E-waste

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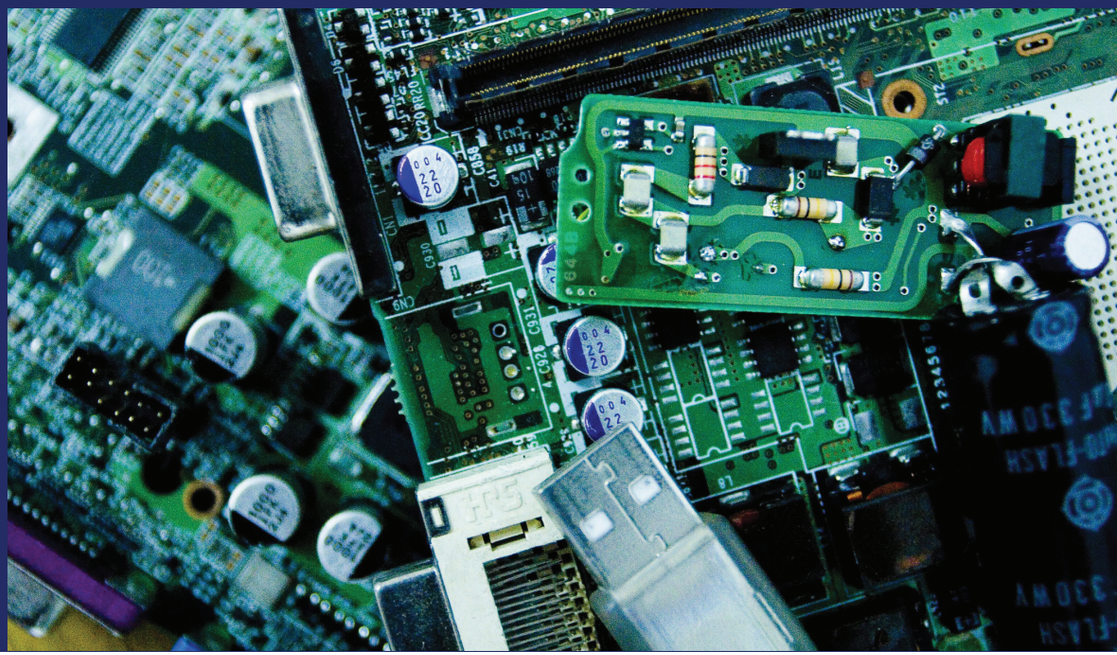
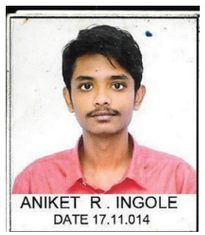
The e-waste production in the recent time has increased tremendously in the world as well as in India. The management of this large amount of waste is very difficult and hence due to the poor waste management it is producing lots of problems and health related issues.To simplify the waste management issue we have designed an advance waste management system which is mainly comprises of E-buckets, centralized controlling system, web portal and an android application. E-waste collected by this system electronic wastes have several blessings over conventional/traditional materials and strategies. On employment electronic waste and mixing it with Concrete to get roads, Manufacturing bricks and using it in soil stabilization. . In order that one will have a step towards more elaborated data concerning these materials and so be able to implement on field which can undoubtedly improve the extent of construction.





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Aniket Ingole

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Its advance collection system and innovative application in field of Civil and Environmental Engineering

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E-waste, Advance e-waste collection system and its innovative application

By

Er. Aniket Ravindra Ingole

Civil and Environmental Engineer

My lovely Parents

Who always been with me in this journey of life

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INTRODUCTION

It is a tough undeniable fact that with the voluminous increase in use of ICT devices to bridge the digital divide there's additionally associated in nursing fearful growth of e-waste worldwide. E-waste is outlined as “waste electrical and equipment, whole or partly or rejects from their producing and repair method, that area unit meant to be discarded” whereas electrical and equipment has been outlined as ‘equipment that depends on electrical currents or electro-magnetic fields to be totally functional’. There’s a necessity for e-waste management as e-waste elements could cause severe health risks and environmental injury, when crude, unscientific strategies area unit applied for recovery of helpful elements. There’s a necessity to encourage utilisation of all helpful and valuable material from e-wastes to preserve the natural resources. Most of the developing countries area unit suffering with the speedily growing issues of e-waste and have to be compelled to have sound e-waste Management systems for finish of life ICT product to avoid the threat on surroundings and grouping. The rise of ICT, Frequent innovations and technological changes area unit leading to shorter era of ICT instrumentality. Further more in developing countries the amount of foreign noncurrent Electrical and equipment (EEE) is uncontrolled .So the volume of e-waste has additionally inflated drastically in developing and developed nations. At constant time, it's encouraging that each nation, together with going for the event within the ICT sector, is additionally operating for ‘going green’ by taking care of problems like economical use of natural resources, minimisation of e-waste, property utilisation of e-waste and development of product with minimum use of unsafe substances. Electrical and equipment (EEE) contain valuable moreover as unsafe materials and if at finish of lifetime of EEE, the unsafe materials aren't disposed of scientifically it should cause serious injury to the surroundings and public health. The presence of serious metals (like Arsenic,

Cadmium, Barium, Lead, Lithium, Mercury, Nickel, metal Sulphide) and different virulent substances like PCB (Polychlorinated biphenyls) etc. could cause extreme damage, if not disposed of in surroundings friendly manner. ITU has accepted the very fact that the laws in several developing countries to hide the areas of WEEE (Waste Electrical and Electronic Equipment) are inadequate as they exclude key topics and key stake holders just like the informal sector. The gathering, recycling, recovery and associated activities of e-waste management by the informal sector having little/no information concerning techniques, precautions etc, cause a lot of injury to their health and surroundings. thus going in line with the definition of environmental property i.e.“ the power to take care of the qualities that area unit valued within the physical surroundings by the employment of style for surroundings principles, economical use of non -renewable resources, economical and environmentally sound utilisation and use of renewable resources the maximum amount as possible”, so as to possess a property policy to handle e-waste in Associate in Nursing surroundings friendly manner, it's so extraordinarily necessary that policy of e-waste disposal and regulative aspects ought to be Stringent more over as rational. The major portion of the c-waste generated domestically furthermore as lawlessly foreign are recycled in crude manner resulting in pollution of the setting. Lack of legislation in our country at this time is aiding this hazardous variety of employment. So there's pressing got to frame and implement rules for control this waste and to seek out environmentally sound, economically viable strategies for employment and putting off this necessary evil.

WASTE PRODUCE IN THE WORLD

Around the world, waste generation rates are rising. In 2012, the worlds' cities generated 1.3 billion tonnes of solid waste per year, amounting to a footprint of 1.2 kilograms per person per day. With rapid population growth and urbanization, municipal waste generation is expected to rise to 2.2 billion tonnes by 2025.

Compared to those in developed nations, residents in developing countries, especially the urban poor, are more severely impacted by unsustainably managed waste. In low and middle-income countries, waste is often disposed in unregulated dumps or openly burned. These practices create serious health, safety, and environmental consequences. Poorly managed waste serves as a breeding ground for disease vectors, contributes to global climate change through methane generation, and even violence. Managing waste properly is essential for building sustainable and liveable cities, but it remains a challenge for many developing countries and cities. Effective waste management is expensive, often comprising 20-50% of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported. The World Bank study projects a 70% global increase in municipal solid waste by 2025– with developing countries facing the greatest challenges as their waste is expected to more than double. The projected amount of waste will rise from 1.3 billion tons per year today to 2.2 billion tons per year by 2025. The projected annual global costs will rise from $205 billion to $375 billion per year. Buying and selling waste at market rates is part of our world economy. Poorer, more rural, countries become dumping grounds for the world's most challenging waste at minimal rates, while wealthier, more urban, countries generate revenue by selling their disproportionately high amounts of inorganic waste.

Solid waste is the most visible and pernicious by-product of a wealthier, urban, resource-intensive, consumer-based lifestyle. Greenhouse gas emissions, water

pollution and endocrine disruptors are additional by-products of more urban lifestyles. Cities, in developing countries, who already cope with burgeoning populations, scarce financial resources, and a limited capacity to manage environmental issues, are facing a sharp rise in the amount and costs of garbage that they will be required to deal with by 2025.

In low-income countries, MSW is often the largest single budget item for cities, and one of the largest employers. This makes waste management the most important service a city can provide. A city that cannot effectively manage its waste is rarely able to manage more complex services such as health, education, or transportation. China surpassed the United States in 2004 for the world's most municipal solid waste growth. This corresponds to their increasing urbanization and GDP which in turn generates waste increases and change; the increased consumption of plastics, paper, glass, and aluminium increases while the organics fraction decreases.

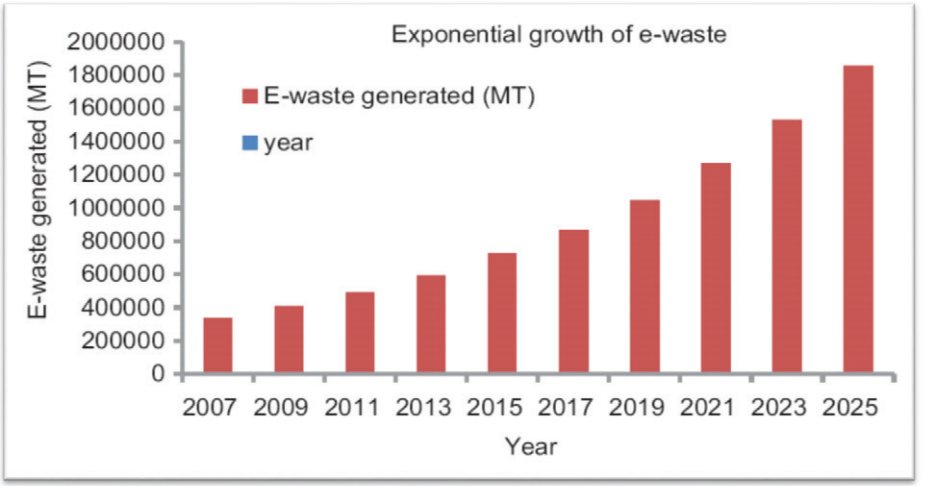


Fig1: E-waste produces in world (Mega tonnes MT)

WASTE PRODUCE IN INDIA

As prosperity grows, 62 million tonnes of garbage is generated everyday by the 377 million people living in urban India, now the world's third-largest garbage generator. However, it's not the amount of waste generated that's as much of an issue as the fact that more than 45 million tonnes, or 3 million trucks worth, of garbage is untreated and disposed of by municipal authorities everyday in an unhygienic manner leading to health issues and environmental degradation. These 3 million trucks, if laid end to end, would cover half the distance between the earth and the moon. Or to put it another way, that's the distance you would cover if you made 15 trips between Mumbai and Los Angeles. With rapid urbanisation, industrialisation and an explosion in population in India, solid waste management will be a key challenge for state governments and local municipal bodies in the 21st century. "Large metropolis such as Mumbai and Delhi generate around 9,000 metric tonnes and 8,300 metric tonnes of waste per day, respectively. India suffers from inefficient and insufficient waste infrastructure and also from increasing rates of solid waste generation per capita. Issues of service quality and waste quantity need to be handled together. Besides, the infrastructure and technologies, we must also concede that we have not addressed the issue from a systemic perspective," said Chowdary, inaugurating an Assocham Conference on 5th national conference and awards on waste to wealth.

