production and transportation, and reduction of pollution are also the advantages of recycling. In particular, concrete is a perfect construction material for recycling. In gulf countries natural resources are imported from different locations for fulfilling the need of construction. Small sources available in gulf countries in Arabian Peninsula are limited. For construction work, demand of desalinated water & sand locally available exits. Conservation of natural sources, saving natural resources, energy transportation & reduction of pollution are advantage. Guide for Cement & Concrete Association of New Zealand (CCANZ) has shown that the charges applying $10/ton on land fill dumping often make recycling concrete aggregate (RCA) a preferred option. The use of RCA to conserves natural aggregate & the associated environmental cost of exploration & transportation waste minimization & reducing the burden on landfills is a global issue. Extensive research has been carried out worldwide on the use of recycled aggregate in concrete. It also shows that globally the concrete construction industry has taken a responsible attitude to ensure that its natural resources are not over exploited. Due to issues relating to sustainability and limited natural resources, it is clear that the use of recycled and 25 secondary aggregates (RSA), for example, crushed concrete and asphalt and industrial by products such as fly ash and blast furnace slag, will grow. However, currently, it is only in the USA, Japan, parts of Western regulations have been sufficiently put in the place that the use of RSA exceeds 10% of the total aggregate usage. Consequently, worldwide the use of RSA stands at approximately 750 million tonnes, it is less 3% out of total aggregates use in world. They also insist that sustainability is generally recognized as a foundation for resource and energy – saving technological developments in many fields including that of construction. Parekh, Modhera (2011) discuss the issues relating to sustainability and limited natural resources. They also suggest use of recycled and secondary aggregates (RSA), for example crushed concrete and asphalt and industrial by products such as fly ash and blast furnace slag. Then products now reused in different material production. There are many studies that prove that concrete made with this type of coarse aggregates can have mechanical properties similar to those of conventional concretes and even highstrength concrete is nowadays a possible goal for this environmentally sound practice. Mirjana Malešev et al insisted that the quantity of recycled aggregate varies with river aggregate by % of 0, 50,100 respectively. The properties of workability (slump test) immediately after mixing and 30 minutes after mixing, bulk density of fresh concrete, air content, bulk density of hardened concrete, water absorption (at age of 28 days), wear resistance (at age of 28 days), compressive strength (at age of 2, 7 and 28 days), splitting tensile strength (at age of 28 days), flexural strength (at age of 28 days), modulus of elasticity (at age of 28 days), drying shrinkage (at age of 3, 4, 7, 14, 21 and 28 days), bond between ribbed and mild reinforcement and concrete are tested. Ninety nine specimens were made for testing of the listed properties of hardened concrete. It has been found that workability of concrete with natural and recycled aggregate is almost the same if water saturated surface dry recycled aggregate is used. Also, if dried recycled aggregate is used and additional water quantity is added during mixing, the same workability can be achieved after a prescribed time. Bulk density of fresh concrete is slightly decreased with increase in the quantity of recycled aggregate. The authors also insist that for concrete, compressive strength mainly depends on the quality of recycled aggregate. If good quality aggregate is used for the production of new concrete, the recycled aggregate has no influence on the compressive strength, regardless of the 26 replacement ratio of natural coarse aggregate with recycled aggregate. The same findings are found for concrete tensile strength (splitting and flexural). The modulus of elasticity of concrete also decreases with increasing recycled aggregate content as a consequence of lower modulus of elasticity of recycled aggregate compared to natural aggregate. Shrinkage of concrete depends on the amount of recycled concrete aggregate. Concrete with more than 50% of recycled coarse aggregate has significantly more shrinkage compared to concrete with natural aggregate. Increased shrinkage is a result of the attached mortar and cement paste in the recycled aggregate grains. Brett et al (2010) insist that the use of recycled aggregates in concrete is both economically viable & technically feasible. In addition to demolition waste sources, RA can also be composed of excess Concrete materials returned to the plant. Mirza and Saif have studied the effect of silica fume on recycled aggregate concrete characteristics. The percentages of recycled aggregate replacements of natural aggregate used by weight were 0, 50, and 100%, whereas the percentages of silica fume replacements of cement used by weight were 5, 10, and 15%. The results show that the compressive and tensile strengths values of the recycled concrete aggregate increase as the recycled aggregate and the silica fume contents increase. The study also indicates that in order to accommodate 50% of recycled aggregate in structural concrete, the mix needs to incorporate 5% of silica fume. Gupta discusses that normally coarse aggregate is the fractured stone obtained from rocks in hills or pebbles from river bed, and because of depletion of good conventional aggregate in certain regions, the need for development of Recycled Aggregate technology should be taken up commercially. It is similar to fly ash, which is available from electrostatic precipitators of various super thermal power stations which is an industrial waste material. It is chemically reactive when, mixed with cement for use in concrete. This is also useful as partial replacement of cement, as it gives concrete having better impermeability. Thus, it has a wider use in construction industry. He also notifies large scale recycling of demolished waste will offer, not only the solution of growing waste disposal problem and energy requirement, but will also help construction industry in getting aggregates locally. Such demolition waste can be crushed to required size, depending upon the place of its application and crushed material is screened in order to produce recycled aggregate of appropriate sizes. An aggregate produced by demolished buildings will be called Recycled Aggregates.

