# INCORPORATION OF WASTES IN BRICK MAKING

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***Abstract: The disposal of sewage wastes forms one of the major environmental problems world-wide as these wastes makes the environment unfriendly. The growing demand for utilization of wastes has made solid wastes like sludge and demolition waste an essential composition of this study. The possibility of reduction of the production costs provides a strong base for use of this waste in the manufacturing of the bricks.***

***Generally sludge, bio-degradable materials are dumped in the land, and they decompose over the period of time. This study involves the usage of sludge, construction and demolition waste as an essential ingredient in the manufacturing of the bricks. The sludge was checked for its physical characterization such as bulk density, compressive strength and chemical properties including the water absorption percentage. The estimated cost of resultant bricks was also obtained and compared. The study was performed by making mixes using different ratios of fly ash, clay, cement, and sludge and demolition waste for making brick samples and the corresponding results were obtained.***

***Keywords: Construction and demolition waste, environment, sludge, water absorption, compressive strength.***

## I. INTRODUCTION

Sludge as we know are the waste materials from any source, be it Industrial Waste or Municipal Waste. For waste water sludge or any other kind of sludge, there have been many attempts made to incorporate these wastes with other materials into the production of bricks, for examples, rubber, limestone dust, wood sawdust, processed waste tea, fly ash and polystyrene.

Utilization of sludge in making of light weight bricks, artificial aggregates and its cement-like properties is a win strategy as it not only recycles the waste product, but also mitigates the problem of waste disposal. Recycling of such wastes by incorporating them into building materials is a practical solution for pollution problem.

Construction and demolition waste are usually found whenever any construction or demolition activity takes place such as construction of buildings, bridges, flyovers, roads etc. It comprises mostly of inert and non- biodegradable material such as sand, gravel, concrete, metal, plastic, glass, etc. Demolition wastes are heavy, bulky and have high density and take up loads of land and space. So recycling of these wastes may prove to be beneficial.

These wastes can be used as landfill, base or sub base in road construction, embankment fill, and railway ballast and most importantly in aggregate replacement method for the formation of recycled concrete.

### *1.1 Need for study*

- To check the feasibility of sewage sludge as ingredient in brick making.
- Conservation of natural resources like clay.
- To solve the problem of disposal of sewage sludge in urban region.
- To make eco-friendly low cost and durable construction material.

### *1.2 Objectives of study*

- Conservation of natural resources.
- To give better environment to the town.
- Economical design and light weight product.
- Reduction in construction cost.
- To examine the effect of dry sludge in brick properties.
- Reduce environmental pollution.

## II. EXPERIMENTAL MATERIALS

The properties and the detail of the all kind of material to be used in the mix design are as given below:

- Dry Sludge
- Demolition Waste
- Fly Ash

### *2.1 Dry Sludge*

Now a day, disposal of sewage has become a necessity for societies. The construction of treatment plants has caused problems with huge content of dry sludge. It has been found that each person produce 35 to 85 grams of solid sludge per day. In recent years, waste production has increased dramatically in developing nations such as India. There are two methods to solve the problem such as disposal of solid waste (dry sludge) including land filling and using dry sludge as fertilizers. But these methods result in some harmful material remains in sludge which causes harm to environment including land, air and water as a whole.

### *2.2 Fly Ash*

Fly ash, also known as "pulverised fuel ash" is one of the coal combustion products, composed of the fine particles that are driven out of the boiler with the flue gases. Ash that falls in the bottom of the boiler is called bottom ash. In modern coal-fired power plants, fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys. Together with bottom ash removed from the bottom of the boiler, it is known as coal ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO2) (both amorphous and

crystalline), aluminium oxide (Al2O3) and calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata. Constituents depend upon the specific coal bed makeup but may include one or more of the following elements or substances found in trace concentrations (up to hundreds ppm): arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium, along with very small concentrations of dioxins and PAH compounds.

## III. EXPERIMENTAL DESIGN ANALYSIS

### *3.1 Sample Collection*

Sludge was collected from UEEDSewage Treatment Plant Srinagar, fly ash was collected from JK Cements Company Pampore, and demolition waste was collected from IUST construction sites.

### *3.2 Sample Preparation*

The sludge is first dried at atmospheric temperature for 2 days & then sieved through 1.75 mm. Now the demolition waste is crushed using hammer and then sieved through a sieve size of 1.75 mm.

### *3.3 Mix Design*

#### *3.3.1 Mix Design 1*

Table 4. 1: Mix Design 1

| Sample | Sludge % | Clay % | Demolition Waste % | Fly ash % |
|---|---|---|---|---|
| **A** | 10 | 50 | 30 | 10 |
| **F** | 20 | 45 | 25 | 10 |
| **H** | 30 | 40 | 20 | 10 |
| **N** | 40 | 35 | 15 | 10 |
| **X** | 50 | 30 | 10 | 10 |

#### 3.3.2 Mix Design 2

Table 4. 2: Mix Design 2

| Sample | Sludge % | Cement % | Demolition Waste % | Fly ash % |
|---|---|---|---|---|
| **M** | 30 | 20 | 20 | 30 |
| **Z** | 30 | 20 | 30 | 20 |
| **T** | 30 | 15 | 30 | 25 |
| **P** | 40 | 20 | 20 | 20 |
| **S** | 40 | 10 | 20 | 30 |
| **L** | 40 | 15 | 20 | 25 |
| **C** | 50 | 10 | 20 | 20 |
| **D** | 50 | 20 | 10 | 20 |
| **E** | 50 | 15 | 20 | 10 |