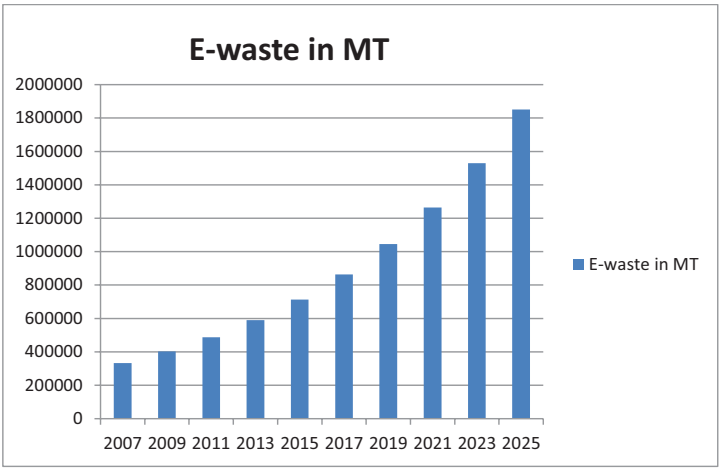


Fig.2: Growth of E-waste in India.

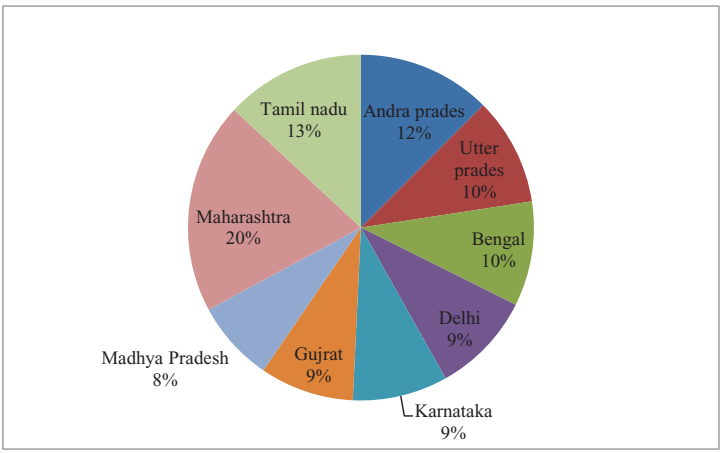


Fig.3: State wise E-waste generation in India.

EFFECT OF E- WASTE ON HEALTH AND ENVIRONMENT

With the usage of electrical and equipment (EEE) on the increase, the quantity of electrical and electronic waste (e-waste) created day by day is equally growing hugely round the globe. Usage of valuable parts contained in e-waste like copper and gold has become a supply of financial gain principally within the informal sector of developing or rising industrialised countries. However, primitive usage techniques like burning cables for retentive the inherent copper expose each adult and kid staff additionally as their families to a variety of unsafe substances. E-waste-connected health risks might result from direct contact with harmful materials like lead, cadmium, chromium, brominated flame retardants or polychlorinated biphenyls (PCBs), from inhalation of harmful fumes, additionally as from accumulation of chemicals in soil, water and food. Additionally to its unsafe elements, being processed, e-waste will produce to variety of harmful by-products possible to have an effect on human health. Moreover, usage activities like dismantlement of electrical instrumentality might doubtless bear AN accumulated risk of injury. Children are particularly prone to the health risks that will result from e-waste exposure and, therefore, want additional specific protection. As they're still growing, children's intake of air, water and food in proportion to their weight is considerably accumulated compared to adults, - and therewith, the chance of unsafe chemical absorption. Moreover, their bodies' practical systems like the central nervous, immune, procreative and gastrointestinal system are still developing and exposure to harmful substances, by hampering additional development, might cause irreversible injury. several kids are exposed to e-waste-derived chemicals in their everyday life as a result of unsafe usage activities that are usually conducted at their home- either by members of the family or by the youngsters themselves. Moreover, kids could also be exposed through dump sites placed near their homes, colleges and play areas. E-waste, or electronic waste, is waste from all forms of physics starting from computers and mobile phones, to house physics like food processors, pressure, cookers etc. The effects of improper disposal of this E-waste on the atmosphere are very little known;

these impacts withal create terribly real threats and dangers to the world atmosphere at giant. Threats display by E-waste to the atmosphere. Improper disposal of those electronic wastes have an effect on the soil, air, and water elements of the atmosphere.

a) EFFECTS ON AIR

One of the foremost common results of E-waste on air is thru pollution. As an example, a British documentary concerning Lagos and its inhabitants, known as Welcome to Lagos, shows variety of lowland scavengers World Health Organization bear various landfills in Lagos yearning for improperly disposed physics which incorporates wires, blenders, etc., to create some financial gain from the usage of those wastes. These men were shown to burn wires to induce the copper (a terribly valuable commodity) in them by exterior burning which may unleash hydrocarbons into the air.

b) EFFECTS ON WATER

When physics containing serious metals like lead, barium, mercury, metal (found in mobile and laptop batteries), etc., are improperly disposed, these serious metals leach through the soil to achieve groundwater channels that eventually run to the surface as streams or little ponds of water. Native communities usually depend upon these bodies of water and therefore the groundwater. Excluding these chemicals leading to the death of a number of the plants and animals that exist within the water, intake of the contaminated water by humans and land animals leads to unwellness. a number of these serious metals are malignant neoplastic disease.

c) EFFECTS ON SOIL

In this approach, harmful serious metals and chemicals from e-waste enter the "soil-crop-food pathway," one amongst the foremost important routes for serious metals' exposure to humans. These chemicals aren't biodegradable—they act the atmosphere for long periods of your time, increasing the chance of exposure. These

dangers display by improper disposal on the atmosphere ultimately have impacts on personalities -human cost; the health effects of those toxins on humans embrace birth defects (irreversible), brain, heart, liver, urinary organ and frame injury. They additionally considerably have an effect on the nervous and fruitful systems of the body. Once laptop monitors and different physics are burned, they produce cancer-producing dioxins that are discharged into the air we tend to breathe. If physics are thrown in landfills, these toxins might leach into groundwater and have an effect on native resources. Therefore improper disposal of e-waste not solely has effects on the atmosphere, it indirectly and ultimately poses grave dangers to humans and placental.

E-WASTE DISPOSAL WAYS

Can you imagine this year one out of each 3 Americans can discard their recent cellular phone to get the most recent version of mobile phone? Nonetheless, several alternative persons would be trying forward to discarding their obsolete computers, televisions and alternative electronic devices. It's calculable that around one hundred thirty million mobile phones and three million loads of alternative electronic gadgets like televisions, laptops and computers area unit retired annually. According to UNEP nearly 2-3% of the municipal waste includes of e-waste and out of that solely 15-20% is recycled. Whereas most of the e-waste goes to the incinerators and landfills therefore polluting the character or a number of the e-waste was shipped to the developing countries like Republic of India, China, West Pakistan and Asian nation. However, in 2008 legislation was introduced in a number of the U.S.A. states for altogether prohibition of the e-waste export to the developing countries. Currently the stress is arranged in the main on the correct e-waste disposal and for the interference of contamination at abroad and residential each.

E waste disposal in order to modify the present state of affairs U.S.A. has tailored bound e-waste disposal ways; therefore allow us to peek into these ways.

a) LANDFILLING

This is the foremost common methodology of e-waste disposal. Soil is excavated and trenches area unit created for concealment the e-waste in it. A mothproof liner is formed of clay or plastic with a leachate basin for assortment and transferring the e-waste to the treatment plant. However, lowland isn't AN environmentally sound method for disposing off the e-waste as cyanogenetic substances like atomic number 48, lead and mercury area unit discharged within the soil and well water.

b) ACID BATH

Acid tub involves soaking of the electronic circuits within the powerful sulphuric, hydrochloric or acid solutions that free the metals from the electronic pathways. The recovered metal is employed within the producing of alternative merchandise whereas the venturous acid waste finds its ways in which within the native water sources.

c) INCINERATIONS

This is a controlled means of disposing off the e-waste and it involves combustion of electronic waste at extreme temperature in specially designed incinerators. This e-waste disposal methodology is kind of advantageous because the waste volume is reduced extraordinarily a lot of and also the energy obtained is additionally used individually. However, it's conjointly not free from disadvantages with the emission of the harmful gases mercury and atomic number 48 within the atmosphere.

d) RECYCLING OF E-WASTE

Mobile phones, monitors, CPUs, floppy drives, laptops, keyboards, cables and connecting wires are often re-utilized with the assistance of the use method. It involves activity of the device, separation of the elements having venturous substances like CRT, computer circuit boards etc. then recovery of the valuable metals like copper, gold or lead are often finished the assistance of the economical a strong e-waste recycler. The foremost crucial factor here is selecting the correct quite recycler that doesn't break laws and handle the e-waste within the eco-friendly manner.

Nowadays, there are a unit several e-waste use corporations turning out with the acquire facilities aggregation obsolete electronic things from your homes. Moreover, they're conjointly running many use programs for the users, retailers and makers for the gathering of the physical science. Bound agencies like Environmental Protection Agency, Earth 911, e Cycling Centre, Call2Recycle, Greener Gadgets and

Electronic Industries Alliance area unit the extra resources for serving to individuals to find the near drop off locations.

e) REUSE OF ELECTRONIC DEVICES

This is the foremost fascinating e-waste use method wherever with slight modifications the mobile phones, computers, laptops, printers are often reused or given as second user product to the opposite person. The recent equipment may be given within the varied charity programs and therefore serving to the persons in would like. Moreover, there's a stronger means conjointly by marketing the recent mobile phones or laptops to the some use and refurbishing corporations. Many websites area unit acting because the middleman between recyclers and electronic users. it's a win-win state of affairs for the users as they not solely get free off the recent mobile phones however conjointly get paid once reselling it.

ADVANCE E-WASTE MANAGEMENT SYSTEM

Healthy environment leads to wealthy life but currently we see the numbers of dustbins with full of waste and without proper management and maintenance. Lack of work force, high cost of installation and collection, low transportation facility leads to arise many problems, these problems has adverse effect on human health and society. Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease. Normally it is the wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems. The plague outbreak in Surat is a good example of a city suffering due to the callous attitude of the local body in maintaining cleanliness in the city. Plastic waste is another cause for ill health. Thus excessive solid waste that is generated should be controlled by taking certain measures. The group at risk from the unscientific disposal of solid waste include – the population in areas where there is no proper waste disposal method, especially the pre-school children; waste workers; and workers in facilities producing toxic and infectious material. Other high-risk group include population living close to a waste dump and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites. Uncollected solid waste also increases risk of injury, and infection. In particular, organic domestic waste poses a serious threat, since they ferment, creating conditions favourable to the survival and growth of microbial pathogens. Direct handling of solid waste can result in various types of infectious and chronic diseases with the waste workers and the rag pickers being the most vulnerable. Exposure to hazardous waste can affect human health, children being more vulnerable to these pollutants. In fact, direct exposure can lead to diseases through chemical exposure as the release of chemical waste into the environment leads to chemical poisoning. Many studies have been carried out in various parts of the world to establish a connection between health and hazardous waste.