III. MATERIALS FOR GREEN CONCRETE

3.1.1 Cement:

A Cement is a binder, a substance used in construction that set, hardens and adheres to other materials, binding them together. Cement is seldom used solely, but is used to bind sand and gravel aggregate together. Cement is used with fine aggregate produce mortar for masonry, or with sand and gravel aggregates to produce concrete Cements used in construction are usually inorganic, often lime or calcium silicate based, and can be characterized as being either hydraulic or non-hydraulic, depending upon the ability of the cement to set in the presence of water.

3.1.1.1 Types of cement:

- ordinary portland cement
- rapid hardening cement or high early strength cement
- extra rapid hardening cement
- sulphate resisting cement
- quick setting cement
- low heat cement
- portland pozzolana cement

air entraining cement

- supersulphated cement
- masonry cement
- expansive cement
- colored cement
- white cement
- portland slag cement
- high alumina cement

3.1.1.2 Manufacture of Cement:

Portland cement is manufactured by crushing, milling and proportioning the following materials: 32
Lime or calcium oxide, CaO: from limestone, chalk, shells, shale or calcareous rock Silica, SiO2: from sand, old bottles, clay or argillaceous rock Alumina, Al2O3: from bauxite, recycled aluminum, clay

Iron, FeSO3: from from clay, iron ore, scrap iron and fly ash Gypsum, CaSO4.2H20: found together with limestone The materials, without the gypsum, are proportioned to produce a mixture with the desired chemical composition and then ground and blended by one of two processes - dry process or wet process. The materials are then fed through a kiln at 2,600º F to produce grayish-black pellets known as clinker. The alumina and iron act as fluxing agents which lower the melting point of silica from 3,000 to 2600º F. After this stage, the clinker is cooled, pulverized and gypsum added to regulate setting time. It is then ground extremely fine to produce cement. Most of CO2 in concrete is from the cement manufacturing process. A typical cubic meter of concrete contains about 10% cement by weight. Out of all ingredients, cement gives out most carbon dioxide. The reaction in the process of cement manufacture is: CaCO3 = CaO + CO2 The calcium oxide is then spent (slaked) mixing it with water to make slaked lime (calcium hydroxide) CaO + H2O → Ca(OH)2 Once the excess water is completely evaporated (this process is technically called setting), the carbonation starts Ca(OH)2 + CO2 → CaCO3 + H2O

3.1.2 Aggregate:

Use of virgin aggregates contributes about 1% of all CO2 emissions from a typical cubic meter of concrete. Therefore, the use of alternate aggregate is desirable. The use of local and recycled aggregates is desirable as it can reduce transportation and fuel cost and support sustainable development. 33

3.1.2.1 Coarse Aggregate:

Aggregate contents have direct and far-reaching effect on both the quality and cost of concrete. Unlike water and cement, which do not alter in any particular characteristic except in the quantity in which they are used, the aggregate component is infinitely variable in terms of shape, size and grading etc. With coarse aggregates graded infractions between 5mm and 40mm, differences in particle shape and surface texture affect the bulk void content and frictional properties of concrete. Generally the requirement of course aggregate in concrete is more than 50%. Similarly sand required is about 30%.

