

INVESTIGATING THE SUBSTITUTION OF FINE AGGREGATE WITH PLASTIC WASTE IN CONCRETE ALONGSIDE AN EXAMINATION OF SOLID WASTE MANAGEMENT IN DHULE CITY

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ABSTRACT

This study provides an overview about the existing situation of solid waste management in Dhule city along with the possible solutions for the problems identified for the city with the preparation of integrated solid waste management plan for the city. Given the escalating environmental concerns surrounding plastic pollution, there's a pressing need for innovative approaches to address this issue. This research examines the mechanical, structural, and environmental ramifications of integrating plastic waste either partially or entirely in lieu of traditional fine aggregates in concrete. Comparative analysis of different cities in India has been done for better understating. The outcomes of this investigation aim to prepare Integrated solid waste Management Plan for Dhule city. Through a series of laboratory experiments, the paper evaluates the performance, durability, and environmental footprint of these composite materials. The findings aim to provide valuable insights into the potential of utilizing plastic waste in construction, offering a promising avenue towards sustainable and eco-friendly practices in the built environment

Keywords: Solid Waste, Plastic Waste, Recycle, Recover, Concrete

1. INTRODUCTION

In Dhule City, plastic waste has become a major environmental concern, piling up in landfills and causing significant harm to our planet. Our project tackles this issue head-on by introducing an innovative idea: using plastic instead of the usual fine aggregate in concrete blocks.

Think about it every time we throw away plastic; it remains in the environment for years without breaking down. This project aims to not only reduce the impact of plastic waste but also make a positive change in the construction industry. Imagine a future where the plastic we discard is transformed into a valuable resource for building materials. Our project involves exploring whether plastic can be a viable alternative to traditional fine aggregate in concrete blocks. This isn't just about finding a quick fix; it's about reshaping the way we build, making it more environmentally friendly. This research aims to explore the characteristics of concrete incorporating recycled plastic materials and investigate relevant physical properties. In this study we also focused proposed plan for Dhule city. The integration of plastic waste as a substitute for traditional fine aggregate in concrete blocks is gaining momentum as an innovative and sustainable solution. This approach not only addresses environmental concerns related to plastic disposal but also explores the potential benefits in terms of improved material properties and reduced ecological impact.

Significance of Solid Waste Management:

Solid Waste Management (SWM) is an age old service provided by the urban local bodies (ULBs), efficient municipal solid waste management benefits in maintaining hygienic conditions leading to lesser health issues, better living environment, improved economic prosperity in the area, aesthetically cleaner surroundings with cleaner drains for storm water flow, cleaner water sources and safer neighborhoods.

SWM SYSTEM:

A SWM system refers to a combination of various functional elements associated with the management of solid wastes. The system, when put in place, facilitates the collection and disposal of solid wastes in the community at minimal costs while preserving public health and ensuring little or minimal adverse impact on the environment. The functional elements that constitute the system are:

(i) Waste Generation: Wastes are generated at the start of any process, and thereafter, at every stage as raw materials are converted into goods for consumption. For example, wastes are generated from households, commercial areas, industries, institutions, street cleaning and other municipal services. The most important aspect of this part of the SWM system is the identification of waste.

(ii) Waste Storage: Storage is a key functional element because collection of wastes never takes place at the source or at the time of their generation. The heterogeneous wastes generated in residential areas must be removed within 8 days due to shortage of storage space and presence of biodegradable material. Onsite storage is of primary importance due to aesthetic consideration, public health and economics involved. Some of the options for storage are plastic containers, conventional dustbins (of households), used oil drums, large storage bins (for institutions and commercial areas or servicing depots), etc. Obviously, these vary greatly in size, form and material.

(iii) Waste Collection: This includes gathering of wastes and hauling them to the location, where the collection vehicle is emptied, which may be a transfer station (i.e., intermediate station where wastes from smaller vehicles are transferred to larger ones and also segregated), a processing plant or a disposal site. Collection depends on the number of containers, frequency of collection, types of collection services and routes.

(iv) Transfer And Transport: This functional element involves: the transfer of wastes from smaller collection vehicles, where necessary to overcome the problem of narrow access lanes, to larger ones at transfer stations; the subsequent transport of the wastes, usually over long distances, to disposal sites. The factors that contribute to the designing of a transfer station include the type of transfer operation, capacity, equipment, accessories and environmental requirements.

(v) Processing: Processing is required to alter the physical and chemical characteristics of wastes for energy and resource recovery and recycling. The important processing techniques include compaction, thermal volume reduction, manual separation of waste components, incineration and composting.

