iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.50221

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

An Experimental Approach to Strength Assessment of Concrete by Fractional Substitution of the Fine Aggregate with Expanded Polystyrene Beads

D. V. Shanmukesh[1], B. V. Ramana Murty[2], M. Sai Ram[3], P. Chandra[4], S. Anand[5], S. Lokesh kumar[6], S. Teja[7]
[1]M.E. (Ph. D) Sr. Professor NSRIT (A) (Guide), [2, 3, 4, 5, 6, 7]B.Tech, Department of Civil Engineering, JNTU-GV

Abstract*: Constructions are two types RCC and Steel Structures. In our Country most of the constructions are of RCC. Not only in our country but also in the world most constructions are of RCC type in which Concrete is been used. Even though Cost of concrete is comparatively less than steel, but is somewhat costlier. Ingredients of concrete are water, cement, coarse, sand. But Concrete is Heavier in weight. And when considered for precast structures those might fail at lifting due to mismatch of eccentricity by its own weight. So, in this project Sand in concrete is been partially replaced with Expanded polystyrene (EPS) beads, of 10 to 50 of intermediate percentages and it's compressive strength and Split Tensile Strength are been checked. Because, to reduce cost parameter and also to check the increase of strength parameter which might be an hope. EPS Beads is been considered because it is cheap and abandoned.

Keywords: EPS Beads , M20Concrete, etc.

I. INTRODUCTION

A composite material that consists essentially of a binding medium, such as a mixture of portland cement and water, within which are embedded particles or fragments of aggregate, usually a combination of fine and coarse aggregate. Concrete is by far the most versatile and most widely used construction material worldwide. It can be engineered to satisfy a wide range of performance specifications, unlike other building materials, such as natural stone or steel, which generally have to be used as they are. Because the tensile strength of concrete is much lower than its compressive strength, it is typically reinforced with steel bars, in which case it is known as reinforced concrete.

A. EPS Beads

EPS, or expanded polystyrene, is a rigid cellular plastic originally invented in Germany by BASF in 1950. It has been used in packaging solutions since 1958. It is 98% air but the rest is made from tiny, spherical EPS beads - themselves made only of carbon and hydrogen. EPS structures are produced through a 3 part process called steam moulding that expands these tiny beads to more than 40 times their original size. This expanding process is precisely timed to determine the size the beads will finally reach. It is this final density of the expanded beads that determines the strength of the structure. After the first stage the beads are left to absorb air for between 24 and 48 hours. In the final stage the freshly expanded beads are poured into individually manufactured moulds where steam and pressure are applied to compress and bond the beads into a final structure of the required strength and density.

B. Composition

There are two principal components of EPS: solid styrenic polymer (polystyrene beads) and a blowing agent. The information below will detail the technical information on the components of EPS

II. APPLICATION

A. Construction

1) Floor, Ceiling and Wall Insulation
2) Structural Insulated Panels (SIPs)
3) Sheathing
4) Geofoam
5) Door Cores
6) Insulating Concrete Forms (ICF's)

©IJRASET: All Rights are Reserved

7) Roofing Insulation Systems
8) Exterior Insulation and Finishing Systems (EIFS)

B. Packaging/Shapes
1) Picnic Coolers/Buckets
2) General Purpose Packaging
3) Original Equipment Manufacturer (OEM) Packaging
4) Refrigeration Divider Trays
5) Air Conditioning Insulation
6) Computer Cushioning Thermal Protective Packaging
7) Pharmaceutical

C. Specialty Foams
1) Foam Cups and Containers
2) Coffee Cups
3) Cold Drink Cups
4) Noodle Bowls Ice Cream Bowls
5) Take-out Conta
6) Iner

III. EXPANDED POLYSTYRENE BEADS

A. Properties of EPS Beads

EPS has been a material of choice for over half a century because of its technical versatility, performance and cost effectiveness. It is widely used in many everyday applications where its light weight, strength, durability, thermal insulation and shock absorption characteristics provide economic, high performance products.