3.1.2.2 Fresh Local Aggregate:

Many places there are stone quarry available. Though these may not be of high quality stone like granite, basalt, Dolomite etc. but they may be of little lower quality. These can be used in making concrete with the help of appropriate mix design - may be for lower characteristic strength. A typical local aggregate in sand stone.

3.1.2.3 Recycled Demolition Waste Aggregate:

Construction industry produces huge waste called demolition waste or MALWA. It is estimated that per capita waste generation (including Municipal waste) general from 0.4 to 0.8 Kg per day per person. A typical waste dump. The waste contributes to greenhouse gas emissions and thus waste prevention and its recycling will reduce greenhouse gases and methane gas emission etc. A typical Waste Dump on the Road sides Therefore, for sustainability of resources, it is necessary that all waste must be scientifically managed. Waste Management is Collection, Transport, Processing, Recycling or disposal of waste materials. When analyzed, a typical waste product distribution in any solid waste dump is shown in figure 4. This waste distribution shows that there is about 50% demolition waste in the dump. In order to have sustainability of resources this demolition waste must be recycled and used. Therefore, for sustainability of resources, it is necessary that all waste must be scientifically managed. Waste Management is Collection, Transport, Processing, Recycling or disposal of waste materials. When analyzed, a typical waste product distribution in any solid waste dump. This waste distribution show that there is about 50% demolition waste. Recycled Aggregate is produced from Broken Building Part called MALWA. Such 34 demolition waste - MALWA, can be converted to Course aggregate. The Demolition waste can be broken into the pieces of approximately 20 & 10 mm size with the help of light crusher. Typical shape & color of recycled aggregate. This type of processing the waste will make the system Sustainable. The physical and chemical properties of such recycled aggregate must be determined before use as given. The properties of recycled aggregates will vary from place to place and from time to time. For example, the specific gravity of recycled aggregate may be less than fresh conventional aggregate because it may have mixture of materials. Typical shape and color of recycled aggregate If properties of sample recycled aggregate are suitable then such aggregate can used in concrete mix. The concrete mix design can be done as of general method described earlier. The shape of slump cone of concrete with recycled aggregate is generally similar to conventional aggregate. The failure pattern of cubes fracture mechanism is also similar to conventional cubes.

Fig 3.1 Waste aggregate

3.1.3 Fine Aggregate:

When the aggregate is sieved through 4.75mm sieve, the aggregate passed through it called as fine aggregate. Natural sand is generally used as fine aggregate, silt and clay are also come under this category. The soft deposit consisting of sand, silt and clay is termed as loam. The 35 purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent.

Fine aggregate Size variation

Coarse Sand 2.0mm – 0.5mm

Medium sand 0.5mm – 0.25mm

Fine sand 0.25mm – 0.06mm

Silt 0.06mm – 0.002mm

Clay <0.002

3.1.4 Recycled Concrete Material (RCM):

Recycled Concrete Material, also known as crushed concrete is similar to demolition waste. It is a reclaimed Concrete material. Primary sources of RCM are demolition of existing concrete pavement, building slabs & foundations, bridge structures, curb and gutter and from commercial private facilities. This material is crushed by mechanical means into manageable fragments. The resulting material is in the form of Coarse Aggregate. Comprised of highly angular conglomerates of crushed quality aggregate and hardened Crushed concrete physical characteristics make it a viable substitute for coarse aggregate however, its physical and chemical properties must be there. 36

Fig 3.2 RCM

The properties of recycled aggregates will vary from place to place and from time to time. Such aggregate can be used in concrete mix or in Highways concrete construction similar to demolition waste aggregate concrete.

3.1.5 Recycled Glass Aggregate:

Glass is formed by super cooling a molten mixture of sand (silicon dioxide), soda ash (sodium carbonate), and or limestone to form a rigid physical state. Glass aggregate is a waste product of recycled mixed glass from manufacturing and post consumer waste. Glass aggregate, also known as glass cullet, is 100 percent crushed material that is generally angular, flat and elongated in shape. This fragmented material comes in variety of colors or colorless. The size varies depending on the chemical composition and method of production Crushing. When glass is properly crushed, this material exhibits fineness modulus & coefficient of permeability similar to sand. It has very low water absorption, compared to rounded sand, enhances the stability of concrete mixes. Such material can be easily used in concrete construction as fine aggregate and give a better cohesive mix which will save on the consumption of cement

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3.1.5.1 Advantages of recycled glass aggregate:

- The amount of energy needed to melt recycled glass is considerably less than that needed to melt raw materials to make new bottles and jars. Recycling one bottle can save enough energy to power a television set for one and a half hours. 37
- Not only does glass save energy by using recycled glass, but each 1000 tonnes of recycled glass that we melt saves 314 tonnes of CO2.

