

MANUFACTURING OF COST-EFFECTIVE LEGO BLOCKS USING WASTE PLASTIC, M SAND & QUARRY DUST

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Abstract –

The current work is performed for the assembling of blocks or building block from M-Sand & Quarry Dust and waste plastic. The blocks or building blocks are produced by blending M-sand and Quarry Dust, squander plastic by warming at 200°C. It is a development strategy in assembling the block. In this review, squander plastic has been utilized for the readiness of plastic blocks. The compressive strength ought to be find out by utilizing Compressive Testing Machine. The water retention of plastic blocks diminished with expansion in the rate substitution of sand and M-Sand of the plastic blocks. These Bricks are light weight and financially low. Also, plastic blocks are having more strength when contrasted with regular blocks.

Key Words: Manufacturing, Plastic Bricks, Using Waste Plastics, M-Sand, Quarry Dust.

1. INTRODUCTION

Plastic is one of the everyday expanding helpful as well as a perilous material. At the period of scarcity, plastic is viewed as extremely helpful yet after its utilization, it is basically discarded, making a wide range of risks. Plastic is non-biodegradable that remaining parts as a risky material for more than hundreds of years. Plastics overall are among the materials utilized in the cutting edge designing items in the worldwide market today. Plastic comprises of many engineered and semi-manufactured natural mixtures which could be formed into various strong shapes as a result of its flexibility property. The amount of plastic waste in Municipal Solid Waste (MSW) is growing quickly. It is assessed that the pace of extension is twofold for like clockwork.

Today, it is beyond the realm of possibilities for any essential area to work effectively without use of plastic beginning from farming to ventures. In this way, we can't boycott the utilization of plastic yet the reuse of plastic waste in building developments ventures are viewed as the most practicable applications. Plastic soil block has more benefits which incorporates cost productivity, asset proficiency, decrease in outflow of ozone depleting substances, and so on, Plastic sand block is otherwise called "Eco-Bricks" made of plastic waste which is generally hurtful to all living organic entities can be utilized for development purposes. The harms from

the aggregated plastic squanders to our current circumstance are indispensable as a result of the unsafe impacts to both plant and human existence. It builds the compressive strength when contrasted with fly debris blocks. By utilization of plastic sand blocks, the water assimilation presence of antacids was profoundly decreased. Inferable from various benefits further exploration would work on quality and strength of plastic sand blocks. Plastics are secret weapons in round economy and reusing after the finish of helpful life.

1.1 Interlocking Blocks or Lego Blocks

Interlocking blocks are the enhanced form of conventional bricks. Each block is constructively designed to lock itself to other block around without the use of mortar. The self-locking is achieved using lock mechanism. Based on the design, shape of the mechanism changes and the complimentary lock is provided on the opposite side of the bricks. Load transfer is achieved by gravity.

LEGO blocks are like 2 adjoining pieces of a jigsaw puzzle. Each block has a projection at one end and a depression at the other. The projection of the block fits in to the depression of the next so that they always align perfectly.

1.2 Benefits of Using Lego Blocks

- Earthquake resistance
- Does not require plaster work
- Provides cooler interior
- Unskilled / Few labor are required
- Minimizes cost
- Time efficient
- Fast construction
- Customized design
- Durable
- Low maintenance

1.3 Advantages of Plastic Sand Bricks

Plastic sand bricks are effective and proven as earthquake resistant construction material.

- A plastic sand brick provides a much cooler interior.
- It is the most time efficient way of construction.

- It is more durable as compared to other types of bricks.
- Bricks are economic.
- It is high resistance to water.

1.4 Objectives

Following are the objective of the project study.

- To develop an efficient way and to utilize the waste plastics.
- To reduce the dumping area of waste plastics.
- To minimize and reuse of plastic waste on land and water to avoid pollution.
- To produce cost effective materials which a common person can afford easily.

2. MATERIALS AND METHODOLOGY

2.1 Materials Used

2.1.1 Plastic

Plastic is the material which melts when being heated, it changes from solid state to liquid state. The liquid nature gives a smooth surface and helps in binding with the sand when they are being mixed together. The plastics such as polypropylene (PP), Low density polyethylene (LDPE), and High- density polyethylene (HDPE) are being used. The waste plastics are collected from landfills, from the beaches, from houses etc.

2.1.2 M-Sand

The M-Sand is produced from crushing of grain stone. The M-Sand is used as a substitute of river sand for constructions. Manufacture sand is produced from hard granite stone by crushing. The size of M-sand is less than 4.75mm.

2.1.3 Quarry Dust

Quarry dust can be defined as residue, tailing or other non-volatile waste material after the extraction and processing of rocks to form fine particles less than 4.75mm. This quarry dust can be effectively used in the construction industry as a partial replacement of sand in concrete.

2.2 Design of Lego Blocks

By studying the properties of conventional bricks and the properties of the interconnecting structures (interlocking blocks) we designed a model of the LEGO block as shown.

