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Assessment of Environmental Impact on carbon-dioxide emission between conventional slabs and Bubble Deck Slabs

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Abstract : In latest years, global warming has turn out to be a massive difficulty, affecting from industries, Power plants, transportation, and the obliteration of hills. As a result, the weather will change and some health issues will arise. Not only that,but the cost of living is increasing as well. A number of the industries are construction industries, chemical industries, paper industries, and other production industries, amongst others, are all contributing to growing air pollutants and international warming. Concrete is the maximum critical a part of the construction enterprise. Through reducing the amount of materials the quantity of concrete is also reduced. When production and transportation are reduced, carbon-dioxide emissions are lowered as properly. The purpose of this article is to use bubble deck slabs to reduce carbon dioxide emissions. The main intention of this paper presents the comparison between the Conventional slab(CS) and Bubble Deck Continuous ball Slab (BDCBS) , Bubble Deck Alternative ball Slab (BDABS) and Conventional Fly ash Slab(CFS), Bubble Deck Fly Ash Continuous ball Slab (BDFACBS), Bubble Deck Fly Ash Alternative ball Slab (BDFAABS) in estimation of CO2 emissions impact on environment.

IndexTerms - Conventional slab(CS) and Bubble Deck Continuous ball Slab (BDCBS) , Bubble Deck Alternative ball Slab (BDABS) and Conventional Fly ash Slab(CFS), Bubble Deck Fly Ash Continuous ball Slab (BDFACBS), Bubble Deck Fly Ash Alternative ball Slab (BDFAABS), Emission Factor

I. INTRODUCTION

Air pollutants is exceedingly excessive nowadays, and as a result, the surroundings is polluted and harmed. The environment has been impacted, and various forms of health problems have arisen because of weather changes. Not most effective is the environment closely infected, but global changes are also seriously impacted. Human beings, birds, and animals are all affected at once through those outcomes. But, presently, air pollution is severely constrained. Production companies inclusive of cement, fine aggregate, and coarse aggregate pollute the air within the construction location. Those are massive-scale

industries within the constructing industry. There are numerous cement production corporations within the area. Those agencies are AP Cement, ultra Tech Cement, KCP Cement, and Birla organization Ltd, among others. The authorities of India's Ministry of commerce and enterprise has indexed 153 cement agencies in India.

All through cement manufacture and transportation, each enterprise released a considerable amount of CO2 emissions, polluting the air. Gravel (coarse aggregate) companies, along with stone crushers and quarries, RK stone crushers, and so on, are growing in recognition nowadays. Heavy system which includes stripping and drilling equipment, wheel loaders, dual carriageway vans, and crushing system are utilized in these industries. From rocky terrain, gravel, sand, and beaten stones are removed. Tremendous quarries are quality proper for gravel, while others are pleasant perfect for sand or rock, depending at the soil type. Gravel and sand are often extracted from shallower locations than rock. Gravel is shoveled and loaded onto conveyor belts with grates that filter out the sand, gravel, and stones via length and do away with unwanted material like clay. A quarry is a vicinity where traffic can accumulate uncooked materials consisting of stone or gravel from the ground. Limestone, granite, and sand are some of the most usually used materials in quarrying operations worldwide. Due to all materials, the surroundings is extraordinarily polluted. On the development facet, rehabilitation processes are utilized to lessen pollution within the air by way of lowering the amount of substances used. As a result, air pollution is decreased.

Karl Ziegler and Giulio Natta got the Nobel Prize in Chemistry in 1963 for independently synthesizing polypropylene from propylene monomers (CH2=CHCH3) in 1953. Polypropylene comes in an expansion of forms, each with its own melting point and stiffness. Battery containers, bottles, tubes, filament baggage, and hollow balls are all fabricated from polypropylene. Polypropylene hollow ball is a light weight material compared to other substances like Cement, Fine aggregate and Coarse aggregate. Many traditional materials are heavier than plastics. A paper service bag, as an instance, weights nearly six instances that of a plastic service bag. A 1 litre plastic box of oil weighs only 7% of a tumbler bottle of the identical length. As a result, fuel usage and transportation prices are reduced. The carbon emissions of Polypropylene per unit kg of polymer were determined to be 1.34 kg CO2.

