"Design And Fabrication of Machine for multiple Brick Manufacturing from waste material"

2019-2023

Submitted by

Muhammad Naqeeb	UET/SCET-19F-ME-040
Ahmed	UET/SCET-19F-ME-034
Abdul Basit	UET/SCET-19F-ME-043

Supervisor:

Engr. Fawad Yousaf Malik

DEPARTMENT OF MECHANICAL ENGINEERING SWEDISH COLLEGE OF ENGINEERING AND TECHNOLOGY, WAH CANTT

(Affiliated with University of Engineering & Technology Taxila)

Aug,2023

ABSTRACT

Plastic is one of the daily increasing useful as well as a hazardous material. At the time of need plastic is found to be very useful, but it, its simply thrown away, creating all kinds of hazards. Plastic is not bio degradable, so it will continue to be hazardous for more after being used than centuries. The idea of the paper is to find a use for this waste plastic scrap into something beautiful. The mixing of plastic with sand to create a new type of brick was put into thought. Since it is uneconomical to approach a local brick manufacturer for lending the machine, we designed and fabricated a brick manufacturing machine in the nearby engineering workshop. The machine was designed so as to fulfil our need for manufacturing brick in small quantity. The plastic scrap used was leftover pieces of bottles, cans etc. So, as a trial the plastic was chopped into small pieces and heat was given, and sand was added in suitable proportions. The paste only contain sand and plastic. After thorough mixing, the paste was poured into a rectangular mold with standard brick dimensions. The paste took only 20 minutes to settle and harden. Cold of the set was done by cold water and after 5 more minutes the brick was extracted from the mold. It had a dark grey texture and increased weight by the initial analysis. Local brick testing methods were conducted such as free fall of the brick and scratch test. In both of tests, our brick showed increased strength. The brick was then subjected to compressive test, water absorption test and efflorescence test. The results showed, that the Plastic Composite Brick was efficient than the clay brick and cement brick.

Design And Fabrication of Machine for multiple Brick Manufacturing from waste material

A thesis submitted for partial fulfillment of the requirements for the Degree of

Bachelor of Science

in

Mechanical Engineering

____________________	____________________
Project Supervisor	Project Coordinator
Engr Ammar Naseer	Engr. Hassan Kazmi

____

HOD

Mechanical Engineering Department

DEPARTMENT OF MECHANICAL ENGINEERING

SWEDISH COLLEGE OF ENGINEERING AND TECHNOLOGY, WAH CANTT

(Affiliated with University of Engineering & Technology Taxila)

Aug,2023

Declaration:

We declare that the work contained in this thesis is my own, except where explicitly stated otherwise. In addition, this work has not been submitted to obtain another degree or professional qualification.

____

Muhammad Naqeeb

____

Ahmed

____

Abdul Basit

Acknowledgment

In the name of Allah, the Most Gracious, The Most Merciful "All praises be to Allah, Lord of the worlds, Owner of the Day of Judgment, the (alone) we worship; Thee alone we ask for help, show us the straight path, the path of those whom toughest favored; Not (the path) of those who earn Thine anger nor of those who astray". (Al- Quran)

First of all, thanks to Allah Almighty. We would like to express our heartfelt gratitude to our supervisor **Engr. Ammar Naseer** for his kind supervision, moral support, valuable discussions, guidance and encouragement during our experimentation and writing up of research work. We also acknowledge the guidance from **Engr. Ammar Naseer**

We want to express our thanks to University of Engineering and Technology, Taxila for giving monetary help during our studies.

Finally, we are thankful to our beloved Parents and siblings for their never-ending supportand love through our thick and thin.

Dedication

We dedicated this report to God Almighty for His unlimited grace, consistent love, immeasurable faithfulness, and for sparing our life throughout the period of our studies program. Secondly to our beloved adorable parents for their undiminished support and unquantifiable assistance throughout the whole exercise and also our beloved friends who always encourage us to be strong.

Table of Contents

List of Figures:

List of Table:

Abbreviations

BIA: brick business Association

CBRI: Central Building Research Institute

N/mm: Newton per Square Millimetre

PLCs: Programmable Logic Controllers

ESPs: Electrostatic precipitators

IIOT: Industrial Internet of Things

PET: Polyester strapping

CSEB: Compressed stabilized earth blocks

KN: kilo newton

SCADA: Supervisory Control and Data Acquisition.

