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EXPERIMENTAL INVESTIGATION OF EXTRUDED POLYSTYRENE CONCRETE USING MANUFACTURED SAND

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Abstract - *The extruded polystyrene beads are mixed to the concrete which substitute in the place of fine aggregate. The main objective of this investigation is to find a concrete mix proportion which expect to gives better result than the conventional concrete. The concrete mix consists of cement, aggregate, polystyrene beads, manufactured sand which is the replacement of river sand and to study the properties such as compressive strength, workability test, split tensile strength of extruded polystyrene beads concrete. Then its property is compared with conventional concrete.*

Key Words: Polystyrene, M-Sand, Extruded Polystyrene, XPS

1. INTRODUCTION

The use of raw materials in the civil industry has been very intense in recent years. This increase is very consistent in developing countries, which is motivated primarily by economic growth. It conveys many concerns, because the supply of types of raw materials used is non-renewable resources. In many cities this problem is much more critical due to its geological formation. It has rocks, which are easily accessible for use in construction such as coarse aggregate. There is no possible resource for fine aggregate. There we can partially replace extruded polystyrene beads as fine aggregate since it is less than 4.25 mm. This investigation presents an alternative technology for the use of polystyrene from packing. This can be used as the aggregate in concrete for the production of blocks. These blocks could be used for the construction walls or pavements. Thus, the purpose of this study was to obtain the most advantageous percentage and size of the polystyrene that can be integrated to concrete as a substitute for aggregate, without any loss of compressive strength.

XPS beads are used for packaging of goods for easy handling and transportation. But the disposal of XPS beads is becoming a problem for the waste disposal department. Since, XPS is lightweight, non-biodegradable, hydrophobic and chemically inert in nature, and also have good thermal and sound insulation. It can be used as a low-cost replacement of the coarse aggregates for the concrete. Since, it a waste product from the packaging industry, utilizing it in construction of concrete will not only reduce the cost but all reduce the burden on waste disposal departments. In this paper, the XPS concrete is designed for M25 at 10%, 30%, and 50% of XPS (by vol. of fine aggregates). A comparative study between the XPS and standard concrete is done on parameters like compressive strength and split tensile strength.

2. MATERIALS USED AND METHODOLOGY

2.1 Material used

The materials used in XPS concrete are Cement, Fine aggregate, Coarse aggregates, XPS and water.

2.2 Experimental method

In this experiment, three different sample of XPS concrete was prepared at different percentage of XPS beads (by vol. of fine aggregates). The concrete was designed for M25 mix design as per the IS 10262: 1982. The cube specimen of size 15 x 15 x15 cm were prepared at 10%, 30%, and 50%, of XPS (by vol. of fine aggregates). After 7, 14 and 28 days of curing, they were tested for compressive strength and split tensile strength in CTM machine.

Table1: Quantity of material for cube

	Material used	C.C kg	10% kg	30% kg	50% kg
1	Cement	11.66	11.66	11.66	11.66
2	Fine aggregate	29.53	26.58	20.66	14.77
3	Coarse aggregate	38.87	38.87	38.87	38.87
5	XPS	0	2.94	8.86	14.77

Table2: Quantity of material for cylinder

	Material used	C.C kg	10% kg	30% kg	50% kg
1	Cement	18.35	18.35	18.35	18.35
2	Fine aggregate	46.45	41.81	32.52	23.22
3	Coarse aggregate	105.55	105.55	105.55	105.55
5	XPS	0	4.64	13.94	23.22

3. RESULT

3.1 Compressive Strength

The compressive strength of the cube was tested after 7, 14 and 28 days of curing in CTM machine

Table-3: Compressive strength of XPS and standard concrete.

	% XPS	At 7 days (N/mm2)	At 14 days (N/mm2)	At 28 days (N/mm2)
1	0%	10.85	27.1	27.56
2	10%	15.43	22.07	23.1
3	30%	17.77	22.37	22.2
4	50%	12.65	14.5	17.3

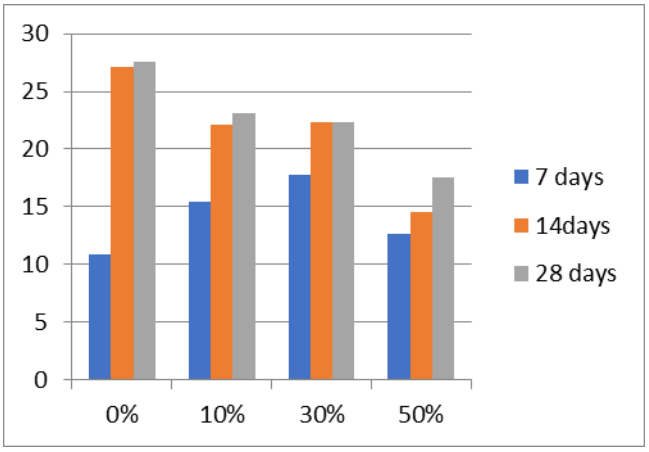

Chart -1: Comparison of Compressive Strength

3.2 Split tensile strength

The split tensile strength of the cylinder was tested after 7, 14 and 28 days of curing in CTM machine.

Table-4: Split tensile strength of XPS and standard concrete.

% XPS	At 7 days (N/mm2)	At 14 days (N/mm2)	At 28 days (N/mm2)
0%	2.21	2.5	1.5
10%	1.89	2.03	1.21
30%	0.86	0.9	0.5
50%	1.08	1.11	0.65

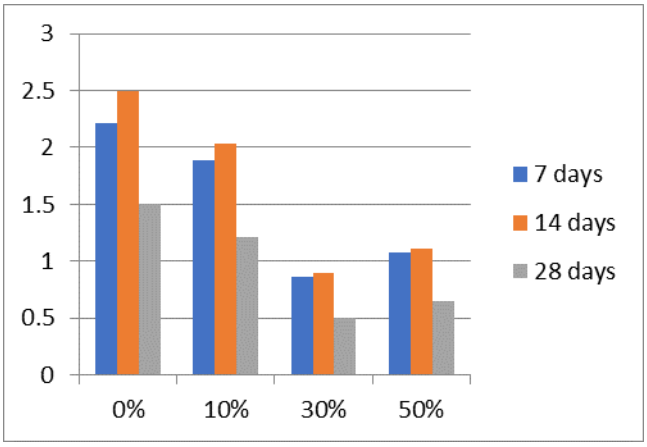

Chart -1: Comparison of Split Tensile Strength

CONCLUSIONS:

1. At 10% replacement of XPS, the compressive strength obtained was 23.1 N/mm^2, which is 16.19% lower than that of conventional concrete.
2. At 30% replacement, the compressive strength obtained was 22.2 N/mm^2, which is 19.45% lower than that of conventional concrete.
3. At 10% replacement, the split tensile strength obtained was 1.21 N/mm^2, which is 19.34% lower than that of conventional concrete.
4. At 30% replacement, the split tensile strength obtained was 0.5 N/mm^2, which is 19.45 %lower than that of conventional concrete.

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