II. LITERATURE REVIEW

Piti Sukontasukkul .et al (2009) mounted how to calculate CO2 emissions in the ready-mixed concrete manufacturing procedure. Cement firms, aggregate plants, ready-mixed factories, and a literature survey are amongst the areas the area inventory data for concrete's raw components and one-of-a-type essential operations is obtained. On the basis of the accrued records, a technique for identifying whole CO2 emissions inside the manufacturing machine is provided. Equations can be used to compute the CO2 emissions of ready-mix concrete. It is positioned to be accelerated while in comparison at hand blending due to the reality of the usage of a mixing computing device (energy consumption). Hand mixing, on the one-of-a-type hand, is no longer regularly incredible in practice for medium to big portions of concrete. The most kinds of concrete are transportable mixers and ready-mixed concrete. While in evaluation to a portable mixer, ready-mixed concrete emits a good deal less CO2, which ought to be attributed to the mixer's efficiency.

Dan T. Babor .et al(2009) modern building creation requires using cement and concrete. Durability, lifespan, heat storage capability, and chemical inertia are only some of the environmental advantages of concrete. Concrete outperforms extraordinary materials together with wooden and metallic in lots of eventualities. Cement, on the other hand, is one of the maximum strength-extensive materials used inside the creation area and a massive contributor to CO_2 emissions within the environment. The main intention of this paper is reduce the amount of concrete utilized in buildings, utilize alternate types of concrete (including fly ash), and use that concrete well to reduce environmental effect.

Tajkia syeed Tofa .et al(2015) look into establishing empirical CO2 emission equations for 5 of Bangladesh's most generally used construction materials, such as brick, cement, and sand. An attempt has been made to provide a guideline for estimating CO2 emissions of various aggregate mixtures primarily based on the effects of the whole examine. Cradle to gate, component raw material transportation to site, and building construction were the primary steps. With 3 distinct types of aggregate ratios, CEM-I (95-100 percentage Portland cement) has been used. The largest CO2 emissions are produced by using concrete with a mix ratio of 1:1.5:3. Simplest on this composition do the emissions from cement and bricks outnumber each other. Concrete with a 1:3:6 blend ratio, however, produces the least quantity of CO2. The 1:1.5:3 mixing ratio creates 22.3 percent greater CO_2 than the 1:3:6 mixing ratio. As the coarse aggregate, brick was employed. 6732.29 g CO_2/cft is the maximum CO_2 output for Brick.

Amit k. Shrivastava .et al (2021) turned into methodically carried out to address the problem of data availability in computing CO2 emissions from cement production in India. It was resolved by way of factually examining respectable data, emission factors, and cement protocols from diverse cement-manufacturing sectors with less assumptions for higher accuracy. As a result, using the Greenhouse gas Protocol and Cement sector Emissions Calculation tool: Indian version 1.0 (July 2005) and CO2 Accounting and Reporting standard for the Cement industry, The Cement CO2 Protocol, version 2.0, a customised framework has been developed (Cement Sustainability Initiative, June 2005). For the computation of direct CO2 emissions and indirect CO2 emissions in various cement-production plant units, the framework has been extensively categorised into Scope 1 and Scope 2. It is a simple formula that can be used as a reference for calculating the carbon footprint of a cement factory in India.

III. MATERIALS

Cement:- From volcanic debris, crushed pottery, burnt gypsum, and hydrated lime to the first hydraulic cement used by the Romans in the middle ages, cement development continued till the 18th century, whilst James Parker patented Roman cement, which became famous but turned into eventually changed by way of Portland cement in the 1850s. The KCP cement used was ordinary Portland cement 53 grade as in line with IS 12269:1987 necessities.

Environmental Engineer Vivek Gilani has described the 28 cement groups out of 51 that have a higher emission component in step with ton produced than India's average. If all of these enterprises improve their efficiency using the techniques outlined above, they will save up to 10.41 million tone of CO2 emissions, which is equivalent to the Indian average. Within the satisfactory-case situation, if all 50 businesses perform at least in addition to the exceptional in elegance, Cochin Cement Ltd., which emits 0.46 tons of CO2 emission consistent with ton of cement produced, about 71.21 million Tons of CO2 emission may be avoided. One of these zone- and employer-unique understanding of GHG intensity might be a useful device for policymakers in framing direct and goal GHG discounts. The sort of region- and organization-unique expertise of GHG intensities can be a beneficial device for policymakers in framing direct and target-based totally incentives, which might be required if India is to fulfill its 2020 emission discount goal of 20-25 percent underneath 2005 stages. And additionally given every business enterprise's cement emission factor. This study utilized that cement emission issue.

