Utilization of plastic waste as construction material

Abstract
This Project gives the information about the uses and ideas for Plastic waste in civil construction as a Construction material. This concept is revolutionary in SWM techniques and also increases in efficiency of civil construction or structure in economy as using plastic waste as modifier; we can reduce the quantity of cement and sand by their weight, hence decreasing the overall cost of construction.

Keywords: Plastic waste management, plastic as construction material, recycle, construction, technology, reuse

Introduction
Environmentally plastic is a growing disaster. Plastic packaging especially the plastic bag is a significant source of landfill waste. Synthetic plastic does not biodegrade. The waste produced will go on deposited on landfills and take at least 450 years to biodegrade or more. It just sits and accumulates in landfills or pollutes the environment. Plastics have become a municipal waste nightmare, prompting local governments all over the world to implement plastic bag bans.

Because of bans implemented by government the production or use at commercial or domestic use of plastic will be minimized. But still the landfill previously filled up with plastic waste keeps disturbing balance of environment. This waste should be neutralized or recycled effectively. Government is also trying to produce awareness about recycling and reusing the plastic waste materials. But according to CPCB only 25% of plastic waste is being recycled or properly disposed. The remaining plastic waste catches landfills or sea bed dumped or can be found on streets or beaches inviting numerous problems and hazards.

Let’s take a look on the statistics
According to this graph as per readings of CPCB the total known plastic waste produced is 0.28 billion tonnes (28 crore tonnes) and from them only 0.7 billion tonne (7 crore tonnes) of waste is recycled. The remaining 0.21 billion tonnes of waste is present in environment which hamper the nature and cause environmental problems. To cope with this problems maximum plastic waste produced before and to be produced should be properly recycled or reused or to be disposed off correctly. But Unfortunately only 25% waste is reused or recycled (As per review of CPCB) and Remaining waste which is not reused or treated for neutralization by SWM bodies is:

i. Dumped in Ground (Dumping Yard)
ii. Dumped in Sea (Water)
iii. Burned
iv. Litter on Road Sides, Beaches

This produces some problematic effects
There is the way to remove plastic waste on big scale from dumping yards, sea beds, beaches, street side and litter in cities. The best and efficient way of plastic waste management is to use this waste in civil constructions. We know that the maximum material consumption is only caused in civil construction works. According to this if the Waste plastic is used in civil construction the maximum quantity is engaged in structures and will not cause any type of natural imbalance.
The types of plastic are illustrated in Table 2(A). From The Identification code of plastic HDPE, LDPE, PP, PETE plastic groups (refer Table 1(A)) can be used for recycling or reusing.

### Properties of plastic waste as construction material

After all we termed Plastic Waste as a refuse but after all it is Plastic, it possess same characteristics and properties like ordinary plastic. This Will Be as Follow:

#### Light in weight

The Plastic is the material which has low specific weight and specific gravity which makes it Light in weight.

This property give ease of transport and workability.

<table>
<thead>
<tr>
<th>Group</th>
<th>Typical application</th>
<th>Symbol</th>
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</thead>
<tbody>
<tr>
<td>PET (polyethylene terephthalate)</td>
<td>Plastic soft drink, sports drink and water bottles. Also used in food containers because it is transparent (so the contents can be seen) and resists breakage</td>
<td><img src="PETE.png" alt="PETE" /></td>
</tr>
<tr>
<td>HDPE (high density polyethylene)</td>
<td>Milk, water and juice containers, liquid detergent bottles, laundry soap containers and ice cream containers, bottle caps</td>
<td><img src="HDPE.png" alt="HDPE" /></td>
</tr>
<tr>
<td>PVC (polyvinyl chloride)</td>
<td>Bottles with handles</td>
<td><img src="V.png" alt="V" /></td>
</tr>
<tr>
<td>LDPE (low density polyethylene)</td>
<td>Shopping bags, bread bags, frozen food bags, and dry-cleaning bags. Plastic sheeting, packaging film and sheeting</td>
<td><img src="LDPE.png" alt="LDPE" /></td>
</tr>
<tr>
<td>PP (polypropylene)</td>
<td>Food containers</td>
<td><img src="PP.png" alt="PP" /></td>
</tr>
<tr>
<td>PS (polystyrene)</td>
<td>Food-service applications, grocery-store meat trays, egg cartons, cups, plates. Fresh produce containers. Large packaging</td>
<td><img src="PS.png" alt="PS" /></td>
</tr>
<tr>
<td>Other (multi product/layer)</td>
<td>Specialised packaging products</td>
<td><img src="OTHER.png" alt="OTHER" /></td>
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</table>
Durable, non-biodegradable