(vi) Recover and Recycling: This includes various techniques, equipment and facilities used to improve both the efficiency of disposal system and recovery of usable material and energy. Recovery involves the separation of valuable resources from the mixed solid wastes, delivered at transfer stations or processing plants. It also involves size reduction and density separation by air classifier, magnetic device for iron and screens for glass. The selection of any recovery process is a function of economics, i.e., costs of separation versus the recovered-material products. Certain recovered materials like glass, plastics, paper, etc., can be recycled as they have economic value.

(vii) Waste Disposal: Disposal is the ultimate fate of all solid wastes, be they residential wastes, semi-solid wastes from municipal and industrial treatment plants, incinerator residues, composts or other substances that have no further use to the society. Thus, land use planning becomes a primary determinant in the selection, design and operation of landfill operations. A modern sanitary landfill is a method of disposing solid waste without creating a nuisance and hazard to public health. Generally, engineering principles are followed to confine the wastes to the smallest possible area, reduce them to the lowest particle volume by compaction at the site and cover them after each day's operation to reduce exposure to vermin. One of the most important functional elements of SWM, therefore, relates to the final use of the reclaimed land.

2. LITRTURE REVIEW

M.D. Meena, M.L. Dotaniya, B.L. Meena, P.K. Rai (2023) Sustainable management of municipal solid waste (MSW) is the utmost importance not only because of the health and environmental concerns but also due to its disposal issues of large quantities of waste generated and to achieve the Sustainable Development Goals (SDGs). Improper management of MSW causes hazards to inhabitants. Environmental and economic implications linked with the proper eco-friendly disposal of modern-day waste, has made it essential to come up with alternative waste management practices. Several studies revealed that approximately 90% of MSW disposed of unscientific manner as open dumps and landfilling, and created severe enigma to human health and the environment as well as contaminating the food chain cycle. Norah Muisa, Zikali, Munyaradzi Chingoto, Beaven Utete, Francisca Kunedziwe (2022) Municipalities in developing countries are failing to cope with large volumes of solid wastes generated by rapidly increasing urban populations resulting in environmental and public health risks. Municipal authorities must collect recyclables from a whole suburb rather than individual households as a viable waste management and poverty alleviation strategy to sustain livelihoods and minimize health hazards in developing countries such as Zimbabwe. The clear discrepancy of generated solid waste quantities obtained from interview responses and validated weight data indicated a need to substantiate data from questionnaires with actual waste measurements. Deval Singh, Yash Aryan, Digamber Chavan, Mamta Tembhare, Anil Kumar Dikshit (2022) The rapid generation of biomedical waste (BMW) due to covid-19 pandemic has created burden on the existing municipal solid waste management (MSWM) system in both developed and developing countries. The substantial influx of covid patients in Maharashtra, India has influenced the pattern of BMW generation, especially for the yellow category of BMW and incineration facilities. The objective of the study was to estimate the daily face mask consumption (DFM) and BMW generation from May 2020 to August 2021 in

Maharashtra, India. The study was carried out based on the confirmed covid 19 cases, population forecast, urban population (%), BMW generation rate (kg/bed/day), and so on. The data set for each parameter were collected from web-portals, published reports based on previous studies.

Ram Kumar Ganguly, Susanta Kumar Chakraborty (2021) The COVID-19 pandemic has created a global emergency crisis in terms of socio-economic-environmental challenges. Such crisis has altered generation and disposal of wastes both in terms of qualitative as well as quantitative aspects and poses real challenges to the policy makers to arrive at decision to ensure sustainable management of environment. The present study tries to reflect the challenges faced by the existing waste management framework to combat huge waste generation.

Developing country like India, ranks second among the COVID 7 positive cases across world which results into an enormous hike in biomedical waste generation. Therefore, the present study has attempted to highlight and discuss all those newly generated problems in view of ongoing global pandemic with the necessity of chalking out strategies integrating different traditional, modern and newly proposed waste management strategies to tackle the deteriorating environmental problems especially in respect of generation, collection, disposition and recycling of huge amount of municipal solid wastes alongside assessing different guidelines as imposed by different Government agencies for handling of municipal solid wastes under this global crisis.

Khan Raheel Anjum, Syed Turab Raza Nazir Ahmed Bazai (2021) Municipal solid waste (MSW) is a reflection of the culture that generates it and has a negative impact on the health of the humans and the environment. In the global context, people are abandoning increasing volumes of garbage, and the content of that waste is becoming more complicated than it has ever been, as plastic and electronic consumer goods spread. At the same time, the world is rapidly urbanizing. These changes place a burden on cities to manage garbage appropriately on both a social and environmental level. Globally, extensive research has been conducted to develop a comprehensive MSW management system that includes treatment.