3.1.6 Marble powder:

Marble has been commonly used as a building material since ancient times. Disposal of the waste materials of the marble industry, consisting of very fine powders, is one of the environmental problems worldwide today, these waste materials can be successfully and economically utilized to improve some properties of fresh and hardened properties of mortar and concrete. Marble waste powder is an industrial waste containing heavy metals in constituent. Fineness with 90% of particles passing by 300µm sieves. Marble powder was collected from the deposits of marble factories during shaping. It was retained on IS-150 micron sieve before mixing in concrete. Marble has been commonly used for various purposes like flooring, cladding etc. as a building material since the ancient times. The industry's disposal of the marble powder material, consisting of very fine powder today constitutes one of the environmental problems around the world. In India, marble dust is settled by sedimentation and then dumped away which results in environmental pollution, in addition to forming dust to summer and threatening both agriculture and public health. Therefore, utilization of the marble dust in various industrial sectors especially the construction, agriculture, glass and paper industries would help to protect the environment. Some attempts have been made to possibilities of using waste marble powder in mortar and concretes and results about strength and workability were compared with control samples of conventional cement sand mortar concrete.

IV. EXPERIMENTAL PROGRAM

1 Waste Material Preparation

Recycled aggregate is generated from crushing inert construction and demolition waste. It may be classified as crushed concrete aggregate (CCA) or recycled concrete aggregate (RCA) when consisting primarily of crushed concrete. It may be classified as a more general recycled aggregate when it contains substantial quantities of materials other than crushed concrete, currently, only the use of coarse aggregate derived from construction or demolition waste is recommended for use in new concrete construction, 10-20 mm aggregate can be used by the recycling. recycled aggregate concrete (RAC) for structural use can be prepared by completely substituting natural aggregate, in order to achieve the same strength class as the reference concrete, manufactured by using only natural aggregates this is obviously a provocation since large stream of recycled aggregates to allow for full substitution of natural aggregates is not available. It is useful to prove that to manufacture structural concrete by partly substituting natural with recycled aggregates by up to 50% is indeed feasible. In any case, if the adoption of a very low water to cement ratio implies unsustainably high amounts of cement in the concrete mixture, recycled aggregate concrete may also be manufactured by using a water reducing admixture in order to lower both water and cement dosage, or even by adding fly ash a partial fine aggregate replacement and by using a super plasticizer to achieve the required workability, high volume fly ash recycled aggregate concrete can be manufactured with a water to cement ratio of 0.60 recycled aggregate, is used this behavior seems to be enhanced when concrete rubble powder, that is the fine fraction produced during the recycling process of concrete rubble to make aggregates, is reused as filler, In this condition, the segregation resistance appears so high that the coarse recycled aggregate can float on a highly viscous cement paste, and an adjustment could be attempted by adding fly ash which, when used alone as a filler, confers reduced flow segregation resistance and increased flow ability to concrete.

4.1.1 Waste material cleaning:

Aggregate washing plant processes crushed inert construction and wastes into a clean homogeneous recycled product by removing contaminants and extracting the silt and clay deposits that bind the constituents together and reduce the compressive strength of concrete products. Researching the market suggested that the technology involved had advanced markedly in recent years. The latest generation of aggregate processing technology has enhanced the efficiency of the process. The settled upon the Agree sand 150 modular system manufactured by Terex Washing Systems and distributed by Duo Equipment, which has a number of innovative features. The plant's dual cyclone system enables a high grade coarse sand to be produced with less than 2% silt content.

Several sorting systems have been integrated to remove clay, ferrous metals and trash contaminates such as plastics and organics, enabling more wastes to be used, which would previously have been sent to landfill. The wash plant can also operate all year round due to a new electric-drive feeder system, which aggressively screens cohesive material, enabling production of aggregates even in the winter months, when added moisture causes the wastes to bind more than usual.