Waste from agriculture and industries can also cause serious health risks. Other than this, co-disposal of industrial hazardous waste with municipal waste can expose people to chemical and radioactive hazards. Uncollected solid waste can also obstruct storm water runoff, resulting in the forming of stagnant water bodies that become the breeding ground of disease. Waste dumped near a water source also causes contamination of the water body or the ground water source. Disposal of hospital and other medical waste requires special attention since this can create major health hazards. This waste generated from the hospitals, health care centres, medical laboratories, and research centres such as discarded syringe needles, bandages, swabs, plasters, and other types of infectious waste are often disposed with the regular non-infectious waste.

Waste treatment and disposal sites can also create health hazards for the neighbourhood. Improperly operated incineration plants cause air pollution and improperly managed and designed landfills attract all types of insects and rodents that spread disease. Ideally these sites should be located at a safe distance from all human settlement. Landfill sites should be well lined and walled to ensure that there is no leakage into the nearby ground water sources. E-waste management system comprises of following four elements

a) E-bucket
b) Web page
c) Android application
d) Feedback system

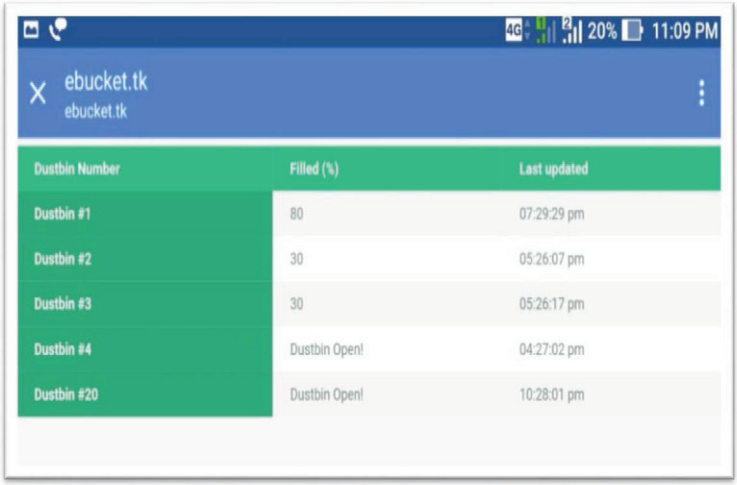
a) E-BUCKET (Dustbin)

Pic 1: Advance Waste Management System

E-bucket comprises of following parts

- Body of E-bucket
- Module
- Sensors
- LED display
- Control panel
- Solar panel
- Battery

b) WEB PAGE (http:ebucket.tk)



Pic 2: Layout of web page

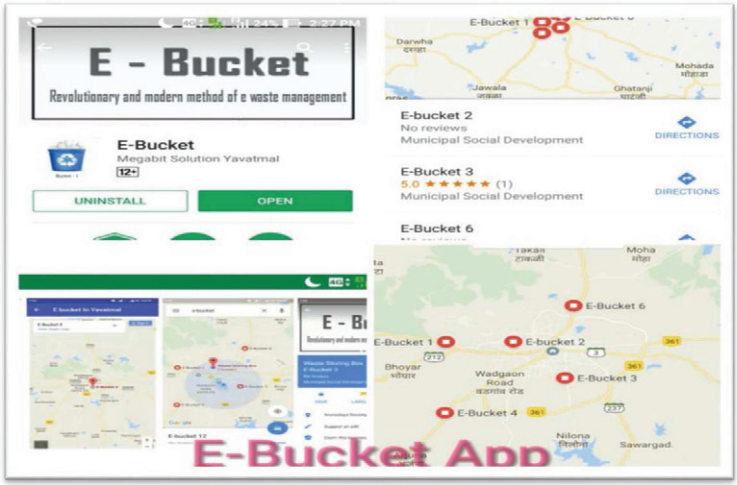
Bucket number 1) 2)	Filled (%)	Last update (Time, Date)

Table 1: Tabular representation of contents on web page

1) Web page address is http:ebucket.tk.
2) Web page get update as the E-bucket sends the data when connected to internet.
3) Web page shows the bucket number, percentage of waste filled in bucket, time and date.
4) It's a part of centralized control system, single man can see and operate the entire data regarding the e-bucket at single place, reducing the efforts and cost for waste management and control.
5) Since web page shows the time to time data of waste in dustbin it's become waste management system becomes easy and cheap.

6) Data on this site can be seen on android app (E-bucket) available on play store at free of cost.

c) ANDROID APPLICATION (e-bucket)



Pic 3: Android application

Silent feature of application: E-bucket

1) Available on android play store free of cost.
2) Idea behind developing this application is just to make easy and convenient to people for finding the e-bucket in their nearby area.
3) Main function of this app to show location of e-bucket and data of web portal.
4) E-bucket app shows location of e-bucket fitted in society and with help of Global Positioning system takes the person to nearest e-bucket. This reduces the difficulty for finding the dustbin.
5) Man can easy download this app and search the dustbin in nearby area. App is easy to operate and has low size which just consumes 2 mb in memory. Since it is available free of cost so anyone can download this application and search dustbin and amount of waste filled in it.

6) When new e-buckets are added in society their location can easily update in application by just taking the co-ordinates and filling this data to app, this will add new e-bucket in application.

d) FEEDBACK SYSTEM

1) In case when a person goes to put the waste and system is full then feedback program works.
2) Its shows the massage of Dustbin full on LED display of e-bucket.
3) Application and web portal gets information from e-bucket and feedback on application and web portal display, so person gets next duration to put the waste.
4) Centralized control system gives the duration of clearing waste from this e-bucket; this massage will get display on L.E.D. display, web portal, application.
5) Feedback system saves the time and waste accumulation.

Salient features of E-bucket

1) Fitted with Wi-Fi-module
2) GPS location
3) Web portal (www.ebucket.tk)
4) Self electricity generation with help of solar plates
5) Waste indication LED display
6) Waste calculating sensor (ECO sensor)
7) Android location app (E-bucket)

Advantages of E-bucket

1) 25-30% labour cost saving
2) 30% transportation cost saving
3) Easy to find location of Bucket
4) Self Electricity generation

5) Centralized administration control
6) Second wise waste indication
7) No need to separate electronic waste separately
8) E-waste can recycle by using it in construction

INNOVATIVE USES OF E-WASTE

Following are some innovative methods of application of e-waste invented by author.

1 ENVIRONMENTAL FRIENDLY BRICKS

This is the foremost fascinating e-waste use method wherever with slight modifications the mobile phones, computers, laptops, printers are often reused or given as second user product to the opposite person. The recent equipment may be given within the varied charity programs and therefore serving to the persons in would like. Moreover, there's a stronger means conjointly by marketing the recent mobile phones or laptops to the some use and refurbishing corporations. Many websites area unit acting because the middleman between recyclers and electronic users. it's a win-win state of affairs for the users as they not solely get free off the recent mobile phones however conjointly get paid once reselling it.

SPECIFICATION OF MATERIALS USED IN CONSTRUCTION OF E-BRICKS

a) CEMENT

Portland cement is that the most common kind of cement usually use around the world as a basic ingredient of concrete, mortar, stucco, and non-specialty grout. It had been developed from different kinds of hydraulic lime in England at intervals the centre nineteenth century, and usually originates from rock. it is a fine powder, created by heating rock associate degreed clay minerals in an extremely kitchen appliance to form clinker, grinding the clinker, and adding very little amounts of different materials.[clarification needed] many types of cement unit of measurement out there. The foremost common, noted as normal cement (OPC), is grey in colour, but white cement is in addition out there. Cement, in general, adhesive substances of all sorts, but, in associate degree extremely narrower sense, the binding materials utilized in building and engineering construction. Due to their hydrating properties, constructional cements, that is ready to even set and harden to lower place water, unit

of measurement typically noted as hydraulic cements. The foremost very important of these is cement. Portland cement consists essentially of compounds of lime (calcium matter, CaO) mixed with semiconducting material oxide (silicon oxide, SiO2) and aluminium (aluminum oxide, Al2O3). The lime is obtained from a carbonate (lime-containing) stuff, and thus the choice oxides unit of measurement derived from associate degree clayey (clayey) material. any raw materials like silicon dioxide sand, iron matter (Fe2O3), and bauxite—containing hydrous metal, Al(OH)3—may use in smaller quantities to urge the desired composition.

b) SAND

A well-built home is not alone meant to possess good look, it have to be compelled to even have good strength and support. What's the employment of obtaining a reasonably home lacking correct structure or strength? If you are yearning for such a well-built dream home, you'd wish to get your home from associate degree professional builder. Associate degree honest builder thus provides the foremost effective solutions in your home construction project. but detain mind, there are a unit many shady builders out there trying to push in normal materials in either side of the event to avoid wasting few greenbacks. The building would possibly develop cracks or damages with use of improper quality of sand. Numerous grading of sand.

The size of the particles or granules of sand ranges from 1/16mm to 2mm. supported the size of the particles, the sand are going to be classified as fine, medium and coarse. The particles of fine sand area unit rife smaller once place next to the other kinds. However, each of them has their own purpose in construction. The coarse sand is utilized for constructing pillars and underground tanks, whereas the medium sand is utilized for the first layer of covering and completely different works. The final word finish of covering includes the employment of fine pit coarse sand obtained from quarries is utilized at intervals the development of homes in urban areas of Hyderabad. It's filtered once required for specific uses in construction like covering. Like any completely different material, there are unit sure choices that verify the quality of sand. Good quality sand mustn't possess quite four wheel drive

of silt content. It has to be compelled to have natural and crushed stone sand. It ought to be free from organic matter and completely different dirt particles.

How to check the quality of sand

Many folks do not acknowledge the quality, features, and measurements of fine sand. Many builders/suppliers build and of this by providing a reasonable rate load and will tell that it's of fine quality.

c) AGGREGATE

Aggregates consisting of materials which are able to react with alkalis in cement and cause excessive growth, cracking and deterioration of concrete mix have to be compelled to never be used. thus it's required to ascertain mixtures to know whether or not or not there is presence of any such constituents in mixture or not. The size and sort of {the mixture, the combination} particles greatly influence the number of cement required in concrete combine and thus ultimately economy of concrete. For the preparation of economical concrete mix on have to be compelled to use largest coarse aggregates doable for the structure. IS-456 suggests following recommendation to form your mind up the utmost size of coarse mixture to be used in P.C.C & R.C.C mix. Maximum size of mixture has to be compelled to be however One-fourth of the minimum dimension of the concrete member. One-fifth of the minimum dimension of the concrete member. The development of effortful bond strength between mixture particles and cement paste depends upon the surface texture, surface roughness and surface consistence of the mixture particles. If the surface is rough but porous, most bond strength develops. In porous surface aggregates, the bond strength can increase because of setting of cement paste at intervals the pores.

The quantitative relation of weight of household appliance dried aggregates maintained for 24 hours at a temperature of 100 to 1100C, to the load of equal volume of water displaced by saturated dry surface mixture is known as density of aggregates.