1) *Light Weight:* EPS is an extremely lightweight material which is not surprising considering it is comprised of ~98% air. This characteristic makes it ideal for use in packaging as it does not significantly add to the weight of the total product thereby reducing transportation costs. Energy consumption for transport fuel is also reduced and vehicle emissions minimised – all contributing to lower global warming.
2) *Durability:* The exceptional durability of EPS makes it an effective and reliable protective packaging for a wide range of goods. The cellular structure of EPS makes it dimensionally stable and therefore does not deteriorate with age. EPS is also odourless and non-toxic.
3) *Moisture Resistance:* EPS is a closed cell material and does not readily absorb water. There is no loss of strength in damp conditions, making EPS ideal for cool-chain products. The material is moisture resistant, so the highest hygiene requirements are met. The ability of EPS to resist moisture also lends itself for use in fishing floats and marina buoys. Even when subjected to prolonged.
4) *Thermal Efficiency:* The superior thermal efficiency of EPS makes it ideal for packaging any product that is sensitive to temperature change. Products enclosed in EPS containers can be maintained for long periods at temperature above or below ambient conditions and can be protected from sudden temperature changes that can occur in the transport through different climatic zones. Examples include fresh produce and seafood as well as pharmaceutical and medical products.
5) *Shock Absorption:* EPS exhibits excellent shock absorbing characteristics making it the first choice for packaging of a wide range of products including appliances, electronic products, computers and chemicals.

IV. MIX PROPORTIONS

[1]	cement	=	359	Kg/m3
[2]	replacement of cement	=	0	Kg/m3
[3]	water	=	197	Kg/m3
[4]	admixture	=	0	Kg/m3
[5]	fine aggregate	=	506	Kg/m3
[6]	coarse aggregate	=	1145	Kg/m3
[7]	replacement of F.A	=	0.555962	Kg/m3
[8]	replacement of C.A	=	0	Kg/m3
[9]	water cement ratio	=	0.499	Kg/m^3

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

V. RESULTS

A. *Tabular values for Compressive Strength*

1) Tabular values for 10% Replacement

Load in KN

Days	speci1	speci2	Speci3
3	264	261	246
7	376	374	358
14	458	447	442
28	541	537	526

Compressive Strength in N/mm2

Days	speci1	speci2	speci3	Avg
3	11.6952	11.5952	10.8952	11.3952
7	16.6806	16.5806	15.8806	16.3806
14	20.3416	19.8416	19.6416	19.9416
28	24.04	23.84	23.34	23.74

Total Compressive Strength in N/mm2

Days	Compressive Strength in N/mm2
3 Days	11.4
7 Days	16.39
14 Days	19.95
28 Days	23.74

2) Tabular values for 20% Replacement

Days	speci1	speci2	speci3
3	242	240	224
7	351	349	333
14	426	415	410
28	515	510	499

Compressive Strength in N/mm2

Days	speci1	speci2	speci3	Avg
3	10.74528	10.64528	9.94528	10.44528
7	15.59568	15.49568	14.79568	15.29568
14	18.92176	18.42176	18.22176	18.52176
28	22.86	22.66	22.16	22.56

Total Compressive Strength in N/mm2

Days	Compressive Strength in N/mm2
3 Days	10.45
7 Days	15.3
14 Days	18.53
28 Days	22.56

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

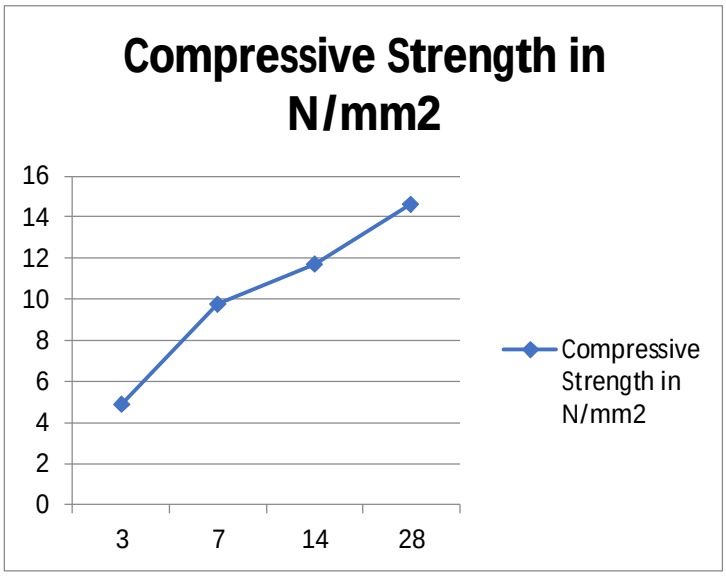
Tabular values for Split Tensile Strength