CEB: compress Earth bricks

DC: direct current

ASTM: American Society for Testing Materials

PET: polyethylene terephthalate

MPA: mega pascal

mPA: milli pascal

eqn: equation

kW: kilo watt

lpm: litter per minute

CHAPTER 1
INTRODUCTION

1.1. Introduction:

No construction is feasible without bricks. Since several centuries brick creating has been practiced by citizenry. Presently, we have two types of bricks manufacturing simply created by machines which is new technology, and clay brick which is made by hand which is old technology. Different types of automatic machines use completely different techniques to form bricks. The raw materials employed by the machines for creating interlocking bricks area unit ash, sand lime, iron oxide, lime sludge, quarry wastes etc.

The focus of this project is on the assembly of bricks machine, specifically interlocking bricks which supply a speedier, price effective, environmentally sound different to traditional walling materials. It supported the principle of compaction of a lean concrete combine to form an everyday uniform, high performance masonry unit. Concrete Block Technology will be simply custom-made to suit special wants of users by modifying some style parameters like combine proportion, water to cement quantitative relation and type of production system. It's a good means of utilizing wastes generated by stone crushers, production and stone process units. The technology has high potential in area units wherever raw materials are simply on the market. The new technique in manufacturing this interlock brick will generate an extremely profitable business for small and tiny scale art fact producers and construction corporations. The marketplace for this kind of wall in Pakistan isn't growing at a speedy rate, their area unit demands in construction industries because of low production rate that mirror the value of brick itself.

1.2. Aims and Objectives:

The aim of the project is to use the plastic waste and many other waste components like fly ash. The scope of project is clearly outlining the particular field of the analysis and make sure that the complete content of this proposal is confined the scope. This project is begun with the literature review on product specification so as to satisfy the project objectives. Once getting the merchandise specification, this project is finished base on the scope below; Project can target interlocking brick creating machine solely. Planning the inter-locking brick creating machine that fulfill the project objective. Machine style to suit the regular interlocking bricks. The project goes till detail style of interlocking brick creating machine. The main output of this project is to provide the analysis of market and cost Fabrication of machine. The scope of labour will be delineated in terms of flow chart as per the subsequent**.**

1.3. Historical Background:

Bricks were preponderantly utilized in the Indus vale Civilization. In fact, the civilization was initial discovered once ancient bricks getting used to make Railway ballast came to the notice of a passing archaeologist established that in the “cave era”, man lived inside sturdy rock walls and roofs that were Natural and safe. Slowly captive on to homes engineered with mud walls that were a lot of versatile and convenient. Later came sundried bricks and stones. Each new modification has been meshed towards shapes that were higher outlined and handier for construction Down the ages, there are varied attention-grabbing historic and cultural references to bricks. Over time, bricks have appeared, gained prominence, lost importance then come back to the Fore front once more with varied forms of design. Burnt bricks were utilized in ancient Indian, Sand create blocks are walling materials made of a binder (typically Portland cement), sand during a magnitude relation of 1:8:1 cement:sand:water. Four masonry is usually an extremely sturdy sort of construction, Babylonian, Egyptian and Roman civilizations They’re still getting used as filler Materials for framework structures still on construct load bearing structures. Re-emergence of brick creating may be attributed to bricks. Bricks is that the form for associate degree Association of 5 major rising national economies: Brazil, Russia, India, China and South Africa. What’s peculiar to every of those nations is rising population and high demand. For reasonable housing schemes to produce shelters to the grouping. Current trends in brick creating According to the brick business Association (BIA), over the past few years, brick Manufacturers have another, and continuing to feature, new and a lot of technological enhancements to their product lines in response to or in several cases, anticipating of client demand. As a results of this, varied corporations, organizations and countries have come back up with their own set of technologies for brick creating. Prior to the mid-1800s [1], folks created bricks in little batches, wishing on comparatively in efficient Firing strategies. One in all the foremost wide used was associate degree open clamp, during which bricks were placed on fireplace a hearth below a layer of dirt and also the fire died down over the course of many weeks. Such Methods bit by bit became obsolete once 1869[6], once the Hoffmann oven was unreal in Germany. Higher suited to the manufacture of enormous numbers of Bricks, this oven contained a series of compartments through that stacked bricks were Transferred for pre-heating, burning, and cooling.

1.4. Methodology:

This chapter consists of styles for completing product development conditioning. The applied styles, which are well- structured, give a step- by- step approach to complete the task of this design. Grounded on these methodologies, there are three advantages anticipated. Originally, the decision processes are fully made, reducing the possibility of moving forward with unsubstantiated opinions. Secondly, by acting as "roster" of the crucial way in a development exertion and ensure that the important issues aren't forgotten. Third, these structured styles are largely tone- establishing; in the process of executing the system, the record of the decision- making process can be used for future reference.

Development process demands the collaboration among functions of the integrative development styles, which is called as the front- end process. The frontend process generally contains numerous interrelated conditioning similar as; Relating client to fulfill their needs.