Specific gravities area unit primarily of two varieties. Specific gravity could also be a mean to form your mind up the quality of the mixture. Low density usually indicates porous, weak and absorbent materials, whereas high density indicates materials of fine quality. Density of major aggregates falls within the vary of 2.6 to 2.9. Specific gravity values are used whereas coming up with concrete mix. It is printed as a result of the burden of the mixture required to fill a instrumentality of unit volume. It's usually expressed in kg/litre. Bulk density of aggregates depends upon the following 3 factors.

- Degree of compaction
- Grading of aggregates
- Shape of mixture particles

Water absorption is additionally printed as a result of the excellence between the load of really dry aggregates and thus the burden of the saturated aggregates with surface dry conditions.

Depending upon the amount of wet content in aggregates, it'll exist in any of the four conditions.

Very dry mixture (having no moisture)

Dry mixture (contain some wet in its pores)

Saturated surface dry mixture (pores totally filled with wet but no wet on surface) Moist or wet aggregates (pores area unit filled with wet and in addition having wet on surface) It square measure typically printed as in increase at intervals the majority volume of the number of sand (i.e. fine aggregate) in an exceedingly very wet condition over the amount the number} the degree} of the same quantity of dry or totally saturated sand. The quantitative relation of the amount of wet sand because of the amount of sand once dry is termed bulking issue.

Fine sands bulk quite coarse sand. When water is added to dry and loose sand, a thin film of water is formed around the sand particles. Interlocking of air in between the sand particles and thus the film of water tends to push the particles apart because of natural phenomenon so increase the amount. but simply just in case of fully saturated sand the water films area unit broken and thus the degree becomes adequate

that of dry sand. Fineness modulus is typically accustomed get a thought of but coarse or fine the mixture is. Extra fineness modulus price indicates that the mixture is coarser and little price of fineness modulus indicates that the mixture is finer. Mixture The extent per unit weight of the material is termed as specific surface. this may be associate degree indirect live of the mixture grading. Specific surface can increase with the reduction at intervals the scale of mixture particle. The actual extent of the fine mixture is implausibly much more than that of coarse mixture. Aggregates mustn't contain any harmful material in such a quantity soon have a sway on the strength and strength of the concrete. Such harmful materials area unit noted as harmful materials. Harmful materials would possibly cause one of the following effects.

- To interfere association of cement
- To prevent development of correct bond
- To reduce strength and strength
- To modify setting times

Deleterious materials usually found in aggregates, is additionally sorted as beneath organic impurities Clay silt & mud Salt contamination the mixtures crushing price provides a relative live of resistance of associate degree mixture to crushing beneath step by step applied compressive load. The mixture crushing strength price could also be a useful issue to know the behaviour of aggregates once subjected to compressive plenty. The mixture impact price provides a relative live of the resistance of associate degree mixture to fast shock or impact. The impact price of a mix is sometime used as associate degree alternate to its crushing price.

d) E-WASTE

"Electronic waste" or "E-Waste" may even be printed as discarded computers, geographical point instrumentation, amusement device natural science, mobile phones, TV sets, and refrigerators. This includes used natural science that area unit destined for apply, resale, salvage, recycling, or disposal. Others area unit re-usable (working and serviceable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material that's call in the consumer rather than recycled, moreover as residue from apply and usage operations, as a results of numerous surplus natural science area unit typically commingled (good, recyclable, and non-recyclable), several public policy advocates apply the term "e-waste" loosely to all or any or any surplus natural science. Non-particulate radiation tubes (CRTs) area unit thought of 1 among the toughest varieties to recycle.

E-waste unremarkably contains valuable, likewise as probably cyanogenic materials. The composition of e-waste depends powerfully on factors like the kind of device, the model, manufacturer, date of manufacture, and therefore the age of the scrap. Scrap from IT and telecommunication systems contain a better quantity of precious metals than scrap from ménage appliances. as an example, a transportable contains quite forty components, base metals like copper (Cu) and tin (Sn); special metals like metal (Li) atomic number 27 (Co), metallic element (In), and atomic number 51 (Sb); and precious metals like silver (Ag), gold (Au), and Pd (Pd). Special treatment of e-waste ought to be thought-about to stop wasting valuable materials and rare components. Materials like gold and Pd will be mined additional effectively from e-waste compared to mining from ore. In contrast, e-waste contains PBDEs, that square measure flame retardants that square measure mixed into plastics and alternative elements. Circuit boards found in most of the electronic devices could contain arsenic (As), metal (Cd), atomic number 24 (Cr), lead (Pb), mercury (Hg), and alternative cyanogenic chemicals. Typical computer circuit boards treated with lead solder in electronic devices contain roughly fifty g of tin-lead solder per area unit of card. Obsolete refrigerators, freezers, and air con units contain gas depleting

Chlorofluorocarbons (CFCs). The outstanding materials like Ba, cadmium, copper, lead, zinc, and alternative lanthanoid metals square measure contained in end-of-life (EOL) ray tubes (CRTs) in laptop monitors, and televisions. For instance, things like leaded glass give protection against X-rays created within the image projection method in CRTs. The common lead in CTR monitors is one.6-3.2 kg. Thus, the North American country and alternative developed countries within the EU and Japan have illegal the disposal of ray tubes in landfills attributable to their cyanogenic characteristics. An important challenge in coming up with and developing methods to manage e-waste is that the dynamical composition of the numerous constituents due the advancement of technology, significantly within the electronic elements [24]. it's against this background that e-waste utilization and disposal strategies got to keep up with the dynamical composition of e-waste. Many factors influence the composition of e-waste, together with economic conditions, accessibility of a employ market, and infrastructure of the utilization business, waste segregation programs, and regulation social control.

THE PRODUCING PROCESS OF E-BRICKS

The production of concrete blocks consists of 4 basic processes: commixture, molding, curing, and cubing. Some producing plants turn out solely concrete blocks, whereas others might turn out a good form of formed concrete merchandise together with blocks, flat paver stones, and ornamental landscaping items like field border. Some plants square measure capable of manufacturing a pair of 800-1000 blocks per hour. The following steps square measure normally accustomed manufacture concrete blocks.

a) MIXING

The sand and gravel square measure keep outside in piles and square measure transferred into storage bins within the plant by a conveyor as they're required. The Portland cement is keep outside in massive vertical silos to guard it from wetness.

As a production run starts, the specified amounts of sand, gravel, cement, e-waste square measure transferred by gravity or by mechanical means that to a weigh batcher that measures the correct amounts of every material.

The dry materials then flow into a stationary mixer wherever they're homogenised along for many minutes. There square measure 2 sorts of mixers normally used. One type, referred to as a planetary or pan mixer, resembles a shallow pan with a lid. Commixture blades square measure hooked up to a vertical rod within the mixer. The opposite kind is termed a horizontal drum mixer. It resembles a tin can turned on its aspect and has commixture blades hooked up to a horizontal rod within the mixer.

When the dry materials square measure homogenised, a tiny low quantity of water is superimposed to the mixer. If the plant is found during a climate subject to temperature extremes, the water might 1st withstand a heater or excitation to manage its temperature. Admixture chemicals and colouring pigments can also be superimposed at this point. The concrete is then mixed for 6 to eight minutes.

b) Molding

Once the load of concrete is completely mixed, its drop into Associate in nursing inclined Concrete Block bucket conveyor Associate in Nursing transported to an elevated hopper. The blending cycle begins once more for ensuing load.

From the hopper the concrete is sent to a different hopper on prime of the block machine at a measured rate of flow. Within the block machine, the concrete is forced downward into molds. The moulds contain Associate in nursing outer mould box containing many mold liners. The liners verify the outer form of the block and therefore the inner form of the block cavities. As several as fifteen blocks is also wrought at just one occasion.

Once the moulds square measure full, the concrete is compacted by the load of the higher mould head returning down on the mould cavities. This compaction is also supplemented by air or hydraulic pressure cylinders engaged on the mould

head. Most block machines additionally use a brief burst of mechanical vibration to any aid compaction.

The compacted blocks square measure pushed down and out of the molds onto a flat steel pallet. The pallet and blocks square measure pushed out of the machine and onto a sequence conveyor. In some operations the blocks then pass beneath a rotating brush that removes loose material from the highest of the blocks.

c) Curing

The pallets of blocks square measure sent to an automatic labourer or loader that places them during a natural action rack. Every rack holds many hundred blocks. Once a rack is full, it's rolled onto a group of rails and emotional into a natural action oven.

The oven is an interior area with the capability to carry many racks of blocks at a time. There square measure 2 basic sorts of natural action kilns. The foremost common kind may be a nonaggressive steam oven. During this kind, the blocks square measure command within the oven for one to a few hours at temperature to permit them to harden slightly. Steam is then step by step introduced to boost the temperature at a controlled rate of no more than 60°F per hour (16°C per hour). commonplace weight blocks square measure sometimes cured at a temperature of 150-165°F (66-74°C), whereas light-weight blocks square measure cured at 170-185°F (77-85°C). Once the natural action temperature has been reached, the steam is shut off, and therefore the blocks square measure allowed soaking within the hot, damp air for 12-18 hours. When soaking, the blocks square measure dried by exhausting the damp air and any raising the temperature within the oven. The full natural action cycle takes concerning twenty four hours.

Another kind of oven is that the aggressive steam oven, generally referred to as Associate in nursing autoclave. During this kind, the temperature is raised to 300-375°F (149-191°C), and therefore the pressure is raised to 80-185 psi (5.5-12.8 bar). The blocks square measure allowed soaking for 5 to ten hours. The

pressure is then speedily ventilated, that causes the blocks to quickly unharness their at bay wetness. The autoclave solidifying natural action process needs a lot of energy and a dearer oven; however it will turn out blocks in less time.

d) Cubing

The racks of cured blocks square measure unrolled of the oven, and therefore the pallets of blocks square measure unstacked and placed on a sequence conveyor. The blocks square measure pushed off the steel pallets, and therefore the empty pallets square measure fed into the block machine to receive a brand new set of wrought blocks.

If the blocks square measure to be created into split-face blocks, they're 1st wrought as 2 blocks joined along. Once these double blocks square measure cured, they withstand a splitter that strikes them with an important blade on the section between the 2 halves. This causes the double block to fracture and kind a rough, stone-like texture on one face of every piece.

The blocks withstand a cuber that aligns every block and so stacks them into a cube 3 blocks across by six blocks deep by 3 or four blocks high. These cubes square measure carried outside with a self-propelled vehicle and placed in storage.

e) Quality Management

The manufacture of concrete blocks needs constant observation to supply blocks that have the specified properties. The raw materials square measure weighed electronically before they're placed within the mixer. The bay water content within the sand and gravel is also measured with unhearable sensors, and therefore the quantity of water to be superimposed to the combination is mechanically adjusted to compensate. In areas with harsh temperature extremes, the water might withstand an excitation or heater before it's used.