Fly ash:- Fly ash is a fine powder created when crushed coal is burned in electric generating plants. Fly ash can be utilized to replace 35 percent of cement, according to IS 456-2000. It's a by-product of the manufacturing process. As a result, there is no need to consider the emission factor.

Fine Aggregate:- In this paper, natural river sand complying to Zone-III was employed while adhering to the allowed parameters of IS 2386:1963. Appendix 7 provided the Fine aggregate emission factor.

Coarse Aggregate:- The coarse aggregate utilized was 20mm in size. Before utilizing them, make sure they meet the allowed criteria of IS 2386:1963. Appendix 7 provided the Coarse aggregate emission factor.

Polypropylene Hollow ball:- 140mm Polypropylene hollow ball was used here. Carbon dioxide emissions from PP are estimated to be 1.34 kg of CO2 per Kg of polymer.

IV MIXING

Concrete mixes are usually done in one of three methods. One is a hand mixer, followed by a laboratory portable concrete mixer, and finally ready-mix concrete. The carbon-dioxide emissions from these various methods of material mixing vary from one another. A laboratory concrete mixer was utilized to mix the concrete in this study.

The laboratory concrete mixer was utilized according to the design Mix of M25 grade is 1:1.43:2.53. On a frame is a steel vessel with a capacity of 55/110 liters. With the help of a motor and a pulley system, the vessel rotates at 20-22 RPM. Using a hand wheel and counter weight, the vessel of a laboratory concrete mixer may be tilted at any angle. This makes mixing and discharge easier. To fully mix the contents, blades are placed inside the tank. As shown in fig.1, materials like cement, fine aggregate, and coarse aggregate are laid in a laboratory concrete mixer, contaminating the air. Carbon-dioxide emissions are created in addition to mixing during the batching process also.

Fig.1 Laboratory Concrete Mixer

Equation: Assessing the Co_2 emission for each material in slab utilizing the Equation 1. For the most part every material has different emission factor. The computations are displayed underneath the table 1 and 2

Size of the Slab is 1m X 1m X 0.15m

Total Emission = Material Quantity X Emission factor of that material (1)

Units:

Total Emission - (t -Co2)

Quantity - (Kg/0.15m^3) ,

Here 0.15 m^3 is the Volume of the Slab i.e LXWXH = 1X1X0.15 = 0.15 m^3

Emission Factor - (t -Co2/t)

V RESEARCH METHODOLOGY

Conventional concrete slab:- A Conventional slab, also known as a normal slab, is one that is supported by beams and columns. The slab thickness is minimal, but the beam depth is significant, and it is carried to the beams and then to the columns. This slab contains cement, fine and coarse aggregates, and 10mm dia

reinforcement bars. And also 35% of fly ash is used to partial cement replacement, according to IS 456 2000. In comparison to the Bubble Deck Slab, this slab necessitates more formwork

Bubble Deck slab :- In Bubble Deck Slab reinforcement modules and casting process is only different while compare to Conventional slabs. The Reinforcement is taken as sandwich type i.e top and bottom reinforcement meshes are placed in between Polypropylene Hollow balls .Before placing the reinforcement module, concrete is poured and level and compacted at a height of 50mm then placing a reinforcement module after complete the casting process. In this paper Bubble Deck Continuous Slab and Bubble Deck Alternate slabs are casted. Both slabs casted based on Filigree method as shown in figure 2.

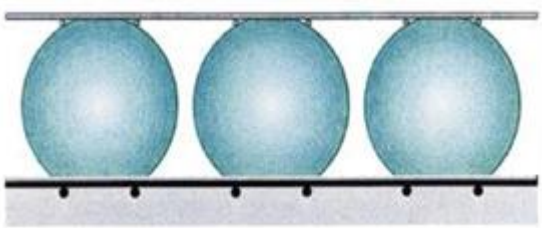


Fig. 2. Filigree Method

Bubble Deck Alternative ball slabs, the polypropylene hollow balls are place alternatively in between top and bottom Reinforcement meshes as shown in figure 3. In Bubble Deck Continuous ball slabs the Polypropylene hollow ball are placed continuously in between top and bottom reinforcement meshes as shown in figure 4.