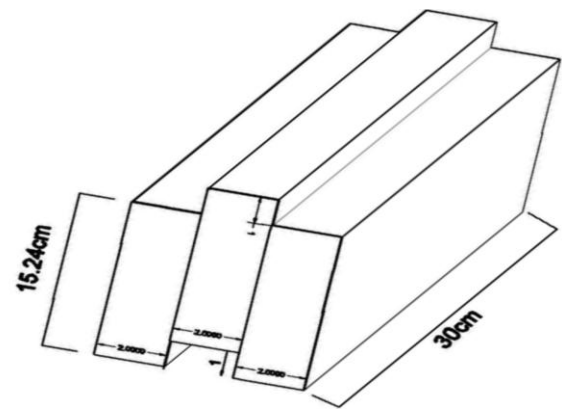


Fig -2.1: 3d Picture of Lego Block

2.3 Cross-Section of Lego Block

The dimension of the block (excluding studs) – 300mm x 153mm x 60mm.

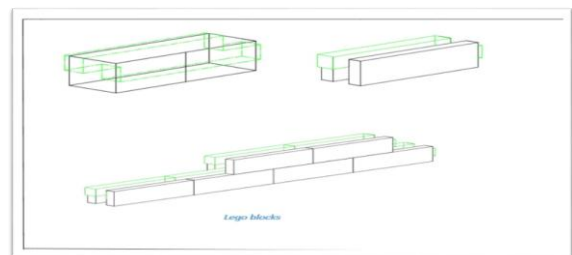


Fig -2.2: Arrangement of Lego blocks to form a wall



Fig-2.3: Lego Block Mold

2.4 Procedure

- The grading of the M-Sand is done by passing the M-Sand in the series of sieve of decreasing sizes.
- The waste plastic collected is first cleaned to get rid of the debris.
- The plastic has to be shredded into small pieces for rapid melting.
- The plastic and M-Sand are batched as per the required ratios. Ex: Plastic: M-Sand (1:1.5) and (1:2).

- e) An iron vat is used for melting procedure.
- f) Add the shredded plastic to the iron vat which is being heated by firing the wood pieces.
- g) When the plastic starts melting at a temperature of 150°C to 250°C add the M-Sand & Quarry dust into it and mix it thoroughly.
- h) Keep the mould ready by applying oil to the inner faces of the mould.
- i) Transfer the Plastic and M-Sand mixture from the vat to the mould with proper vibration for minimizing the formation of air pockets.
- j) Keep the mould aside for cooling and hardening of the mixture.
- k) After 45 to 50 min demold and remove the block from the mold.
- l) The ready brick then has to undergo different tests to compare the properties with conventional bricks.



Fig-2.4: Prepared Lego Block

4. RESULTS AND DISCUSIONS

The compressive strength test is conducted on different ratios of M-sand & Quarry dust bricks and tests results have been given below in the form of table and graph.

Table 4.1: Calculation of compression test of Plastic and M-Sand & Quarry dust bricks

Sl. No	Ratio of Plastic & M-Sand (P:S)	Area of the Brick in mm ²	Load at Failure (T)	Compressive Strength in N/mm ²	Average Compressive Strength in N/mm ²
1	1:1	22700	21	7.99	8.31
2		22700	22	8.64	
3		22700	24	8.32	
4	1:1.5	22700	29.5	12.75	12.64
5		22700	29	12.53	
6		22700	29.25	12.64	
7	1:2	22700	25	10.80	12.46
8		22700	33	14.06	
9		22700	29	12.53	
10	1:2.5	22700	28.5	12.32	11.13
11		22700	23	9.94	
12		22700	25.75	11.13	

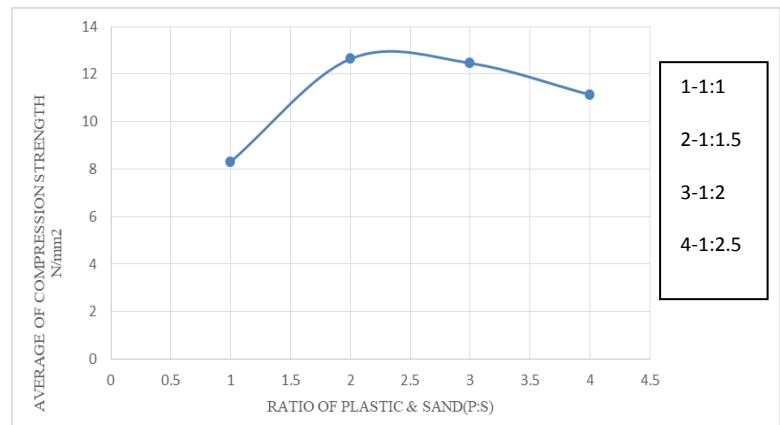


Fig -2.5: Graph on Average Compression Strength on M-Sand + Q Dust

5. CONCLUSIONS

- The waste plastics are utilized for manufacturing of plastic bricks so the pollution is reduced and environmental pollution can be minimized.
- The compressive strength test result shows an increment of 40.6% compared to conventional brick sample for an optimum proportion of 1:1.5. i.e., Plastic: M-sand + Quarry dust brick sample.

- From the above all results it can be concluded that optimum proportion of replacement is 1:1.5 of plastic with M-sand and Quarry dust.
- Lego-block is 32.5% bigger as compare to conventional brick and the cost of 1 Lego-block is 15.6 Rs.

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