As the blocks emerge from the block machine, their height is also checked with shaft sensors. Within the natural action oven, the temperatures, pressures, and cycle

Times Square measure all controlled and recorded mechanically to confirm that the blocks square measure cured properly, so as to attain their needed strength.

f) The Future

The simple concrete block can still evolve as architects and block makers develop new shapes and sizes. These new blocks promise to form building construction quicker and fewer costly, moreover as lead to structures that square measure a lot of sturdy and energy economical. a number of the attainable block styles for the longer term embrace the line block, that has cavities running horizontally moreover as vertically to permit access for plumbing and electrical conduits; the stacked siding block, that consists of 3 sections that kind each interior and exterior walls; and therefore the heat soak block, that stores heat to cool down the inside rooms in summer and warmth them in winter. These styles are incorporated into a epitome house, referred to as mode 2000, that is that the results of a cooperative effort between the National Association of Home Builders and therefore the National Concrete Masonry Association.

Pic 4: E-bricks placed in row for drying

VARIOUS E-BRICKS CASTED

E-bricks- 1

50 gm of cement , 125 gm of sand , 275 gm of Aggregates, 50 gm of e-waste are to be mixed with 40 ml of water are to be mould for 24 hour and to be kept for curing in water for 7 days which gives high strength, and those are to be useful for heavy building constructions.

Example - 2,

50 gm of cement , 150 gm of sand , 225 gm of Aggregates, 75 gm of e-waste are to be mixed with 40 ml of water are to be mould for 24 hour and to be kept for curing in water for 7 days which gives medium strength, which are useful for small building construction.

Example-3

40 gm of cement , 160 gm of sand , 225 gm of Aggregates, 75 gm of e-waste are to be mixed with 40 ml of water are to be mould for 24 hour and to be kept for curing in water for 7 days which gives medium strength, which are useful for small houses construction.

Example-4

Strength of e-brick varies according to changing the grades of concrete are shown in bellow table. (According to the Indian standard, M15, M20, M15, M25, M30, M35, M40, M40 are grade designations. It means a 150 mm cube cast from the concrete mix designed for the number mentioned is supposed to attain at least that many N/mm^2 at the end of 28 days. For example, M20 concrete is supposed to have a compressive strength of at least 20 N/mm^2, 28 days after casting)

Specification of mould use for casting of brick

i. Weight of mould without plate =2074 gm
ii. Weight of mould with plate = 2295 gm
iii. Height of mould=70 mm
iv. Width of mould=70 mm
v. Thickness of mould =12mm
vi. Area of mould= 1400 mm^2

Sr. No.	Material	Cement mortar brick (gm)	E-brick (gm)
1	Cement	75	50
2	Sand	150	125
3	Aggregate	300	275
4	e-waste	-	75
Total		550	550

Table 2: Quantity of cement, sand, aggregate and e-waste used (gm)

COMPARISON BETWEEN CEMENT CONCRETE BRICK AND E-BRICK

Cement concrete brick	E brick
25 gm more cement required i.e.33.34% more cement required	25 gm less cement required i.e.33.34% less cement required
25 gm more sand required i.e.16.67% more sand required	25 gm less sand required i.e.16.67% less sand required
25 gm more aggregate required i.e.8.34% more aggregate required	25 gm less aggregate required i.e.8.34% less aggregate required
20% more water required	20% less water is required

ADVANTAGES OF E-BRICKS

a) 33.34% less cement required
b) 16.67% less sand required

c) 8.34% less aggregate required
d) 20% less water is required
e) While manufacturing it was observed that 50 ml of water was required for the cement concrete brick, while manufacturing of e-brick 40 ml of water was required. This saves 10 ml of water per e-brick construction.

Different Bricks Commerce in Market:

- Burnt clay brick
- Fly ash clay brick
- Concrete brick
- Aerated concrete brick

Advantages of e-bricks over these bricks area unit as follow:

a) Burnt clay brick:

This kind of bricks is sometimes made of clay by burning. Continued use of clay bricks in industry can result in in depth loss of fertile high soil. This might be a devastating environmental hazard. But e-bricks area unit created from E-waste that protects setting. High demand for clay bricks would end in value hike of clay bricks. to stay the value of building materials in affordable vary, we should always choose sure various building materials like ash bricks and hollow or solid blocks whereas e-bricks use e-waste that doesn't cause hike in value of brick and saves construction value up to 20%-30%. .Making use of Burnt clay brick or different various building materials may cut down the speed of deforestation. Every year, a colossal space of forest is destroyed in search of soil for brick producing. No deforestation is completed throughout producing the e-bricks. Burnt clay bricks area unit factory-made victimisation recent superannuated technology and no quality testing facilities area unit accessible at producing website. Most bricks that area unit factory-made victimisation superannuated technology area unit inferior in quality with low compressive strength. They're not appropriate for multi-storey buildings.

No special techniques area unit needed for manufacturating of e-bricks. Producing method is easy and simple.

b) Ash clay Brick:

Once ash is mixed with clay for manufacturing brick that's ash clay brick. Poor quality usually includes a negative impact on the concrete. It will increase the permeableness, therefore damaging the building whereas just in case of e-bricks no negative impact is caused on concrete and permeableness doesn't increase. E-bricks cause no harm to assembling.

Some ash, those area unit created in power station area unit sometimes compatible with concrete, whereas some wants mineral extraction. Thus, it's substantially very important to use solely top quality ash to forestall negative effects on the structure of the building. Since no ash is employed in e-bricks there aren't any such needs. Bonding is lowering attributable to swish finish; additionally the standard of sand has to be checked. Bonding is robust in e-bricks and no use of 1:4 proportion of cement: sand is needed.

c) Concrete Bricks

The main raw materials for this kind of bricks area unit cement and sand. it's additionally referred to as mortar brick.

One of the key benefits concrete blocks hold over different construction materials is sturdiness. Concrete doesn't rot or mildew and isn't broken by insects or different pests. It’s additionally fireproof, and a concrete block wall may be used as a firewall between rooms or structures. Concrete block additionally resists wet, creating it ideal for wet environments, like a home close to the ocean or during a basement.

A major disadvantage of concrete block walls is that the value. The value of concrete fluctuates, however it's still costlier than lumber that is one in the entire foremost standard building materials. Whether or not the extra value of concrete blocks is well worth the benefits it offers depends on the wants of the home-owner, however the additional value may be associate degree obstacle for a few construction

comes. Value of e-bricks is a smaller amount as compare to the concrete blocks attributable to addition of e-waste and therefore creating it cheaper up to half-hour. Concrete block walls aren't well-known for having associate degree appealing look. This can be an obstacle when put next with nearly the other wall material. Drywall, as an example, is end in a position in many various textures, designs and colours. You'll paint concrete block, however you cannot modification the clean concrete's texture and pattern while not defrayal over you'd acquire fine quarried stone. Cement unleash the warmth of association throughout hardening and just in case of enormous structure it huge price whereas e-bricks use e-waste and therefore cement use in construction and unleash of warmth of association is scale back.

Using e-bricks will speed up the development method, giving them a bonus over concrete blocks, lumber and a few different materials. This might additionally ends up in a price savings for labour, since less construction time is critical. In some cases, looking on the scale of the wall and also the quantity of labour concerned, the general value of victimisation concrete blocks may be not up to different materials owing to the labour value savings.

d) Aerated Concrete Brick

Aerated concrete bricks area unit made of a mixture of sand, lime, water, mineral and cement. It provides structure, insulation, hearth and mildew resistance. Blocks, lintels, wall panels, floor and roof panels' area unit a number of the merchandise created with aerated concrete blocks. Aerated concrete blocks area unit product of inorganic materials, however they are doing not unleash negative wastes or contaminate the setting. However, the method of autoclaving the concrete needs lots of energy, which provides it associate degree environmental disadvantage. Since e-bricks area unit created from the electronic waste accessible on earth it helps in reduction electronic waste, therefore protective the setting.

Aerated concrete blocks area unit principally helpful in climates that have huge temperature fluctuations over the course of a 24-hour amount. This can be significantly for sunnier climates that yield a protracted amount of hot days and cold

nights. This can be owing to the high thermal mass that these blocks offer. The walls made of these blocks react the same as a sponge throughout the new sunny hours and so releases the warmth later once the temperature gets colder. No specific temperature and weather conditions area unit needed just in case of e-bricks. Aerated concrete blocks have a wonderful insulation performance of up to 10 times beyond that of standard cement blocks. This can be nice. However, when put next to standard block concrete and porous concrete, they're not as high in performance as materials like insulated concrete forms or structural insulated panels. Insulation performance of e-bricks area unit fare higher than that of aerated bricks. Aerated concrete blocks have open cells that area unit simply broken once exposed to the setting. This harm may be a result from junk or water. Professionals advocate employing a high permeable exterior end for the outside and a coffee vapour one for interior finishes.fly ash is that the residue that's left from burning coal. It’s somewhat sort of a glass powder that's fine in nature. No harm is caused to the e-bricks on exposure to setting.

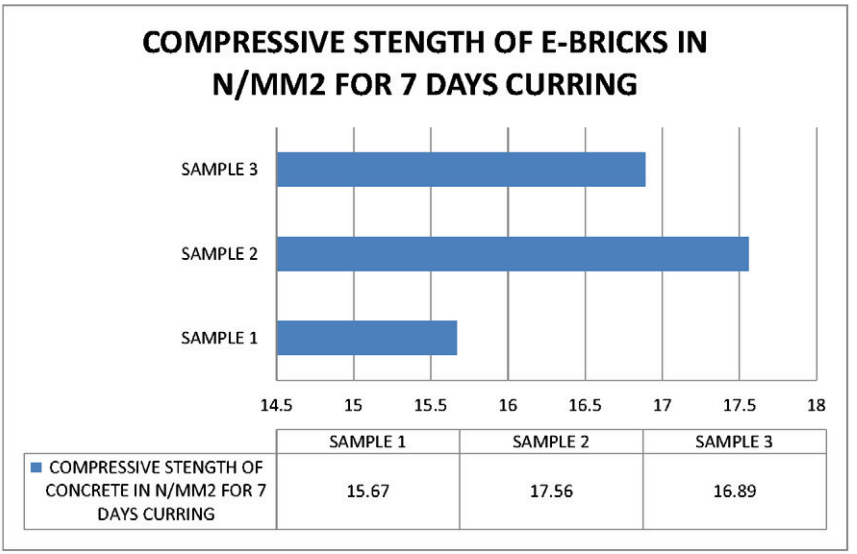
TESTS ON E-BRICK

a) COMPRESSIVE STRENGTH TEST RESULTS

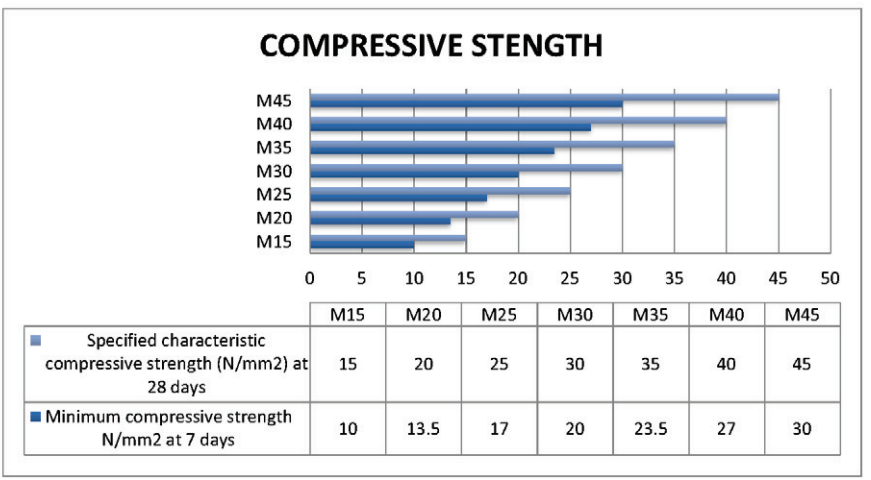
Compressive strength of concrete depends on many factors such as water-cement ratio, cement strength, quality of concrete material, and quality control during production of concrete etc. Test for compressive strength is carried out either on cube or cylinder. Various standard codes recommend concrete cylinder or concrete cube as the standard specimen for the test. American Society for Testing Materials ASTM C39/C39M provides Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens. From IS 2185 1979 part 1 permissible value for M15 grade for 7-days curing is 10 N/mm2Avg. Of three samples=16.70 N/mm2, which is higher than the normal value expected given in IS 2185.