Suman Mor, Khaiwal Ravindra (2023) Municipal Solid Waste (MSW) is collected, transported, and disposed of in an unorganized and disordered manner in lower- and middle-income countries. Improper waste disposal in landfills can have severe environmental consequences in terms of groundwater, soil and air contamination, resulting in numerous health hazards. In India, Landfills require 1240 ha of land per year and only 21% of MSW is adequately managed. The remaining MSW is not reprocessed or recovered through treatment technologies and is generally disposed of in an unhygienic landfill. Urban or rural solid waste is usually dumped in low-lying areas, which adds to the greenhouse gas emissions, obnoxious odor production and causes fire hazards that adversely affect the local ecosystem.

Rasmeet Singh (2021) Due to the rapid increase in population, Municipal solid waste management has become an important activity in urban localities. It is one of the obligatory responsibility of Municipal Corporation and urban local bodies to minimize solid waste and process it efficiently. The high generation rate of municipal solid waste and the complexity of waste generation are major challenges of Municipal Corporation Indore is considered as the business capital of Madhya Pradesh state. The present population in Indore is more than 19 lacks. Apart from infrastructural development, equal importance should be given to Municipal solid waste. A well-planned system needs to be followed to maintain municipal solid waste.

M. Prakash, Dr. B. Hemalatha (2019) Vol 8 Disposal of waste plastic has become a major environmental issue in all parts of the world. Every year millions plastic are discarded, thrown away or buried all over the world, representing a very serious threat to the ecology. It is estimated that every month almost 100000 million plastic waste end their service life and more than 50% are discarded without any treatment. This experimental study was based on the utilization of waste plastic as a partial substitute for natural fine aggregates in cement concrete. The properties of concrete like compressive strength, flexural tensile strength, abrasion resistance, pull-off strength, water permeability, water absorption, resistance to acid attack and sulphate attack, carbonation, depth of chloride penetration, corrosion of steel reinforcements were tested and SEM test was performed to study the micro structure. And modeling done using abbaqus.

Shirsale Rajeshri Vijay, 2Prof H.A. Kuwar (2021) Vol 9 Solid waste is the useless & discarded material resulting from day to day activities in the community. Solid waste management could also be defined because the discipline related to the control of generation ,storage ,collection ,transfer ,processing and disposal of solid waste. According to this project carried out on solid waste management practice by Dhule municipal corporation. The solid waste generation and population and land use of the city and design the undeveloped area as MSW management. This study was also designed to study the composition of solid waste in Dhule city. The objectives of this research were to calculate solid waste generation and composition in Dhule and design the undeveloped area as MSW treatment plant.. The design of MSW treatment plant supported technical guidance of TPS 3R 2017. Based on waste generation and composition data,

required area for MSW treatment plant is 2080m² of available area 3 Ha. This plant consist of waste treatment area 1504 m² and supporting facility area 576 m². Composting utilized in MSW treatment plant is hollow brick box technology. Keywords – Municipal Solid Waste, Population, Municipality.

Aquib Shaikh Tanzeem Shaikh (2018) Vol 4 Recycled plastic aggregate used in a various proportion in the concrete mix and check their suitability. This study investigates the effects of using plastic waste as an alternative of Fine Aggregate. Disposal of plastic waste in the environment is considered to be a big problem due to the rapid growth of population in countries like India the disposing of solid waste is a major problem in our daily life. Solid waste management is one of the major environmental concerns. Among the waste material, plastic is the material that is the major concern to most of the environmental effects. There are different types of plastic which are classified on the basis of the physical property. As the plastic waste is nondegradable, it must be recycled or reused. The objective of the study is to study the behavior of the concrete which is made of the recycled plastic materials along with the study of the some of the physical properties that are related. In this study, M40 cement concrete is considered in which the recycled plastic waste is used as the replacement of fine aggregate in the concrete. Concrete cubes were cast taking 10%, 20%, 30 %, 40% & 50% of plastic as partial replacement of fine aggregate and tested for 7 & 28 days of compressive strength of concrete.