Fig 3 Bubble Deck Alternative Ball slab (BDABS) Casting Process

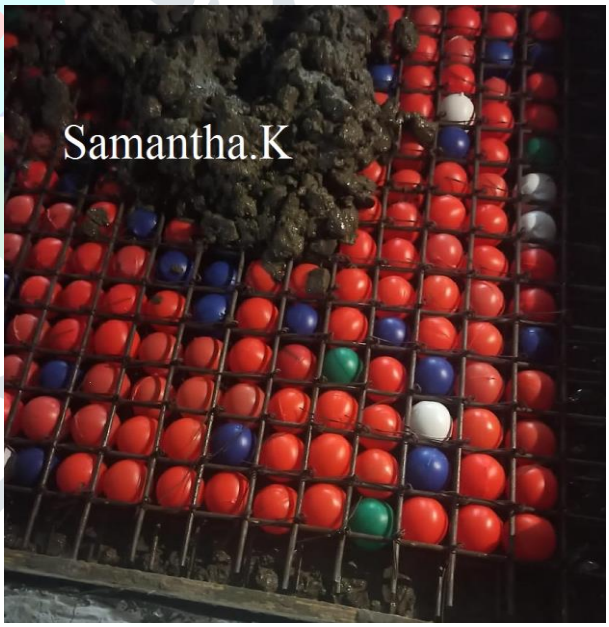


Fig 4 Bubble Deck Continuous ball slab (BDCBS) Casting Process

5.1 Comparison of the BDABS and BDCBS:-

The BDABS and BDCBS are using same prototype of Reinforcement mesh. Here, 8mm dia. Reinforcement bars are used in both horizontal and vertical direction. Spacing of each reinforcement is 50mm. The main difference in both slabs are the placing of polypropylene Hollow balls.

VI RESULTS

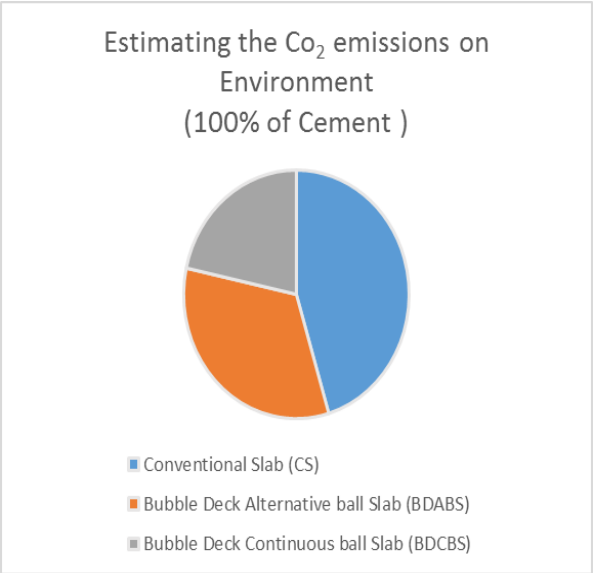
6.1 Estimating CO_2 emissions from materials Using 100 % of Cement:-

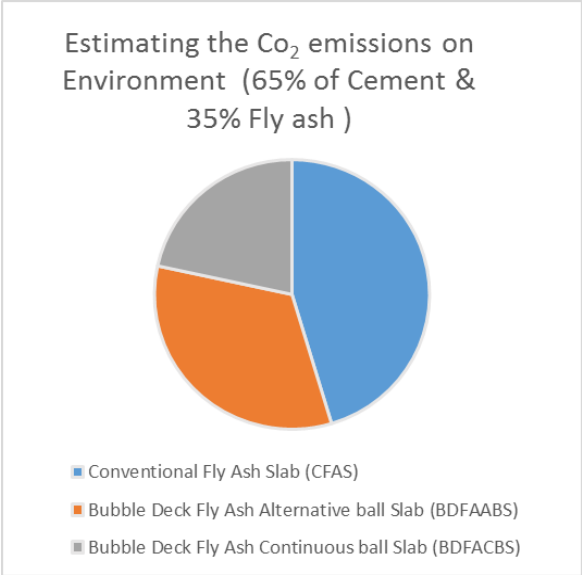
S.No	Description	Materials	Quantity (Kg/0.15m^3)	Emission Factor (t -Co_2/t	Total Emission (t -Co2)
1	Conventional Slab(CS)	Cement	67.065	0.95	0.0637
2		Fine Aggregate	107.890	0.012	0.0013
3		Coarse Aggregate	179.100	0.043	0.0077
				Total Emission	**0.0727**
1	Bubble Deck Alternative ball Slab (BDABS)	Cement	48.861	0.95	0.0464
2		Fine Aggregate	78.606	0.012	0.0009
3		Coarse Aggregate	130.487	0.043	0.0056
				Total Emission	**0.0530**
1	Bubble Deck Continuous ball Slab	Cement	31.935	0.95	0.0303
2		Fine Aggregate	51.376	0.012	0.0006
3		Coarse Aggregate	85.285	0.043	0.0037
				Total Emission	**0.0346**