This is the basic property of plastic because of which Plastic Became a Headache to SWM Branches. But if the Plastic waste is used as a construction material then it will ensure more life span than any other material.

Easily moulded

This property allows us to use the Plastic waste material in civil engineering as construction material and also possess the efficiency to be recycled.

Shatterproof

This means it will not break or damage because of falling from certain height as it is not brittle material.

Water tight

Naturally plastic is Water Tight material which means the water will not seep through or leak through plastic. And also plastic will not react or been damaged because of water or moisture.

Nominal applications of plastic waste

After studying the properties of Plastic We can imagine the quality of work and also decrease in Plastic waste from nature with some economic benefits. Here are some general applications which are multi beneficial.

Plastic brick

The most required & Basic item in civil construction is a Brick. If we use the plastic waste in manufacturing of Bricks the large amount of plastic waste is engaged in that item. And it will also be economic than traditional Bricks as it is made up of waste material.

There are many methods we can use to manufacture plastic bricks:

HDPE plastic bricks

This brick is the brick made of only HDPE plastic by compressing it at high pressure and moderate heat which will not burn plastic only take it to the plastic state and to be moulded with pressurised mould. This brick has very good strength but it has low binding capacity with cement if applied in wall construction. This brick manufacturing need machineries and has large initial investments.

LDPE & PP Plastic brick

In this method LDPE and PP plastic grouped material is just subjected to compaction after shredding. This brick has low strength than any brick. This brick can be used for garden tree compounds for better appearance.

LDPE & PP Plastic brick (hot moulding)

This method is as similar as normal LDPE & PP bricks, but in this method the collected material is heated till it becomes semi-solid and then it is moulded under pressure. This brick has enough strength to be used in wall masonry work.

Plastic sand bricks

In this type of Brick the plastic particularly HDPE, LDPE, PP Type of plastic is melted in hot utensil on fire and after making it sufficiently mixed the calculated proportionate amount of sand is mixed with it and then the hot mixture is poured in mould and after cooling time it is removed. And our Plastic sand brick ready. This brick has maximum strength than any brick. And also this is the most economic method of plastic brick manufacturing.

Plastic pavement block

The plastic pavement block is manufactured by hot mixing of plastic specifically HDPE, LDPE, PP with sand of proportionate quantity. This multi beneficial project is very firstly started in Cameroon, Central Africa to cope with plastic crisis. This type of plastic pavement block gives the enough strength and durability with good economy.

Road construction
If the plastic waste is used in road construction the maximum waste is gets used here and maximum material cost can be saved with this plastic. Generally in two ways plastic waste is implemented in road construction.

As bituminous material

The plastic waste if used as bituminous material itself after some treatments or can be used to increase the melting point of bitumen which helps to increase the speed of construction of road. Much government started to use these methods of SWM to reduce Plastic crisis in their countries. Which will being effective at a different level. Plastic Waste Road (In Bangalore Project by Their Government & Firms). Plastic Waste Road (By JUSCO (Jamshedpur Utilities and Services Company of TATA Group))

Plastic road concept

The concept of Plastic Road by KWS, WAVIN, TOTAL is raised with press meet at 20 OCT 2016. This concept represents A REVOLUTION IN ROAD CONSTRUCTION. By implementing direct modular road pieces and only placing it on its place which will also be easy to repair and maintenance. They had shortly in 2017 Constructed test road for cycles and Pedestrians.

Acknowledgment

None.

Conflict of interest

None.

References

4. https://www.google.co.in/
6. Plastic roads help solve Bangalore rubbish crisis. Published. Climate change-news.
8. Plastic waste to be used in roads construction. TOI-Journal