4.1.2 Waste material crushing:
We get more of the fraction offer jaw crushers, cone crushers, impact crushers, roll crushers, hammer mills and primary gyratory crushers, together with a wide range of screens and feeders for applications such as quarrying, mining and aggregate production.

4.1.3 Waste material screening:
Screening is the separation of materials into two or more different sized products. The materials is separated by passing it through a trammel which has a specifically sized screen , mesh, the materials fall into attached conveyors which stock pile the end products. The end products can be used in the landscaping, building, and construction industries The screening and separation of construction waste aggregate soil compost, sand and mostly any loose bulk material can be economical. Screening separates the feed materials into different size products. Our double deck plant can produce two products in one pass. The feed materials is loaded with an excavator or loader Screening is sample and very cost effective. Rough soil can be turned instantly into screened top soil. Land clearing waste can be converted into a valuable soil amendment. Screening rock concrete will be improve the gradation of the product and could eliminate or reduce the amount of crushing required.

4.1.4 Mixing:
In recent years, the application of green concrete has become popular in many countries including Malaysia. The innovative concrete can be produced using waste materials as one of its components. Green concrete can also be developed using various production processes that are not detrimental to the environment. The criteria for green concrete is that the materials used for making it should be sourced from sustainable "green materials" rather than non-sustainable resources. The use of recycled or waste materials can be considered sustainable as they can lower costs and raw materials as well as reduce land, Green concrete is made of new raw materials namely fly ash, recycled concrete aggregates and Marble powder. Fly ash is a waste product from coal power plants and is commonly disposed of in ponds. Through research it was discovered that fly ash has the potential to replace cement, a material with large environmental impacts due to air pollution from the cement plants. In order to reduce consumption of raw materials and to minimize the wastes generated from demolished concrete structures, crushed concrete can be reused as aggregates mix design, new raw materials and new knowledge of green concrete proper.

NOMINAL MIX DISIGN- M20 (1:1.5:3)
4.2 Methodology
4.2.1 Mixing of constituents:
- Mix the cement and fine aggregate on a water tight none-absorbent platform until the mixture is thoroughly blended and is of uniform colour.
- Add the coarse aggregate and mix with cement and fine aggregate until the coarse aggregate is uniformly distributed throughout the batch.
- Add water and mix it until the concrete appears to be homogeneous and of the desired consistency.

V. TESTING OF AGGREGATE

5.1.1 Aggregate crushing value test:
- This test gives a relative measure of the resistance of aggregate to compressive strength.
- Aggregate passing through 12.5mm sieve and retained on the 10mmsieve is taken. About 6.5kg of surface dry aggregate is filled in the standard cylinder in 3 layer tamping each layer 25 times by a standard tamping rod. It is leveled off. its weight is found out.(A)
- The assembly is then kept under compression testing machine and total load of 40 tones is applied uniformly in 10 minutes.
- The load is released, the aggregate is taken out and sieved on 2.36mm sieve. the fraction passing through is weighed.(B)
- The aggregate crushing value is given by, Aggregate crushing value =B/A*100%

5.1.2 Aggregate impact value test:
Toughness is its resistance to failure by impact.

Aggregate impact value test is performed for finding toughness of aggregate that is this test gives relative measure of resistance of aggregate to suddenly applied load or impact load.
The test sample consists of aggregate passing through 125mm sieve and retained on 10mm sieve.

The aggregate is oven dried at 110 degree Celsius for 4 hours.
The aggregate is filled in the cup, (A) by lifting the handle, hammer is allowed to fall freely as it is released by the tripping mechanism, on to the aggregate in the cup.
15 such blows are given and then the aggregate is taken out and sieved on 2.36mm sieves.
The fraction passing through is weight (B)

The aggregate impact value is given by:
Aggregate impact value =B/A*100.
Aggregate impact values for concrete should not exceed 30% for wearing surface for road and pavements and 45% for other types of road concrete.