1.4.1 Identifying customer needs:

The thing of this exertion is to understand clients' requirements and to effectively communicate them for the optimization job of current machine used. The affair of this step is a set of precisely constructed client need statement, organized in a hierarchical list, with significance weightings for numerous or all of the requirements. The data are attained substantially by canvassing the stoner of interlocking slipup making machine and also from the observation of the current machine design. The identification of the current machine design is really helpful in furnishing the target specification.

1.4.2 Establishing target specifications:

Specifications give a precise description of what a product has to do. It's the restatement of the client needs into specialized terms. Targets for the specifications are set beforehand in the process and represent the companion for generating the idea of machine revision. Latterly these specifications are meliorated to be harmonious with the product conception. The affair of this stage is a list of target specifications.

1.4.3 Concept generation:

The thing of conception generation is to completely explore the space of the product generalities that may address the client needs. Concept generation includes a blend of external hunt, creative problem working, and methodical disquisition of the colourful result fractions. The result of this exertion is three generative generalities, each generally represented by a sketch and brief descriptive textbook. Our machine will be able to produce one brick per cycle.

1.4.4 Concept selection:

Concept selection is the exertion in which the generated generalities are anatomized and successionally excluded to identify the most promising conception(s). The process is using the weight age value and a given marks. The loftiest score can be considered as a chosen conception. Several duplications may initiate fresh conception generation and refinement. After assessing three generated generalities in former we will select the raw material for brick.

1.4.5 Setting final specification:

The target specifications set before in the process are redefined after a conception has been named and tested. At this point, the specific values of the criteria reflecting the constraints essential in the product conception, limitations linked through specialized modelling, and trade- offs between cost and performance.

1.4.6 One-man operation:

The machine operation must be handled by a single worker only (one man operation).

1.4.7 Simple operation process:

Machine is operated by a simple on/ off button only and no complicated process in producing the interlocking bricks.

1.4.8 Livery pressure distribution:

Compression pressure is slightly distributed and applied on the slipup during compacting process.

1.4.9 Easy Penetrated for conservation:

Machine can be fluently maintained and fluently penetrated for conservation area

1.4.10 Safe to handle:

Standard operation procedure is one of the factors that make the machine running is safe.

1.4.11 Low-cost machine:

The cost to make this machine must be reasonable and within the capability of entrepreneurs so that the return of investment time can be docked.

In reflecting on this project all objectives were successfully met. The design product engineered that help a user to maximize the production of the interlocking bricks in the minimum cost. Whereby the current product doesn’t have a simple interlocking making machine that having an automatic working system feature.

Throughout the project the work progress is kept on track by using project management tools such as a Gantt chart. Time management was a very crucial portion of the project because a lot of work had to be done in a short period of time. The team learned that when a task for a project is completed, such as concept selection, even if a table has been constructed it is a good idea to write a summary about where it came from, how it was made/achieved and what the results were, that day so when a final report is being put together nothing is forgotten about past tasks

1.5. Work Schedule Plan:

The total duration of the project is 12 months which is further divided into following further phases.

1.5.1. Phase 1(Collection of relevant literature and data):

The estimated time for this phase is 3 months in which different literatures will be studied.

1.5.2. Phase 2 (design)

Design will perform on solid work in 3d. The estimated time for this phase is 2 months

1.5.3. Phase 3 (Fabrication)

We have done the fabrication keeping in mind the calculation. The estimated time for this is 3 months

1.5.4. Phase 4(Experimental Work):

Experiments will be performed on test rigs for analysis under fretting fatigue. The estimated time for this phase is 4 months.

1.5.5. Phase 5(Compilation of Results):

The Estimated time for this will be 2 Months.

1.5.6. Phase 6(Analysis of Data):

The estimated time for this will be 3 months.

Table 1.1: Work Schedule plane

PHASE	JUL 2022	AUG 2022	SEP 2022	OCT 2022	NOV 2022	DEC 2022	JAN 2023	FEB 2023	MAR 2023	APR 2023	MAY 2023	JUN 2023
Literature Collection												
Design												
Fabrication												
Experimental Work												
Completion of Result												
Analysis of Data												

CHAPTER 2
Literature review

2.1. Manufacture of Building Bricks by A Semi-Mechanized Process:

(NC Majumdar, n. C., wadhwa, s. S, & hiralal, e.S) (1969)