ID Mark	Load (KN)	Area (mm2)	Compressive Strength (N/mm2)
Cement Block	64.60	5100	15.67
	75.64	5100	17.56
	86.50	5120	16.89
		Average value	16.70

Table 3: Load, area and compressive strength of samples



	SAMPLE 1	SAMPLE 2	SAMPLE 3
COMPRESSIVE STENGTH OF CONCRETE IN N/MM2 FOR 7 DAYS CURRING	15.67	17.56	16.89



	M15	M20	M25	M30	M35	M40	M45
Specified characteristic compressive strength (N/mm2) at 28 days	15	20	25	30	35	40	45
Minimum compressive strength N/mm2 at 7 days	10	13.5	17	20	23.5	27	30

Fig 4: Compressive Stength of E-Bricks In N/Mm2 For 7 And 28 Days Curring

b) WATER ABSORPTION TEST

Water absorption test on bricks are conducted to determine durability property of bricks such as degree of burning, quality and behaviour of bricks in weathering. A brick with water absorption of less than 10% provides better resistance to damage by freezing. The degree of compactness of bricks can be obtained by water absorption test, as water is absorbed by pores in bricks. Water absorption by bricks increase with increase in pores. So, the bricks, which have water absorption less than 3 percent, can be called as vitrified.

Sr. no.	Wt after 24 hours in gm	Initial wt in gm
1)	870	800
2)	876	800
3)	880	800

Table 4: Change in weight of sample

Calculation of Water Absorption of Bricks

Water absorption, % by mass, after 24 hours immersion in cold water in given by the formula,

$$W = \frac{M_2 - M_1}{M_1} X\ 100$$

Increase in wt for first sample is 8.75%; second sample 9.5%, Third sample is 10%. Average values is 9.42% which is less than that of 10% value given in IS 2185 hence e-bricks fill the all parameters given by IS 2185.

c) EFFLORESCENCE TEST

Method of determination of efflorescence test of bricks as per IS 3495 part 3

Procedure for efflorescence test bricks

1. Fill distilled water in shallow dish and place the end of the bricks in the dish. Water shall be filled such that bricks should be immersion in water up to 25 mm depth.
2. Place the whole arrangement in a warm well ventilated room until all the water in the dish is absorbed by the specimens and the surplus water evaporates.
3. To avoid excessive evaporation from the dish, cover the dish containing the brick with suitable glass cylinder.
4. When the water has been absorbed and bricks appear to be dry, place a similar quantity of water in the dish and allow it to evaporate as before. Examine the bricks for efflorescence after the second evaporation and report the results. Report and recording results Slight – When thin deposit of salts is covered over exposed area of the brick is less than 10 %.

APPLICATION OF E-BRICKS

Pic 5: E-bricks

Pic 6: Wall made up of e-bricks

Brick plays important role within the field of technology construction. Bricks area unit used as another of stones in construction purpose. Here some main uses of construction brick area unit given below:

1. Construction of walls of any size.
2. Construction of floors.
3. Construction of arches and cornices.
4. Construction of brick wall.
5. Making Khoa (Broken bricks of needed size) to use as Associate in Nursing mixture in concrete.
6. Manufacture of surki (powdered bricks) to be utilized in lime plaster and lime concrete.

7. USE OF ELECTRONIC WASTE AND CEMENT CONCRETE FOR ROAD CONSTRUCTION

Electronic waste is all over in today's life-style. It's was generated from rejected, discarded and improper electronic or electrical equipment results in formation of waste electrical and electronic equipments generally not used for any purposes. With the economic revolution, production of products started and electronic waste appeared to be a less expensive and effective material. Today, each important sector of the economy ranging from agriculture to packaging, automobile, building construction, been nearly revolutionized by the applications of communication or InfoTech has electronic wastes. Electronic waste in several type is found, that is harmful in nature. It's normally collected each urban and rural area. It creates stagnation of water and associated hygiene issues. Electronic waste hazard to the setting .Electronic waste may be reused profitably within the construction of road.

MATERIALS AND METHODS

The analysis can have 2 varieties of specimens, the mixture of Electronic waste Electronic waste ash and cement road pavement and also the plain cement road pavement. To be able to develop such specimens, totally different processes shall be done together with the testing processes the specimen may bear. Fly Electronic waste ash, cement, aggregates and water are the materials of the primary specimen and also the same materials required for the second specimen however this point Electronic waste ash isn't enclosed. These materials square measure collected or gathered initial and also the use of shovels, the materials are mixed alongside sure proportioning. By the time the materials square measure mixed, the oblong and cylindrical molds should already be ready. But first, take samples from the mixture which is able to be used for the slump take a look at. When the blending method, the mixture are placed within the molds. a complete of twelve rectangular specimens and twelve cylindrical specimens square measure aiming to created, six in every sort and 2 specimens in every sort square measure aiming to be tested for its compressive and tensile stress.

Then the specimens bear the process for the aim of association. Throughout the seventh, 14th, and twenty first days, the molds are removed, and by this point, the specimens are tested. Take a look at results are obtained, so interpretation should be done.

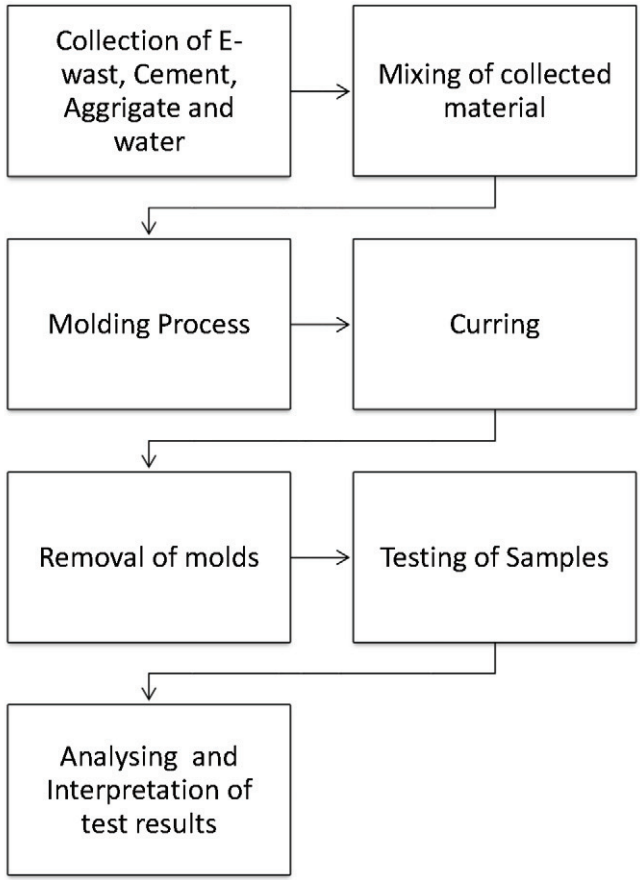


Fig 5: Schematic Diagram of Electronic waste and Cement Concrete pavement Construction and testing.

The analysis is all concerning developing ash for concrete road pavement. Completely different tests are going to be done in order that the investigator might differentiate the projected project from a standard cement-concrete mixture. The projected projects are going to be electronic waste ash and cement concrete mixture and plain cement concrete mixture. 1st a part of the analysis would be the gathering or gathering of the materials. The materials to be utilized in this analysis square measure sand, gravel, cement, ash and water. The gravel may be a combination of 3/7", 3/5" and 1/3" sizes. Relative density of ash would be obtained by victimisation pycnometer. The determination of relative density will verify the share of void. The consistency of the mixture is then checked by slump test. If the slump of the mixture is larger than the desired, then modification the mixture proportioning.If the flexural and compressive strength of ash and cement specimens' square measure on top of the cement specimens, then the mixture of ash and cement is additional economical in terms of construction compared to the plain cement. On the opposite hand, if it's lower, the mixture proportioning should be modified.

RESULTS AND DISCUSSION

a) COMPONENTS OF PLAIN CONCRETE AND E-WASTE ASH AND CEMENT CONCRETE

The physical and chemical properties of materials employed in this study are listed in Table 1. The ash was characterised as a fine, powdery particle that includes a high lime (CaO) content that helps act as a binder to carry the aggregates elements along. The sand was ascertained as a porous rock consisting grain of sand that has obtainable size employed in construction with the sieve analysis of 160 um, 550 um and 1.15 um. Within the gravel, there's a tiny low rock fragment that includes a size of 10 mm, 13.5 mm and 18.5 mm that is created of crystalline oxide whereas cement was characterised as greyish powder manufactured from rock.

Materials	Physical property	Chemical property
Electronic waste ash	Powder particles containing fine particles, spherical in shape. Either solid or hollow and mostly glassy in nature.	Polyethylene, silicon, glassy compound, copper, aluminium components in combination with other non-metals.
sand	Porous rock consisting grains of sand or fine aggregate it has an available size of 160 um, 550 um and 1.15 um	Clay and silica which gives characteristic colours for cementitious substance
Gravel	Small pebbles of rock fragments has coarser than sand have an available size of 3/7", 3/5" and 1/3"	Crystalline silica
Cement	Greyish powder	Limestone or chalk clay which has characterized as paste component

Table 5: Physical and Chemical Properties of Materials Used.

The mix proportion of specimens is shown in Table 2. The proportion used is 1:2:4 specified for concrete pavement. Volume of each raw material is taken per m3 of concrete mixture.

Raw Materials	Volume per cubic meter of concrete mixture	
	Plain cement concrete	Electronic waste ash and cement concrete
Cement	0.15 m^3	0.1 m^3
Sand	0.30 m^3	0.30 m^3
Gravel	0.55 m^3	0.55 m^3
E-waste ash	-	0.05 m^3
Total Volume	1.0 m^3	1.0 m^3

Table 6: Mix Proportion of Specimens

The mix proportion of plain cement concrete specimen is shown in Figure 2. The proportion used is 1:2:4 such for concrete pavement. The chart represents one metric capacity unit of plain cement concrete mixture divided into proportion of raw materials used. The specimens were shaped in rectangular molds.