6.2 Estimating CO_2 emissions from materials Using 65 % of Cement & 35% of Fly ash:-

1	Conventional Fly Ash Slab (CFAS)	Cement	43.592	0.95	0.0414
2		Fly Ash	23.473		0.0000
3		Fine Aggregate	107.890	0.012	0.0013
4		Coarse Aggregate	179.100	0.043	0.0077
				Total Emission	**0.0504**
1	Bubble Deck Fly Ash Alternative ball Slab (BDFAABS)	Cement	31.760	0.95	0.0302
2		Fly Ash	17.101		0.0000
3		Fine Aggregate	78.606	0.012	0.0009
4		Coarse Aggregate	130.487	0.043	0.0056
				Total Emission	**0.0367**
1	Bubble Deck Fly Ash Continuous ball Slab (BDFACBS)	Cement	20.758	0.95	0.0197
2		Fly Ash	11.177		0.0000
3		Fine Aggregate	51.376	0.012	0.0006
4		Coarse Aggregate	85.285	0.043	0.0037
				Total Emission	**0.0240**

Graphs:





VII CONCLUSIONS

The Bubble Deck Alternate Ball slabs reduced the 27.14% of Carbon dioxide (Co2) emissions as compared to Conventional Slabs. The Bubble Deck Continuous Ball slabs reduced the 52.38% of Carbon dioxide (Co_2) emissions in comparison to conventional Slabs. The Conventional Fly ash slabs reduced 30.69% of Carbon dioxide (Co_2) emissions compared to Conventional Slabs. Using Polypropylene hollow balls in slabs is cost effective, resulting in a significant reduction in CO_2 emissions. The Bubble Deck Fly ash Alternate Ball slabs reduced the 27.14% of Carbon dioxide (Co_2) emissions as compared to Conventional Fly ash Slabs. The Bubble Deck Fly ash Continuous Ball slabs reduced the 52.38% of Carbon dioxide (Co_2) emissions in comparison to Conventional Slabs. Whilst, compared to conventional slabs and Conventional Fly ash slabs, the Bubble deck slabs decreased the Co_2 emissions in environment. At the same time, the Bubble Deck continuous ball slabs are extra reduce the Co_2 emissions in environment in comparison to conventional slabs and Bubble Deck alternate Ball slab.

Now a days, environment is absolutely polluted to such a lot of things. One of the important is production field like construction of structures i.e buildings, libraries, cold storages, theaters etc. In these sort of structures the usage of a number of production of materials and transportation. So, New technologies are invited to green house or eco-friendly structures. Bubble deck slabs are new era. Finally concluding that the Bubble deck slabs are much less impact on environment compare to conventional slabs.

REFERENCES

[1]. http://cbalance.in/2013/12/carbon-emissions-in-the-cement-sector-in-india/#.YdKgzclBzIU

[2]. https://www.winnipeg.ca/finance/findata/matmgt/documents/2012/682-2012/682-2012_Appendix_H- WSTP_South_End_Plant_Process_Selection_Report/Appendix%207.pdf

[3] https://eaindustry.nic.in/cement/report1.asp .

[4] Piti Sukontasukkul , King Mongkut's University of Technology North Bangkok, june 2009 Methodology for Calculating Carbon Dioxide Emission in the Production of Ready-mixed Concrete

[5] Dan T. Babor, DIANA PLIAN and LOREDANA JUDELE, Gheorghe Asachi Technical University of Iasi, 2009 Environmental Impact of Concrete.

[6] Tajkia syeed Tofa , Military Institute of Science and Technology, December 2015 Estimation of CO2 of Different Aggregate Mixtures.

[7] Amit K. Shrivastava, Aman Vashishth, Bhagya Jayant, Delhi Technological University, Delhi, India, 2021, Deterministic approach for calculation of Carbon Footprint for Cement plants in India .

[8] Samantha. Konuri , Estimation of Material Quantities with their Cost comparison among Conventional slab and Bubble deck slab (International Association of Engineers (IAENG), Engineering Letters, Online ISSN: 1816093X, 18160948 Volume 30, Issue 1)

[9] Samantha. Konuri , Review on Bubble Deck Slabs Technology And Their Applications (International Journal of Scientific & Technology Research Volume 8, Issue 10, October 2019 Issn 2277-8616).