Load in kN

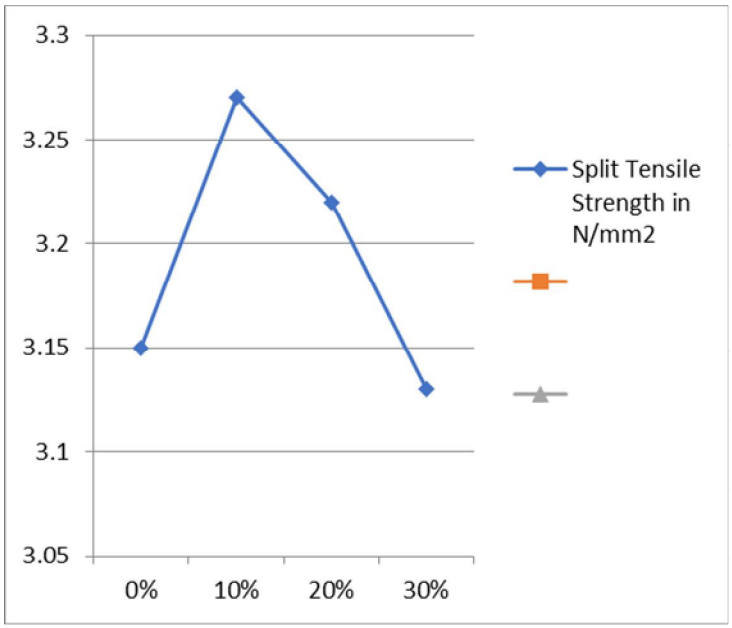
Percentage	speci1	speci2	speci3
0%	248.8141	241.7456	192.2655
10%	242.4524	235.3838	185.9037
20%	248.8141	241.7456	192.2655
30%	242.4524	235.3838	185.9037
40%	243.8661	208.5232	194.386
50%	231.1427	217.0055	181.6626