He concluded that Numerous lakhs of bricks have already been created by the CBRI factory that is already in use. To fulfil the demands of contemporary building methods, research is currently being done to develop the manufacturing procedures of perforated bricks and various forms of structural clay building components. Additionally, research is being done on how to handle clays that contain pebbles, lime knicker, etc. by using ancillary processing equipment such pan mills, vibrating sieves, wash-mills, etc. Complete project reports for the establishment of semi mechanized plants suitable for all varieties of clays found in various regions of the country are anticipated to be available at a later time. The production estimates in this report might only apply to Roorkee and the surrounding areas. However, the main purpose of these estimates is to provide prospective manufacturers with guidelines so they can create their own estimates that take into consideration regional variations in the price of materials, labour, gasoline, and other resources. [2]

2.2. Nineteenth Century Brickmaking Innovations in Britain: Building and Technological Change:

(Kathleen ann Watt) (1990)

He concluded that with the development of two distinct but connected developments in brickmaking during the nineteenth century in Britain, this thesis aims to analyse the process of technological change. Brick production's mostly manual hand processes were replaced by mechanical clay working equipment. The invention of hollow bricks by machines was a result of and a function of the widespread use of brickmaking gear. The study's objective was to demonstrate how a series of intricate, mutually reinforcing social ties, which collectively make up a technological system or network, create technological advancements. Additionally, it aims to demonstrate how, rather than merely acting as passive recipients of new technology The construction sector, and particularly the architectural profession, actively participated in the development of new technological systems and new brickmaking processes and products. Technology is socially shaped in a variety of ways. It occurs directly when the selection of technologies is influenced by the aim to establish or preserve a specific pattern of social relationships. For instance, the brickmaking industry's persistent reliance for the majority of the nineteenth century on inexpensive and plentiful juvenile workers encouraged the adoption of straightforward. [3]

2.3. An Experimental Study on Properties of Fly Ash Brick:

(Kumar, r., & hooda, n). (1992).

He noted that Bricks were deemed to be suitably hard since a fingernail scratch left no visible marks on the surface. compared to regular bricks, it has a different imprint. Due to the fact that the amount of white or grey deposits on all bricks examined was less than 10% on the bricks' surface, which is almost identical to that in regular bricks. It was found that the ringing sound of fly ash bricks was much superior than that of regular bricks. The bricks' structure was observed to be compact, uniform, and free of any flaws like holes. chunks, etc. in contrast to regular bricks. Fly ash bricks have an average absorbed moisture content of 9.77%, compared to 11.93% for clay bricks. As a result, the moisture absorbed by fly ash bricks as compared to clay bricks is decreased by a net 18.10%. Clay bricks have a crushing strength of 8.14 N/mm2, while fly ash bricks have a crushing strength of 18.81 N/mm2. In comparison to clay bricks, fly ash bricks' crushing strength has increased by a net 56.72%. [4]

2.4. A Review Paper on PLC Based Automatic Fly Ash Brick Machine):

(Kendesarinpimraksa)(2001)

He concludes that an alternate use for fly ash is the creation of ash bricks. Pan Mixer and molding equipment are two of the Fly Ash Bricks Plant's most crucial components. The Brick Molding Mechanism was the primary subject of this investigation. Although there are other techniques for moulding bricks, we have solely employed the hydraulic compression technique because it is the most effective and dependable technique. The three sets of brick molds on the pressing machine are 120 degrees apart from one another. In one revolution of this machine, the mixture is placed into one set of molds, squeezed, and then two bricks are produced. This essay's main focus is on preventing unneeded economic losses, providing worker safety, and boosting the brick industry's productivity. For this, we used a Programming Logic Controller to construct this technique (PLC). [5]

2.5. A New Eco-Friendly Material for Making Brick:

(Chen, y., zhang, y., chen, t., zhao, y., & bao, s) (2001)

He noted that Bricks made with fly ash employ 50% fly ash but no clay. Fly ash bricks' mechanical attributes are superior to those of regular brick. According to the study, fly ash from electrostatic precipitators (ESPs) used in the chemical industry can be used to make bricks. Utilizing fly ash in the brick-making process reduces waste while also preserving natural resources such as air, water, and soil. Additionally, to improving the mechanical qualities of brick, the addition of polymer and lime also increases the strength of the material and contributes to energy efficiency and pollution reduction. Due to the fly ash bricks' homogeneity, the quality of since the fly ash is uniform Bricks can lower the cost of plastering following brick work and increase the quality of construction because each brick's layer displays a straight line.[18]. Due to its tremendous strength, it has excellent fire insulation. Due to the homogeneous size of the bricks and mortar needed for joints, there is virtually no breaking during shipping and use. Water penetration into the plaster has decreased by about 50%, and there is significantly less seepage of water through the bricks. Before use, a light misting of water on the bricks is sufficient; they don't need to soak in water for 24 hours. Red bricks have a number of drawbacks, including a high-water absorption capacity and good heat conductivity. [6]