5.2 Testing of Cement
5.2.1 Fineness test:
The strength development of concrete is the result of water with cement particles
The hydration reaction always starts with the cement available at the surface of cement particles.
The rate of gain of strength and also rate evolution of heat depends on the fineness of cement.
% of weight retained after sieving it through a 90 micron sieve. Surface area of cement particles in cm2/g
Fineness of cement improve workability, cohesiveness of concrete mix and reduces the risk of bleeding
Excessive fine cement deteriorate more quickly when exposed to air and likely to cause more shrinkage.

5.2.2 Setting time of cement:
5.2.2.1 Initial setting time:
The initial setting time of cement paste is defined as the time period between the time water is added to cement and time of standard needle fails to penetrate in the test block by 5mm to 7mm from the bottom of mould.
The initial time of cement paste should be sufficiency more, which permits sufficient period available for proper transportation to finishing of concrete.
The setting time is decreases with rise in temperature.
For ordinary Portland cement, minimum initial setting time of 30 minutes is recommended by IS specification.
Procedure for initial setting time of cement.

5.2.2.2 Final setting time:
The final setting time of cement paste is defined as the time lapsed between the mixing of water, till the standard vicat needle for final setting makes an impression on top surface of test block, but the annular attachment fails to do so. The final setting time is determine.
Maximum final setting time for ordinary Portland cement is limited to 600 minutes (10 hours)

5.3 Testing of workability
5.3.1 Slump test:
This is most commonly used test for determination of consistency of concrete.
It can be used on the site as well as in the laboratory because of its handy apparatus and simple test procedure.
The slump test indicate the behaviour of compacted concrete cone under the action of gravitational force.
Which is a slump cone its dimensions are top diameter 10cm, bottom diameter 20cm and height 30cm.
The thickness of the metallic sheet for the mould should not be less than 1.6mm. For tamping, a steel rod of 16mm diameter, 0.6m long with bullet end is used.
The test is suitable for concrete of medium to high workability that is slump value of 25mm to 125mm.
The slump test is limited to concrete with maximum size of aggregate less than 38mm**.**
5.3.1.1 Test procedure:
Thoroughly clean the mould from inside to remove any moisture or previously set concrete
Place the mould smooth horizontal , rigid and non-absorbent surface or the centre of the metallic tray
Fill the mould with concrete to be tested in four layers, tamping each layer by 25 times with the tamping rod, taking care that the strokes are evenly distributed over the cross-section.
Remove the mould by one smooth continuous vertical motion
The concrete subsides and this subsidence is called slump measure the slump in mm by using a metric scale

5.3.2 VEE BEE Consistometer:
This is good laboratory test to measure indirectly the workability of concrete.
It is an extension of slump-cone test.
For this test, the slump test is performed in a cylindrical metal pot instead of an open surface or trey.
Slump test is performed in the cylinder of the consistometer.
Place the glass disc attached to the swivel arm by turning, on the concrete in cylindrical pot.
Start the vibrator and at the same time start a stop watch.

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Continue the vibration till the conical shape of concrete disappears and it assume fully cylindrical shape. This can be judged by looking from the top through glass plate. Whenever the concrete touches the glass plate the transparency of the plate is lost and greenish grey colour of concrete is seen. When the complete glass plates becomes opaque and cement coloured, the concrete has fully acquired cylindrical shape. Stop the stopwatch at this point and note the reading.

This reading in seconds is known as vee-bee degree and its lesser value indicates more workability. This method is very suitable for very dry concrete, whose slump cannot be measured by slump cone test.

5.4 Testing of Cubes

5.4.1 Compressive strength of concrete:

Out of many test applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. Compressive strength of concrete depends on many factors such as water-cement ratio, cement strength, quality of concrete material and quality control during production of concrete etc.

5.4.2 Procedure:

Compressive Strength Test of Concrete Cubes, For cube test two types of specimens either cubes of 15cm X 15cm X 15cm or 10cm X 10cm x 10cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15cm x 15cm x 15cm are commonly used**.** This concrete is poured in the mould and put over VEE BEE CONSISTOMETER so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen. These specimens are tested by compression testing machine (CTM) after 7 days curing, 14 days and 28 days curing.

Clean the bearing surface of the testing machine

Place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast.

Align the specimen centrally on the base plate of the machine. Rotate the movable portion gently by hand so that it touches the top surface of the specimen.

Apply the load gradually without shock and continuously at the rate of 140 kg/cm2/min, till the specimen fail

Record the maximum load and note any unusual features in the type of failure.