Raju Suram, T. Srinivas (2021) The Plastic is a part of our lives due to its daily usage. So, the consumption of plastic is increasing every year. The decomposition of plastic takes more than thousand years because of its non-biodegradable nature. The plastic harms the society and surrounding environment in all aspects So, the best way to control the pollution posed by the plastic is recycling. The exponential growth in construction industry, the demand for natural aggregates increases but leads to depletion of natural resources. To overcome this issue plastic used as a fine aggregate replacement in concrete. The majority of the waste coming from the plastic bottles (Polyethylene Terephthalate) and food containers (Polypropylene). So, the recycled Polyethylene Terephthalate and Polypropylene used as a fine aggregate in concrete with percentages of 5%, 10%, 15%. This paper objective is to assess the effect of Polyethylene Terephthalate and Polypropylene on compressive strength and workability. The workability and compressive strength of PET and PP have given good results up to 10% and 5%. It has been observed from the test results that 5% and 10% is optimum for Polypropylene (PP) and Polyethylene Terephthalate (PET) as fine aggregate in concrete respectively.

Nithya kurup (2016) Due to rapid growth of population in countries like India the disposing of solid waste is a major problem in our daily life. Solid waste management is one of the major environmental concerns. Among the waste material, plastic is the material that is the major concern to most of the environmental effects. There are different types of plastic which are classified on the basis of the physical property. As the plastic waste is non degradable, it must be recycled or reused. The objective of study is to study the behavior of the concrete which is made of the recycled plastic materials along with the study of the some of the physical properties that are related. Usually M20 grade of the concrete is the most commonly used in the constructional works, hence in this study M20 cement concrete is considered in which the recycled plastic waste is used as the replacement of fine aggregate in the concrete. Concrete cube and beam were casted taking 10% to 25% of plastic as partial replacement of fine aggregate and tested for 28 days of compressive strength and flexural strength of concrete.

Patil pramod sambhaji (2016) One of the environmental issues in most regions of Iran is the large number of bottles made from poly-ethylene terephthalate (PET) deposited in domestic wastes and landfills. Due to the high volume of these bottles, more than 1 million m³ landfill spaces are needed for disposal every year. The purpose of this experimental study was to investigate the possibility of using PET waste in asphalt concrete mixes as aggregate replacement (Plastiphalt) to reduce the environmental effects of PET disposal. Concrete is the most widely used man made construction material in the world and its second only to water as the most utilized substance in the planet. Seeking aggregates for concrete and to dispose of the waste from various commodities is the present concern. Today sustainability has got top priority in construction industry. In the present study the recycled plastics were used to prepare the coarse aggregates thereby providing a sustainable option to deal with the plastic waste There are many recycling plants across the world, but as plastics are recycled they lose their strength with the number of recycling. So these plastics will end up as earth fill. In this circumstance instead of recycling it repeatedly, if it is utilized to prepare aggregates for concrete, it will be a boon to the construction industry. Most of the failures in concrete structures occur due to the failure of concrete by crushing of aggregates. Plastic aggregate which have low crushing values will not be crushed as easily as the stone aggregates. These aggregates are also lighter in weight compared to stone aggregates. Since a complete substitution for Conventional Aggregate was not found feasible, a partial substitution with various percentage of plastic aggregate was done. Both volumetric and grade substitution was employed in this investigation.