## IV. RESULTS

Chart 4. 1: Compressive Strength of Mix 1

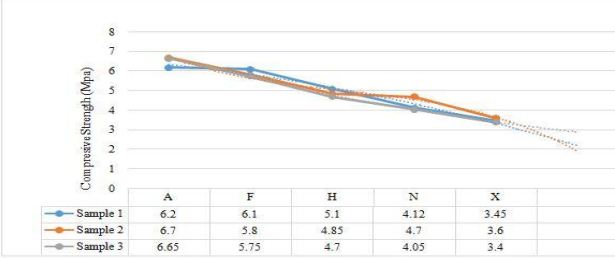
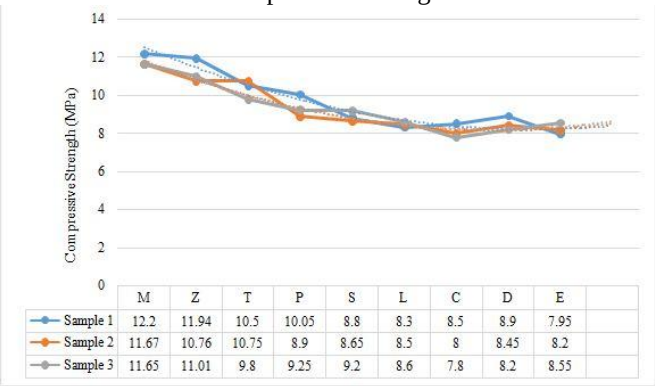



Chart 4. 2: Compressive Strength of Mix 2




### *4.2 Water Absorption*

Chart 4. 3: Water Absorption in Mix 1

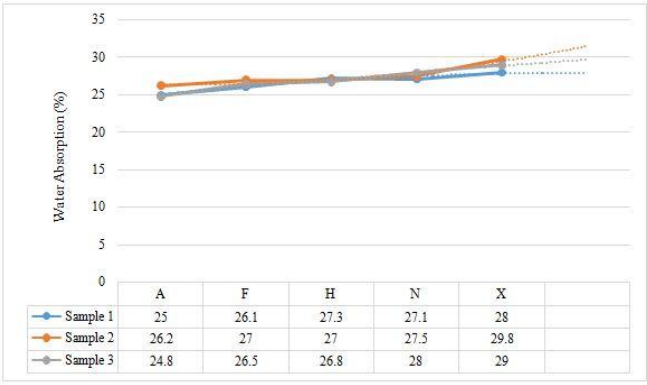
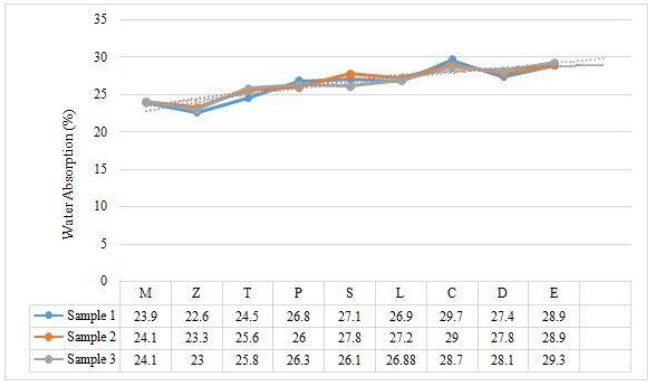



Chart 4. 4: Water Absorption in Mix 2




### *4.4 Comparison of Designed Brick with Traditional Clay Brick*

Table 4. 3: Comparison of Normal and Designed Brick

| Normal Brick | Designed Brick |
|---|---|
| The compressive strength of a normal brick is around 3.5-10 MPa. | The compressive strength of designed brick is in the range from 3-12 MPa. |
| Weight of bricks varies from 2.2-2.5 Kg | Weight of bricks in Mix 1 varied from 1.9-2.25 Kg<br>Weight of bricks in Mix 2 varied from 2.1-2.6 Kg |
| Water absorption of normal brick varies from 20-25 % of weight of dry brick | Water absorption of designed brick varied from 23-29 % of weight of dry brick |
| Cost of normal brick | Cost of designed brick varied |

| | |
|---|---|
| varies from 6-8 Rupees per brick | from 3.5-5 Rupees per brick |

## V. CONCLUSIONS

- Dry sludge is available free of cost so, we will reduce cost of brick.
- The strength of the designed brick in some mixes exceeds that of traditional bricks, so these mixes can be employed for large scale production.
- Bricks of mix 1 are lighter in weight than traditional bricks hence will reduce dead load of structures.
- Use of Dry Sludge in brick can save the ferrous and non-ferrous metal industries disposal, land pollution, cost and produce a "greener" brick for construction.
- Environmental effects from wastes and disposal problems of waste can be reduced or controlled through this research.
- The cost of the designed bricks is 1.5-3.5 lesser than traditional bricks so it is economical.
- An innovative Construction Material is formed through this project.

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