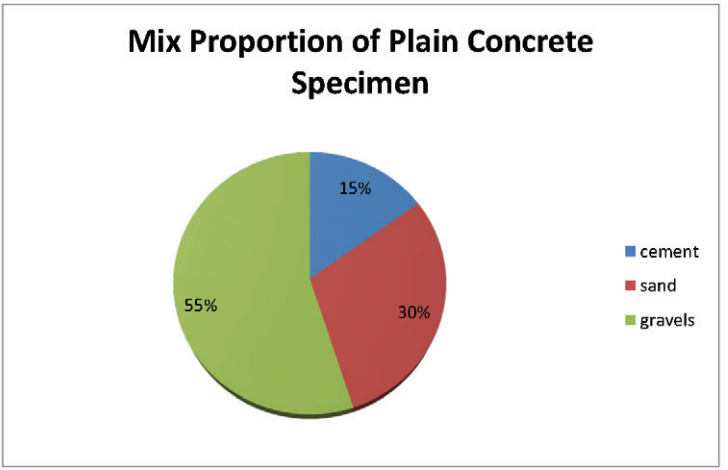


Fig 6: Mix Proportion of Plain Concrete Specimen

The actual weight and dimension of rectangular specimens used in this study are listed in study are listed in Table 3. The specimen was cast in a rectangular mold approximately 160 mm. x 160 mm. x 500 mm. Each specimen is weighed before testing in the universal testing machine.

Days	Specimen	Length (mm)	Width(mm)	Height (mm)	Area (mm^2)	Weight (kg)
Plain Concrete						
7	A	500	155	140	21700	25.0
	B	500	156	139	21684	24.8
	C	497	153	136	20808	23.5
14	A	496	154	138	21252	25.6
	B	495	152	140	21280	23.9
	C	499	155	139	21545	24.8
E-waste ash and Cement Concrete						
7	A	498	153	138	21114	25.1
	B	500	156	140	21840	24.7
	C	496	155	138	21390	23.9
14	A	500	154	139	21406	24.6
	B	499	153	137	20961	25.1
	C	497	155	140	21700	24.9

Table 7: Actual Weight and Dimension of the Rectangular Specimens

b) MECHANICAL PROPERTIES OF PLAIN CONCRETE AND E-WASTE ASH AND CEMENT CONCRETE

Number of Trails	1	2	3
Weight of pycnometer + Water (g) Wa	69.7	68.9	69.5
Weight of pycnometer + water + E-waste ash (g) Wb	72.3	71.5	72.6
Weight of dry e-waste ash Wo	11	10.8	10.7
Specific Gravity Wo/Wo+(Wa-Wb)	1.30	1.32	1.48
Average Specific Gravity	1.37		

Table 8: Specific Gravity Test Results of e-waste Ash

The comparative specific gravity result of cement and E-waste ash is shown in Table 4. The specific gravity of fly ash is lower than that of cement. Specific gravity is 3 while fly ash is 1.37**.**

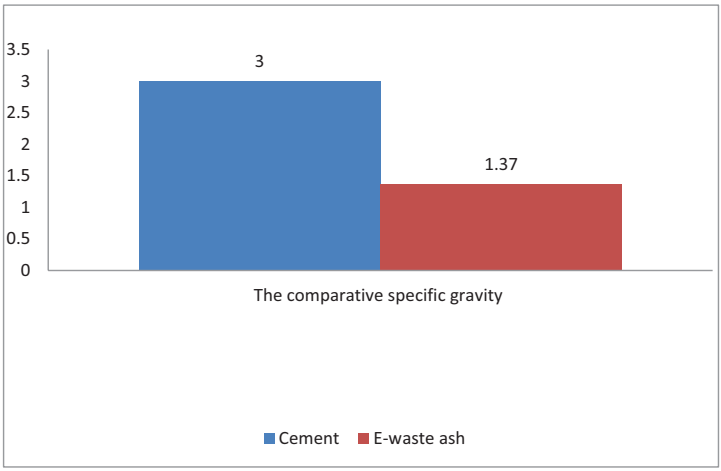


Fig 7: Comparative Specific Gravity Test Results of Plain Cement and E-waste Ash and Cement Concrete

As shown in Figure 5, the slump test result of plain cement concrete and e-waste ash, cement concrete. The consistency of mixture is tested by the slump test. By comparing the results it can be seen that concrete with more than 30% e-waste ash settles at a large amount than the plain concrete.

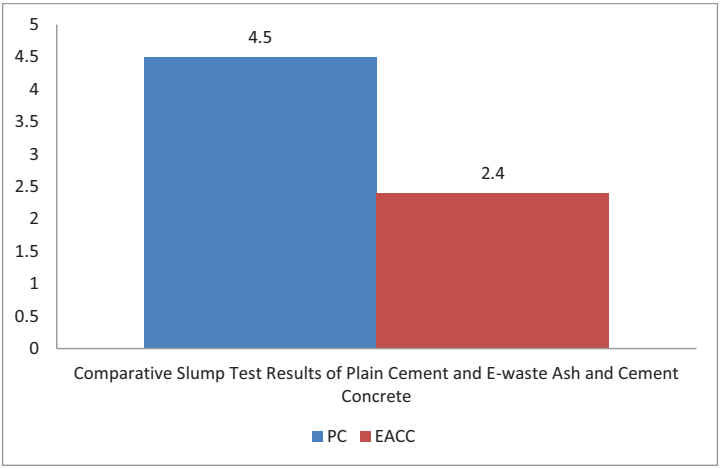


Fig 8: Comparative Slump Test Results of Plain and E-Waste Ash And Cement Concrete

The flexural strength of specimen is shown in Table 6. The flexural strength result of E-waste ash-cement concrete specimen is higher than the plain cement concrete. At the first testing, 7 days of curing, the E-waste ash cement concrete achieved more than twice the strength of the plain cement concrete. And until the last testing, 14 days of curing, still the E-waste ash-cement concrete more than twice the strength of the plain cement concrete.

Time (days)	Plain Concrete		E-waste ash and Cement Concrete	
	Ultimate Load capacity (KN)	Ultimate Strength (Mpa)	Ultimate Load capacity (KN)	Ultimate Strength (Mpa)
7	8.50	0.22	8.47	0.21
	4.78	0.45	5.70	0.40
	8.90	0.41	6.50	0.38
14	10.22	0.45	8.45	0.40
	9.98	0.43	11.52	0.56
	8.98	0.41	10.4	0.48

Table 8: Flexural Strength Test Result of Rectangular Specimens

The flexural and compressive strength versus the hardening amount diagram is shown in Figures 5, severally. By scrutiny the results between plain concrete and E-waste ash cement concrete specimen, it will be found that the strength of e-waste-ash cement concrete develops at a quicker rate than the plain cement concrete specimen inside seven days. E-waste Ash will increase the speed of hardening of the concrete mixture. E-waste Ash with chemicals reacts with lime created by the association of cement and water, thereby isolation their voids that permit the movement of wetness through the concrete.

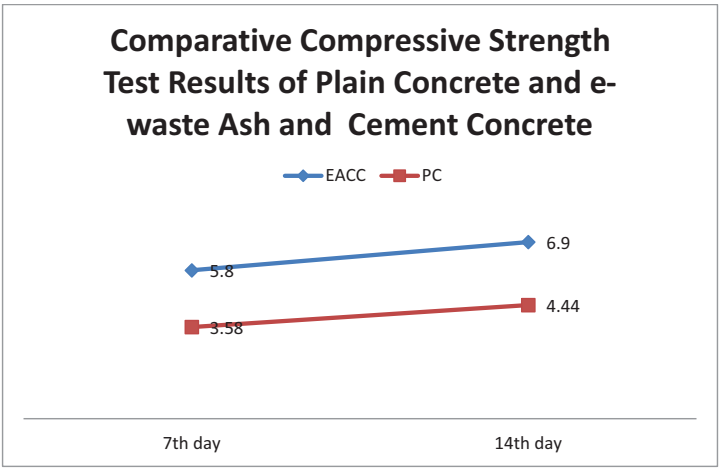


Fig 9: Comparative Compressive Strength Test Results of Plain Concrete And E-Waste Ash, Cement And Concrete

IMPACT OF E-WASTE ASH

a) SPECIFIC GRAVITY:

E-waste ash encompasses a lower unit weight, which implies that on a gram per gram basis, ash contributes roughly additional plain concrete volume of building material per gram versus cement. The larger the share of ash within the paste, higher lubricated the aggregates are and therefore the better the concrete flows.

b) CONSISTENCY:

E-waste ash reduces the number of water required to supply a given slump. The spherical form of the ash particles and its dispersive ability give water reducing characteristics.

c) FLEXURAL STRENGTH:

E-waste ash continues to mix with the lime in cement, increasing flexural strength over time. It helps the concrete mixture come through its most strength quicker.

d) COMPRESSIVE STRENGTH:

E-waste ash continues to mix with the lime in cement, increasing compressive strength over time. It helps the concrete mixture come through its most strength quicker.

e) RATE OF CURING:

E-waste ash will increase the speed of hardening of the concrete mixture. E-waste ash with chemicals reacts with lime made by the association of cement and water, thereby separation their voids that enable the movement of wetness through the concrete

Pic 6: Processes Involved In Making E-Waste and Cement Concrete Pavement

For a given set of materials in an exceedingly concrete mixture, there is also a cement content that produces a most concrete strength. So as to get higher strengths one in all the foremost sensible ways is that the use of ash within the mixture e-waste ash proportioned victimization the ideas prompt by this paper has been shown to present strengths considerably on top of those available by a cement concrete. The tactic of proportioning projected during this paper permits for the employment of a large vary of E-waste ashes, it's been found that it's not the standard of e-waste ash that's necessary however the variation of that quality a couple of mean. Sensible concrete are often proportioned containing an occasional quality ash as long as that quality doesn't vary well. The best advantage of the employment of e-waste ash in concrete is that the flexibility that it permits with the choice of the mixture proportions. By use of the ash, a large vary of potential mixtures are often investigated for any specification. For every state of affairs it's potential to decide on either very cheap price mixture, or the best to put, or the foremost sturdy. E-waste ash contains a lower unit weight which implies the larger the share of ash within the paste, higher greased the aggregates are and therefore the better the concrete flows and continues to mix with the lime in cement, increasing compressive strength over time. It helps the concrete mixture bring home the bacon its most strength quicker. This shows that ashes are often used effectively as material in concrete road pavement.

IMPROVEMENT OF BLACK COTTON SOIL PROPERTIES USING E-WASTE AND LIME

Clayey soil expands once they are wetted and shrink once dried. These soils are known as expansive soil or swelling soil. Attributable to swelling nature, the BCS is problematic for construction. It swells and shrinks to a fault with the amendment of water content attributable to presence of fine clay particles that swell, once they are available in contact with water, leading to alternate swelling and shrinking of soil attributable to that differential settlement of structure takes place. The black cotton soil cowl the plateaus of geographic region, Saurashtra, Malwa, Madhya Pradesh, Chhattisgarh and extend in South-East direction on Godavari and Krishna valleys in India (approximately 350000 km^2). Within the twentieth Century, the knowledge and communication revolution has brought monumental changes within the manner we have a tendency to organize our lives, our economies, industries and establishments. These spectacular developments in times have beyond question increased the standard of our lives. At an equivalent time, these have LED to manifold issues as well as the matter of huge quantity of unsafe waste and alternative wastes generated from electrical product therefore increasing the number of E-waste day by day. E-Waste successively deals with the disposal techniques. Exercise is one in all the disposal techniques, however if it's not recycled then it's to be land stuffed in an exceedingly close disposal facility. Thus by taking this time in thought we've adopted. The Use of E-Waste‟, for up the steadiness of the soils. In construction of any structure engineering properties of soils is that the necessary issue to be thought of. As soil conjointly incorporates a relation with water and therefore stabilising the soil can increase the speed of tolerance of water into the soil therefore creating it quite ideal for engineering purpose. Soil stabilization might increase the amount of soil which can end in less consolidation. Thus, when addition of E-waste improvement within the soil properties may be seen this ends up in soil stabilization.