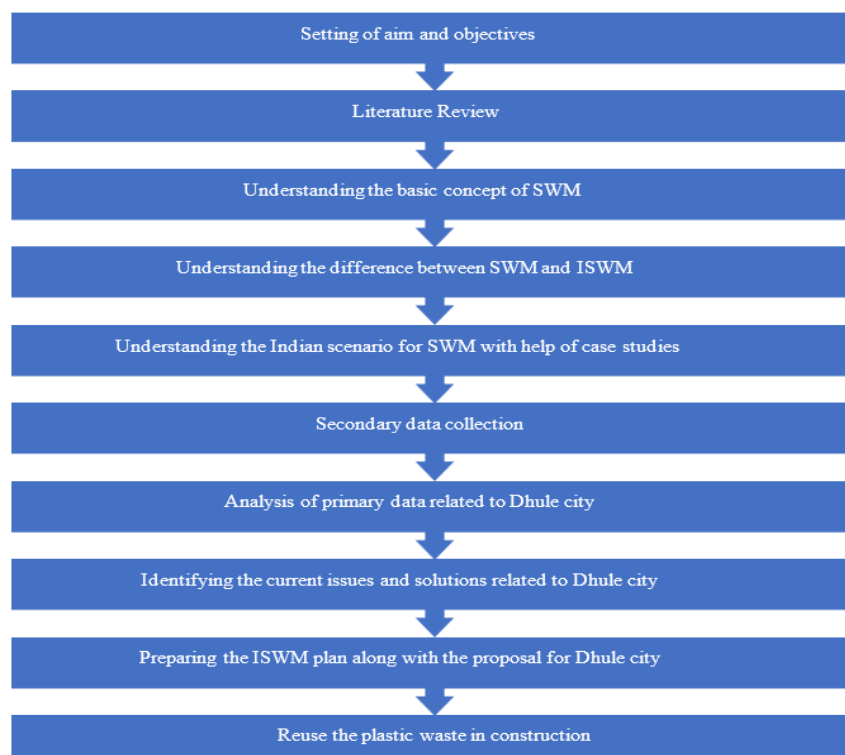
K. Sai Gopi¹, Dr. T. Srinivas²¹ (2020) Nowadays, Environmental concern towards plastic waste rises because of its low degradability and creating problems like chunking sewer lines, drainages, waterways, filling landfills, health problems, etc. The best approach is recycling and reuses plastic waste. Increase in the production of plastic day by day but, very little was recycled. On the other hand, huge demand for concrete in the construction industry. Utilization of recycled plastic waste in the production of sustainable concrete by partial replacement of fine aggregate. This study has been investigated the utilization of two types of recycled plastic waste Polyethylene Terephthalate (PET) and Polypropylene (PP) as fine aggregate in concrete. M30 grade of concrete has been used by partial replacement of fine aggregate (River Sand) with recycled plastic waste in the percentage of 5, 10, 15, 20, and 25. The workability and compressive strength results are checked to find the acceptable percentage of incorporation of PET and PP in concrete. From the results, it is observed that the workability is decreased as the percentage of recycled plastic waste is increased. The Optimum Percentage of replacement of PET is 10%. PP has shown a marginal reduction in compressive strength for 5% replacement.

Azad Khajuria, Puneet Sharma (2019) There is no doubt concrete is most useful thing in construction industry but it has a negative impact also, just like a coin has two faces. Raw materials used in manufacturing of concrete affects the environment in one or the another negative way. Like manufacturing of cement produce carbon dioxide whereas the production of aggregates adds dust to the environment. Production of coarse aggregates also impact the geology of the area from they were extracted. A step taken in this direction is the use of waste products along with or in replacement of cement. Many of these materials are already in use, like silica fume, fly ash etc. In this study, plastic coarse aggregates were used in place of natural coarse aggregates. Plastic aggregates were produced by little processing of waste plastic. Plastic is the biggest threat to the environment, and it is affecting the environment rapidly. Some recent studies show that it can be used construction industry due to some of its properties like inert behavior, resistance to degradation etc. Also use of waste plastic can help in reducing plastic waste. Various experiments were performed to test the mechanical properties of the concrete with plastic coarse aggregates. Concrete was prepared using plastic coarse aggregates in varying proportions of 0, 2.5, 5, 7.5 and 10%.

3. OBJECTIVES

- To study existing condition of city and providing the proposals for solid waste management of Dhule city.
- Preparing the ISWM system for Dhule city
- Casting the concrete blocks with plastic material as a replacement of fine aggregate.
- Conduct testing on cubes for compressive strength.

4. PROPOSED METHEDODOLOGY



Study Area

Dhule is largely emerging as one of the biggest upcoming hubs of textile, edible oil, and power-looms across the state and has gained a strategic advantage for being on the junction of three National Highways vi . NH-3, NH- 6, and NH-21 1 and on most anticipated Manmad - Indore Rail Project. Dhule city is a lso a part of Delhi Mumbai Industrial Corridor Project, India's most ambitious infrastructure program, aiming to develop new industrial cities as 'Smart Cities' and converging next generation technologies across infrastructure sectors. . Dhule is located at 20. 9°N 74.78°E.and has an average elevation of 319m and average annual rainfall in the district is 670mm.

Land-Use- The city land use is divided into residential commercial, industrial public and semi-public etc. Around 48% area is developed and 52% areas is under agriculture, vacant land and barren land.

Land-use Detail

(Land use Area in hectare)

Residential 1284.58

Commercial 77.43

Industrial 78.36

Public and Semi Public 651.28

Public Utility 48.23

Recreational Activity 136.7

Transport & communication 11.8

Agricultural 1106.47

Vacant and Barren Land 995.56

Water Bodies 255.32

Total 4646.00

Status of Existing Solid Waste Management In The City

Waste generation

Municipal solid waste in a typical town of India is residential waste which is around 70-80% of the total waste. Other waste generation sources are commercial units, markets, hotels & restaurants, institutions including schools, colleges, offices, street sweepings, drain silt and green area including park, gardens.