Results for Compressive Strength of all percentages

EPS Beads %	CS
0%	21.5
10%	23.74
20%	22.56
30%	20.32
40%	17.09
50%	14.6



Results for Split Tensile Strength of all percentages



VI. FUTURE SCOPE

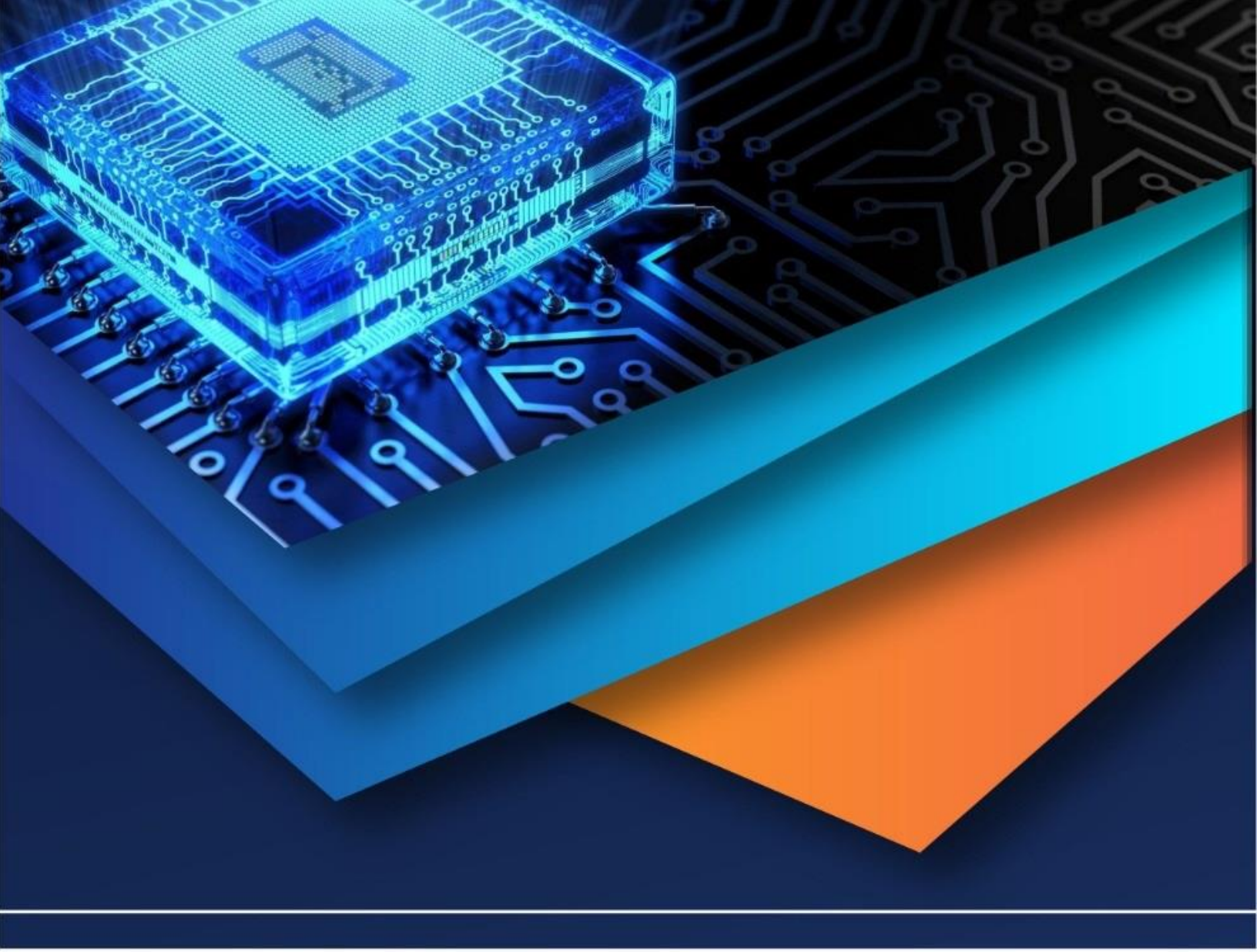
These replacements can be further increase to some percentage Flexural strength can be tested with these replacements Addition of admixtures can be done and be tested. Addition of adhesive materials and fibers or some particles can be done and be tested. Replacements can be done to coarse aggregates can be done and be tested. Age parameter of concrete can be increased for 53 days, 96 days, etc and be tested. Slump parameter variation with strength can be tested

VII. CONCLUSION

1) Gives greater strength of Fck for 10% and 20% replacement of cement in concrete with some decrement.
2) Strength decreased for 30%, 40%, 50% replacement in decreasing order up to next low value of fck.
3) We could use in real time construction with replacement up to 20% to reduce cost.
4) If we want to increase much to reduce cost then we have to design for next highest fck design mix and we have to use it.
5) Weight is Reducing by increase in replacement percentage

REFERENCES.

[1] Kohling K (1960), "The manufacture of light weight concrete using pre-expanded styropore particles s aggregates", betorstein-zeitung.
[2] Mandlik Tarun Sarthak Sood, and others (2013), "Lightweight Concrete Using EPS", ISSN (Online).
[3] Maura G (1978), "Light Weight Concrete made with expanded substituted Polystyrene ",IL Cemento (Rome).
[4] Momtazi and others (2010), "Durability of Lightweight Concrete Containing EPS in Salty Exposure Conditions".
[5] Parton G M and Shendy-EL-Barbary M E(1982), "Polystyrene-bead concrete Properties and mix design", Journal of Cement Composite And Light Weight Concrete.
[6] Tamut Prabhu and others (2014),"Partial replacement of coarse aggregate by Expanded Polystyrene Beads in Concrete".



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)