MATERIALS AND METHODS

a) BLACK COTTON SOIL

The materials used for the tests embrace the black cotton soil and E-waste. The soil was procured from farm in M.I.D.C area, Yavatmal District. Manual labour was used for the procured of soil. Larger size lumps were countermined with rammers. Then it absolutely was large laboratory drier dried for twenty-four hours at 110 °C to 120 °C.

Sr. No.	PROPERY	VALUE
1.	Dry density (ϒd)	14.5 kN/m3
2.	Grain Size Distribution (IS 2720: Part 4) Gravel Sand Clay	 0.58% 14.22% 88%
3.	Liquid Limit (WL) (IS 2720: Part 5)	81.5%
4.	Plastic Limit (WP) (IS 2720: Part 5)	60.7%
5.	Plasticity Index (IP) (IS 2720: Part 5)	19.23%
6.	IS classification of soil	CH or MH
7.	Specific Gravity	2.38
8.	Compaction (IS 2720: Part 8) Maximum Dry Density Optimum Water Content	 15.8 kN/m3 27%
9.	Direct Shear Test (IS 2720: Part 13) Cohesion (C) Angle of Friction (Φ)	 48 kN/m2 10 degree
10.	Unconfined compressive strength (IS 2720: Part 10)	12.23 kN/m2
11.	California Bearing Ratio CBR (IS 2720: Part 16) Unsoaked	 18.65%
12.	Free Swell Index (IS 2720: Part 40)	72.68%

Table 9: Properties of black cotton soil

b) E-Waste

Electronic waste is also represented because the discarded electronic equipments like mobile phones, computers, social unit appliances that fail or aren't any fitter for its originally meant use. Everyday advancements in technology have resulted in quick growing surplus of electronic waste round the globe. E-waste was collected from dump yard at Yavatmal.

c) WATER

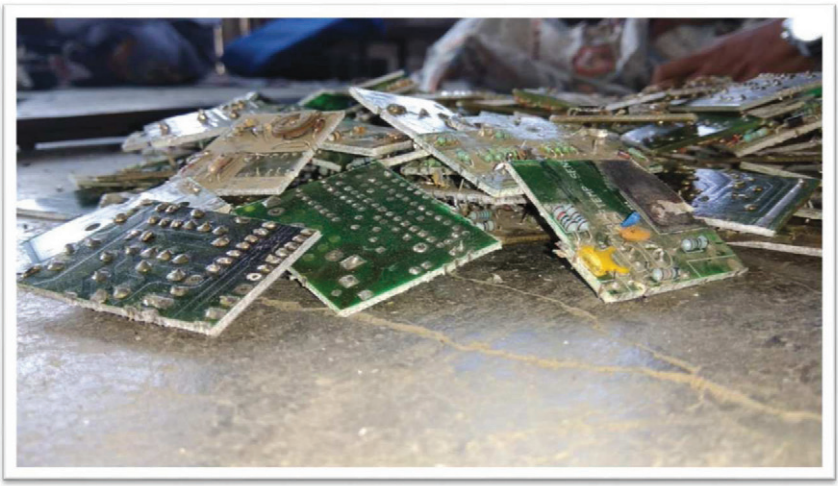
Water may be a vital ingredient of environmental-friendly brick blocks victimization e- waste because it's involved at intervals the chemical change with cement. Potable water need to be used for mixing the cement, sand and e-waste. It needs to be free from organic matter and additionally the pH value ought to be between 6 and 7.5.

d) LIME

Lime could be a calcium-containing inorganic material within which carbonates, oxides and hydroxides predominate. These materials square measure still utilized in massive quantities as building and engineering Materials (including sedimentary rock merchandise, concrete and mortar) and as chemical feedstock's, and sugar processing, among other uses. The rocks and minerals from that these materials square measure derived, usually sedimentary rock or chalk, square measure composed primarily of carbonate. They will be cut, crushed or fine-grained and with chemicals altered. "Burning" and, through resultant addition of water, into the less caustic (but still powerfully alkaline) calcium hydroxide or calcium hydrate (calcium hydroxide, Ca(OH)2), the method of Which is named slaking of lime.

Sr. No.	Properties	Values
1	Specific Gravity (G)	2.8 Kg/m3
2	Liquid Limit (WL)	27 %
3	Plastic Limit (WP)	25 %
4	Shrinkage Limit (WS)	6.5 %
5	Sieve Analysis- Coefficient of curvature (Cc)	0.56

Table 10: Index properties of lime



Pic 7: E-Waste Collected From Dump-Yard Used In Soil Stabilization.

Laboratory tests were conducted on black cotton soil with and while not E-waste. so as to gauge the development in strength properties, physical and strength performance tests namely; Atterberg's Limit, relative density, Compaction check, Unconfined Compressive check, American state Bearing magnitude relation (CBR) and Direct Shear check were performed.

In this project The project have conducted varied experiment to seek out the stabilisation of the sub base victimisation the economic waste and cement the varied

Take a look at conducted to seek out the stabilisation of the sub base supported the ASTM procedure area unit listed below:

I. Liquid Limit (ASTM D 4318 – 05)
II. Plastic Limit (ASTM D 4318 – 10e)
III. Sieve Analysis (ASTM D 6913)
IV. Specific Gravity (ASTM D 6473)
V. Standard Proctor Compaction Test (ASTM D 1557)
VI. Unconfined Compressive Strength (ASTM D 2166)
VII. California Bearing Ratio Test (ASTM D 1883)

MECHANICAL PROPERTIES

a) STANDARD PROCTOR COMPACTION TEST

Samples	Optimum moisture content in %	Dry density in g/cc
sample 1	9.5	1.732
sample 2	10.7	1.856
sample 3	8.56	1.955
sample 4	12.50	1.865
Sample 5	7.32	1.888

Table 11: Standard proctor compaction test

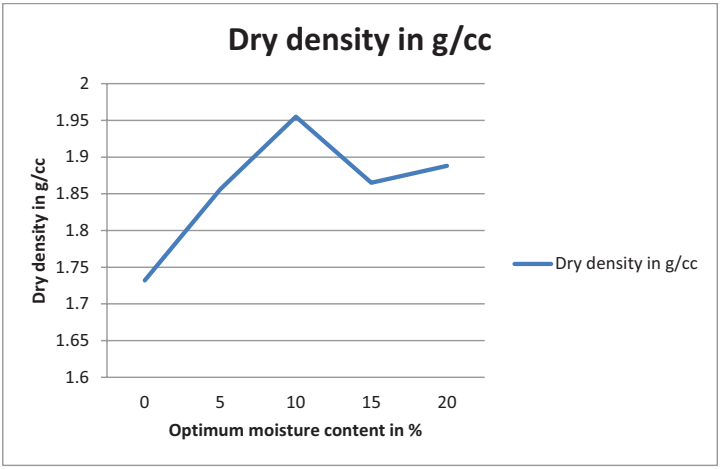


Fig 10: Water content in % Vs Dry density

b) UNCONFINED COMPRESSIVE STRENGTH

Location	Unconfined compressive strength in kN/m^2
Location 1	68
Location 2	190
Location 3	205
Location 4	155
Location 5	175

Table 12: Unconfined compressive strength

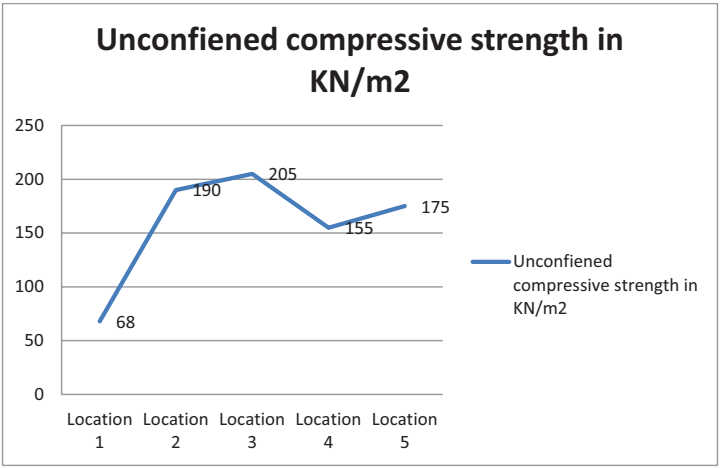


Fig11: Unconfined compressive strength

c) CALIFORNIA BEARING RATIO TEST

Location	Bearing Ratio in %
Location 1	27
Location 2	38
Location 3	19
Location 4	18
Location 5	28

Table 13: California Bearing Ratio Test

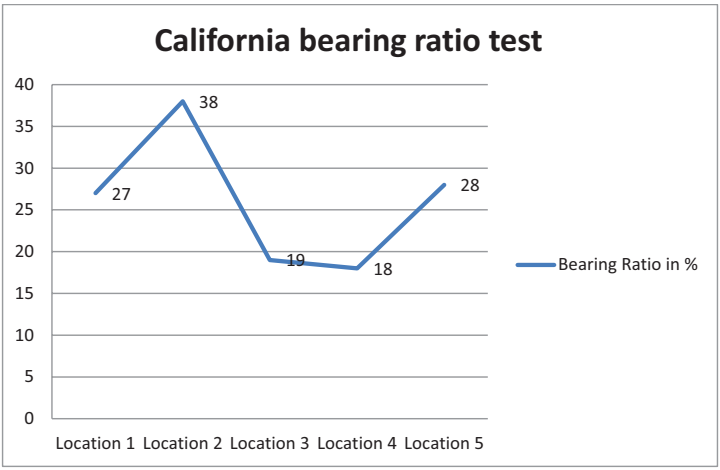


Fig 12: California Bearing Ratio Test

Based on the experimental work distributed within the gift study the subsequent conclusions are drawn for investigation of black cotton soil properties.

1. Relative density and liquid limit raised until five-hitter addition of E-waste however belittled for 8 May 1945 addition of E- waste and plastic limit suddenly raised for five addition of E-waste.
2. Once playing direct shear check, there's Associate in Nursing improvement in angle of internal friction (Φ) because the proportion of E-waste will increase owing to reduction in cohesion between soil and E-waste and increase in friction, as a result the bearing capability of soil conjointly will increase.
3. The unconfined compressive strength of black cotton soil rose with a mean two.41 kN/m2 for fastened proportion of E-waste.
4. MDD raised and OMC belittled for twenty-four and five-hitter because the voids within the soil were stuffed by E-waste which ends in dense soil. MDD bit by bit belittled for 8 May 1945 dose of E-waste.
5. The cosmic microwave background price goes on increasing with reference to addition of E-waste.

6. it's discovered that free swell index values of the soil have belittled with increase in E-waste.

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