The major sources of generation of municipal solid waste in Dhule are :-

1. Households
2. Markets for fresh vegetables & fruits, meat and chicken Parks & open spaces
3. Temples Shops and commercial establishments Others

Most of the solid waste is generated by the households and then the markets and commercial areas. All kinds of waste including biomedical, E-waste and construction & demolition wastes are being mixed in the municipal stream of waste. There are no slaughterhouses in the city. Based on the survey results, the waste generation rate, per capita waste generation considered for Dhule city is 403 GPCD and for the floating population is 202 GPCD.

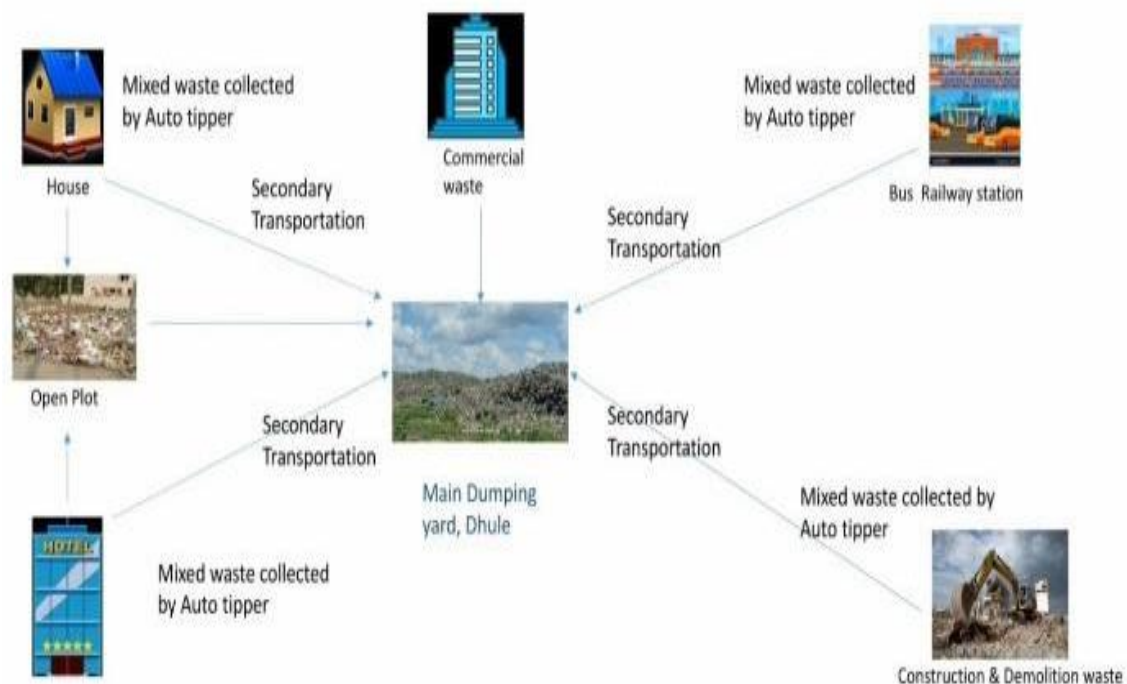
The total waste generated in the city is estimated around 165 TPD

ANALYSIS OF CASE STUDIES: INDIA SCENARIO

Cities	Strength	Problem Faced	Solution Implemented	Results
Indore	Door to door collection. Recycling plant is there. Bio-CNG plant available. People are aware about segregation of waste. More than 400 buses and vehicles are running on Bio- CNG gas.	Lack of waste segregation. Inadequate public awareness and participation. Inefficient waste collection and the transportation system.	Segregation at the source. Door to door waste collection with strict monitoring. Adopting 3R system. Public awareness and participation.	Over 90% of households in Indore now segregate there waste. The cities waste processing facility successfully manages 1000 metric tons of waste daily, with a 90% waste recovery rate. Becomed clean city from 2017 to 2023. Reduced impact on health or environment.