VI. CONCLUSIONS

Cement and concrete may have an important role to play in enabling Denmark to fulfil its obligation to reduce the total carbon dioxide emission by 21 %, as agreed at the Kyoto conference. This is because the volume of concrete consumption is large in Denmark. Approx., 1.5 tonnes of concrete per capita are produced annually. The carbon dioxide emission related to concrete production, inclusive of cement production, is between 0.1-0.2 tons per ton produced concrete, this corresponds to a total quantity of carbon dioxide emission of 0.6 - 1.2 m tons per year. Approximately 2 % of Denmark’s total CO2 emission stems from cement and concrete production, It is realistic to assume that technology can developed which can halve the CO2 emission related to concrete production, With the large consumption of concrete this will potentially reduce Denmark’s total carbon dioxide emission by 0.5 %, these technical requirements include among others new concrete mix designs, new raw materials, and new knowledge about the properties of the new raw materials and concrete mix designs the overview of the present state of affairs in Denmark of concrete types with reduced environmental impact there is considerable knowledge and experience on the subject, the probably also motivate further development of production and use of concrete with reduced environmental impact, the somewhat vague environmental requirements that exist have results need for more specific technical requirements, and this is the focus of recently started, large, Danish research project, where the most important goal is develop the technology necessary to produce and use resource saving concrete structures, green concrete, this applies to structure design, specification, manufacturing, performance, operation, and maintenance. The potential environmental benefit to society of being able to build with green concrete is huge, It is realistic to assume that the technology can be developed, which can halve CO2 emission related to concrete production, with three large energy consumption of concrete and the following large emission of carbon dioxide this will mean a potential reduction of Denmark’s total carbon dioxide emission by (½ - 1%).So we should have to use green concrete in construction because it is more economical and produce less CO2 comparison to conventional concrete, the replacement of fine aggregate with 50% marble sludge powder and 50% quarry rock dust gives excellent result in strength aspect and quality aspect. Green concrete induced higher workability and it satisfy the self-compacting concrete performance which the slump flow is