Pune	Proper collection and treatment. Regularity of sweeping service. Door to door collection. Separate system for hotel waste. ➤ High resources recovery.	➤ Poor waste Management. Waste pickers have difficulties in the segregating different types. Lack of space for sorting and storing recyclable materials. Illegal dumping of waste by the public.	NGO's and waste pickers organization (SWaCH) Implemented 3R system. Separate system for Hotel, E-waste and Industrial waste. ➤ Door to door collection with segregation at the spot.	SWaCH waste management covers over 70% of pune. Waste are becoming recycled. Segregation is done in proper way. ➤ People aware
Surat	Prevention of spillage of waste on roads. Proper collection and treatment. Recycling of plastic MS and rubber items. 80% segregation.	The processing treatment on waste is about 10%. People are not aware. There are no site available for disposal of solid waste. - No proper transportation. - Air and water pollution.	Underground smart dustbin. Segregation at source. Involving citizens. Sweeping, brushing in day and also in night time. - GPS Device. 3r method'	- No foul odour. - Bio-CNG plant. Become 2nd cleanest city in India. (2023) Segregation done in proper way.
Ahmedabad	32 Biogas plant running successfully. Collection of construction and demolition waste. Effective utilization of flower waste from religious places.	- Lack of fund. - Lack of awareness. - Unstable source of C & D waste for recycling. - Lack of coordination. - No segregation	- GPS devices. - Composting & installing Bio-Gas system. Street sweeping by 12,500 workers. 3r method.	more than 90% of waste ends up in open dumping Segregation cost has been decreases by 418 per ton Segregation adopted at source lead to cleaner and better environment