657mm without affecting the strength of the concrete the water absorption of green concrete is slightly higher than conventional concrete the durability of green concrete under sulphate is higher to that conventional concrete, the survey results on current status of the green raw material usage in the U.S. concrete industry, Despite a large number of academic studies on various types of SCMs and AAs, their current usage in the industry was limited to top three SCMs as well as lightweight aggregate and RCA for AAs. Also, companies were at different levels in recognizing and utilizing SCMs and AAs. One “green” raw material already used by some concrete companies might still new to their peers, Benefits and barriers of using SCMs were basically related to concrete properties, cost, and local availability such materials, more advantages of using SCMs than disadvantages were mentioned by survey participants, Compared to SCMs, AAs were less commonly used in the industry and survey participants were less knowledgeable in their benefits and barriers, the concept of being green through using waste materials had been recognized by some industry practitioners, the current status of using “green” raw materials in concrete production as well as benefits and barriers perceived by industry practitioners, academic researchers would need to focus their studies on how the selected SCMs or AAs impact concrete properties, their costs compared with conventional materials, their local availability, other factors identified in this study, the survey results provide insights and directions on how the academia could help the industry solve its real problems, for example, there is not sufficient data on long term concrete durability if using RCA, there lack industry standards, particularly on using AAs, which could lead to less acceptance of these “green” raw materials in industry practice. The survey pool in this study was geographically limited, Future research could expand this study to cover a larger area of the U.S. and potentially Canada. As result, a more accurate and thorough understanding of the usage of “green” raw materials in the industry would be generated due to the increased sample size and a broader sample distribution, the overview of the present state of affairs regarding concrete types with reduced environmental impact that there is considerable knowledge and experience on the subject, the Danish and European environmental policies have motivated the concrete industry to react and will probably also motivate further development of the production and use of concrete with reduced environmental impact, the somewhat vague environmental requirements that exist have resulted in a need for more technical requirements and most important goal is develop the technology necessary to produce and use resource saving structures Green Concrete. This applies to structural design, specification, manufacturing, performance, operation and maintenance of the structure. In 1994 cement industry consumed primary energy, corresponding with 2% of world’s energy consumption. Worldwide 1126 Mt CO2 or 5 of the CO2 production original from cement production, the carbon intensity of cement making amounts to 0.81 kg CO2 per kg of cement. In India, North America and china, the carbon intensity is 10% higher than an average. Specific carbon emissions range from 0.36 kg to 1.09 kg CO2 per kg cement mainly depending on type of process, clinker cement ratio and fuel used, The potential environmental benefit to society of being able to build with Green Concrete is huge, It is realistic to assume the technology can be developed which can halve the carbon dioxide emission related to concrete production and the large energy consumption of concrete and the following large emission of carbon dioxide this will mean a potential reduction of total carbon dioxide emission by 2% . Seventeen different energy efficiency improvement options are identified. The improvement ranges from a small percent to more than 52% per option, depending on the reference case and local situation. The use of waste instead of fossil fuel may reduce carbon dioxide emission by 0.1 – 0.5 kg / kg cement. At the end of pipe technology to reduce carbon dioxide emissions may be carbon dioxide removal. the main technique is combustion under oxygen while recycling, However considerably research is required for all unknown aspects of this technique, It is important to keep a holistic cradle to cradle perspective when it comes to the use of a material, Based on a research, it was concluded that the occupant for 99% of life cycle energy use of a single family home. Less than 1% of the life cycle energy used in that home was due to manufacturing cement and producing concrete, the global cement industry accounts for approximately 5% of global carbon dioxide emissions, So whatever way one looks at it focusing on just the production of concrete accounts for a very small percent of overall carbon dioxide emissions, this is not to say that progress should not be made in reducing CO2 emission from concrete as produced, However one should keep in mind that whatever CO2 emission reductions that are possible will still account for best of 2% global CO2 reduction, Green concrete has manifold advantages over the conventional concrete, Since it uses the recycled aggregates and materials, it reduces the extra load in landfills and mitigates the wastage of aggregates. Thus, the net carbon dioxide emissions are reduced, The reuse of materials also contributes intensively to economy. Since the waste materials like aggregates from a nearby area and fly ash from a nearby power plant are not much expensive and also transport costs are minimal, It helps in recycling industry wastes, It reduces the consumption of cement overall and has better workability, greater strength and durability than normal concrete, compressive strength and flexural behaviour is fairly equal to that of the conventional concrete, thus, it may be concluded that the green concrete is a futuristic building material for Green Buildings.

VII. DISCUSSION

All the experimental data shows that the addition of the industrial wastes improves the physical and mechanical properties, these results are of great importance because this kind of innovative concrete requires large amounts of fine particles, due to its high fineness of the marble sludge powder it provided to be very effective in assuring very good cohesiveness of concrete, from the above study, it is concluded that the quarry rock dust and marble sludge powder may be used a replacement material for fine aggregates.

The chemical compositions of quarry rock dust and marble sludge powder are comparable with that of cement.

The replacement of fine aggregate with 50% marble sludge powder and 50% quarry rock dust gives an excellent result in strength aspect and quality aspect, the results showed that the M20 mix induced higher compressive strength, higher splitting tensile strength, Increase the marble sludge powder content by more than 50% improves the workability but affects the compressive and split tensile strength of concrete.

Green concrete induced higher workability and it satisfy the self-compacting concrete performance which is the slump flow is 657mm without affecting the strength of concrete. Slump flow increases with the increase of marble sludge powder content. Vfunnel time decreases with the increase of marble sludge powder content,

Test results show that these industrial wastes are capable of improving hardened concrete performance.

Green concrete enhancing fresh concrete behaviour and can be used in architectural concrete mixtures containing white cement.

The water absorption of green concrete is slightly higher than conventional concrete.

The durability of green concrete under sulphate is higher to that of conventional concrete. From the results after 90-day immersion, the mortar specimens with green concrete in 7.5% sulphate solution have similar effect with those immersed for 28 days, but for those in 7.5% magnesium sulphate, the influence of addition anti corrosion factor is not obvious.

The combined use of quarry rock dust and marble sludge powder exhibited excellent performance due to efficient micro filling ability and pozzolanic activity, Therefore, the results of this study provide a strong recommendation for the use of quarry rock dust and marble sludge powder as fine aggregate in concrete manufacturing.

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