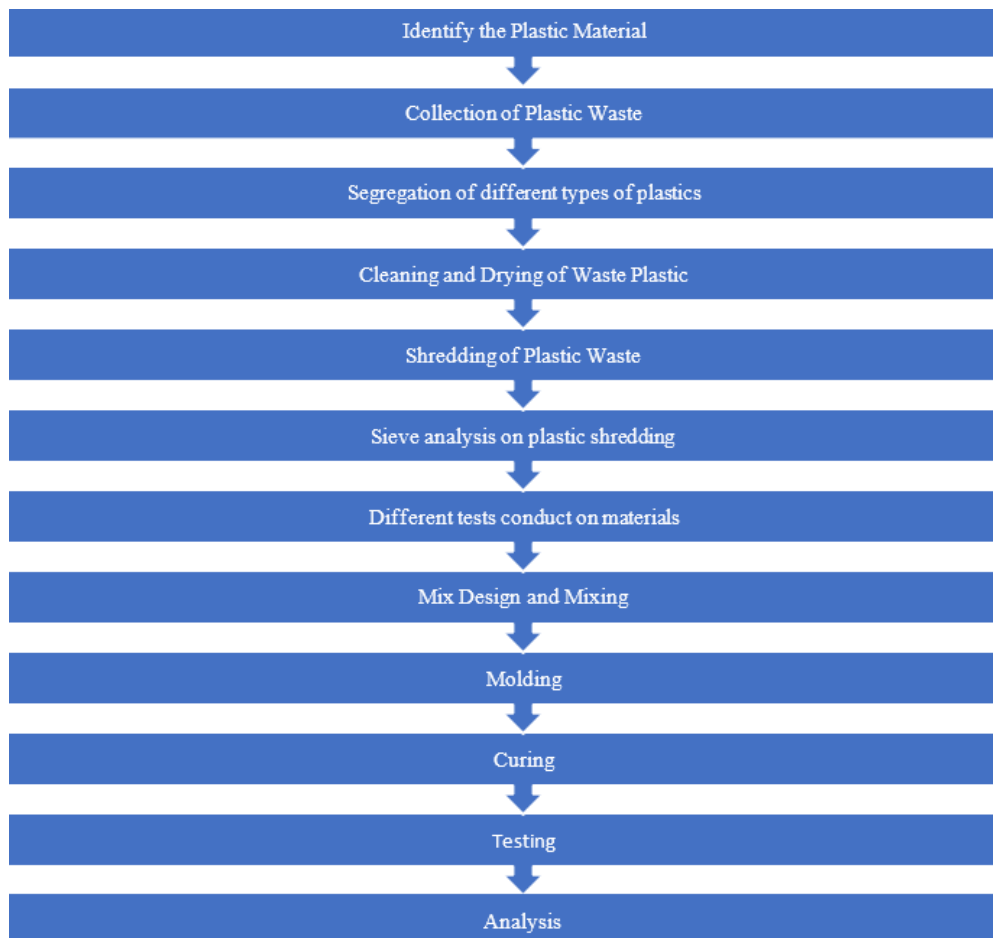
5. EXISTING PLAN OF DHULE CITY



6. PROPOSED PLAN FOR DHULE CITY



7. CASTING METHODOLOGY



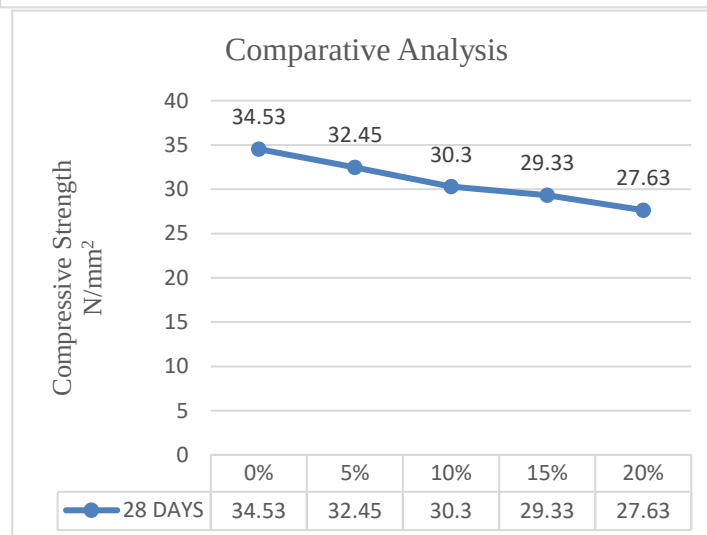
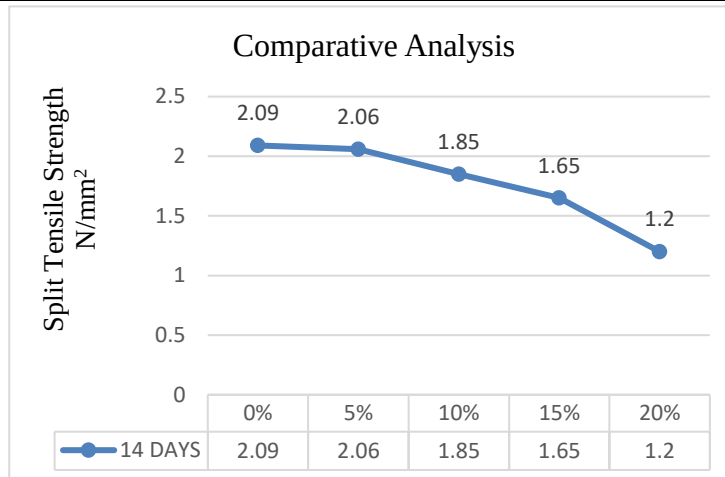
8. COMPARISION OF RESULTS

1) 28 Days result of cube testing:

Percentage of Plastic	Compressive Strength(N/mm ²)
0%	34.53
5%	32.45
10%	30.3
15%	29.33
20%	27.63

2) 14 Days result of cylinder testing:

Percentage of Plastic	Split Tensile Strength (N/mm ²)
0%	2.09
5%	1.842
10%	1.95
15%	1.65
20%	1.2



Result from 5%, 10%, 15% and 20% plastic waste replacement

- 5% replacement for cube testing, result shows that for 28 days compressive strength is 34.53 and 32.45 MPa for Ordinary and Plastic waste cube respectively.
- 5% replacement for cylinder testing, result shows that for 14 days split tensile strength is 2.09 and 2.06 MPa for Ordinary and Plastic waste cylinder respectively.
- 10% replacement for cube testing, result shows that for 28 days compressive strength is 34.53 and 30.3 MPa for Ordinary and Plastic waste cube respectively.
- 10% replacement for cylinder testing, result shows that for 14 days split tensile strength is 2.09 and 1.85 MPa for Ordinary and Plastic waste cylinder respectively.
- 15% replacement for cube testing, result shows that for 28 days compressive strength is 34.53 and 29.33 MPa for Ordinary and Plastic waste cube respectively.
- 15% replacement for cylinder testing, result shows that for 14 days split tensile strength is 2.09 and 1.65 MPa for Ordinary and Plastic waste cylinder respectively.
- 20% replacement for cube testing, result shows that for 28 days compressive strength is 34.53 and 27.63 MPa for Ordinary and Plastic waste cube respectively.
- 20% replacement for cylinder testing, result shows that for 14 days split tensile strength is 2.09 and 1.2 MPa for Ordinary and Plastic waste cylinder respectively.

9. CONCLUSION

Various tests conducted on cubes and cylinders, such as compressive tests and split tensile tests, we understand that the plastic content increases, the strength of both cubes and cylinders gradually decreases. Conversely, an increase in plastic content enhances workability. Workability increases due to plastic's lower water absorption property. The main benefit is it reduces environmental pollution. After extensive research, we have concluded that the cost of plastic waste blocks and cylinders is lower than ordinary blocks and cylinders.

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