2.6. Review of Fly ash Brick Making Technologies Analysis and Design of Concrete Shell Roofs of Anaerobic Digesters View Project:

(Segaran, r g) (2001)

He concluded that According to the techno-economic analysis, power plants should strongly support the following: a) Private entrepreneurs should be encouraged to set up new "ClayFlyash Brick Manufacturing units." Existing clay brick producers near power plants might be encouraged to change their manufacturing processes to produce "Clay - Flyash Bricks." It is technically and financially feasible to set up and run a fly ash brick project based on FaLG Technology. However, " Dry Fly ash " is needed for this technology. [7]

2.7. Review of flyash brick making technologies:

(Das, a., & segaran, r. G) (2005)

He concluded that According to the techno-economic analysis, power plants should strongly support the following: a) Private entrepreneurs should be encouraged to set up new "ClayFlyash Brick Manufacturing units." Existing clay brick producers near power plants might be persuaded to switch over to producing "Clay Fly ash Brick" units. [8]

2.8. **Description o f oates' brickmaking machine**:

(Clift, j.e) (2006).

This work creates a brick machine status analysis system based on the industrial internet of things. The system performs data collection, feature analysis, grouping, and status evaluation. The operating data for the brick machine is the first thing the IIoT module delivers to the database server. The examination of the acquired data then incorporates Preprocessing and feature extraction. Additionally, the data is classified using the K-Means method. Based on the clustering results, the brick machine's state is classified as shutdown, standby, abnormal, voltage loss, and normal. The testing results show the effectiveness of the proposed status analysis system for brick machines. [9]

2.9. Hypothesis For the Extrusion of Lime Flyash-Sand Bricks Using a Manually Driven Brickmaking Machine:

(Askhedkar, r. D., & modak, j. P.) (2007)

He concluded that on the basis of trials utilising the manually driven brickmaking machine extrusion system, empirical models were developed to forecast the performance of the manually driven brickmaking machine to extrude lime-flyash sand bricks. It is suggested a novel idea for how lime-flyash-sand bricks are extruded from a manually operated brickmaking machine. According to this theory, when the clutch is engaged, the flywheel's speed abruptly decreases, indicating energy loss. This energy loss is partially caused by how the clutch engages, and the remaining portion is due to pressure building up in the paste mixture. Extrusion starts when the mix's pressure crosses the yield stress. After a while, the pressure in the clay stops rising as the amount of energy available declines, the pace of extrusion slows, and eventually extrusion stops. The extruded column, paste in the die, and cone hold the energy generated by the flywheel. Even as the auger's speed decreases, it is shown that the torque process maintains essentially constant throughout the extrusion phase. This might be caused by a rise in material yield stress coupled with a decrease in auger speed. This rise in yield stress may be caused by the turbulence that is produced in the paste's cross-section as a result of the change in laminar and plug flow areas. Additionally, it is hypothesised that the extrusion time depends on the amount of energy available. [10]

2.10. A Review Paper on PLC Based Automatic Fly Ash Brick Machine:

(Singh, b., & kumar, a.) (2008)

In a semi-automatic factory, every process is carried out automatically, though not all at once. Each step has a designated time slot, after which the time-consuming following process can only be performed. The suggested model of the brick-making machine, however, uses a programming logic controller and is completely automated. Three brick mould sets, each 120 degrees apart, form part of the pressing machine. In one revolution of this machine, the mixture is placed into one set of moulds, squeezed, and then two bricks are produced. Thus, efficiency is boosted by using this paradigm. System is fully automated. Accident instances are also declining. After receiving the product specifications, this project is completed based on the following scope; The project will only concentrate on interlocking brickmaking machinery. Creating an interlocking brick-making machine that achieves the project's goal. Machine made to fit standard interlocking bricks. The project continues via the interlocking brick manufacturing machine's detailed design. The creation of the detail drawing for the machine design is the project's main deliverable. Manufacturing of machines is not included in this project. [11]

2.11. Design of new interlocking bricks making machine:

(Ramli, m. R. B.) (2010).

He concluded that the scope of the project serves to clearly outline the specific area of the research and to guarantee that the entire material of this thesis falls within the scope. In order to meet the project's goals, this project begins with a literature review on product specifications. [12]

2.12. Mechanical Properties of Fly Ash Brick with Waste Plastic Strips:

(Alan, s., sivagnanaprakash, b., suganya, s., kalaiselvam, a., & vignesh, v) (2010)

He noted that in this study, recycled PET strips were taken into consideration as brick reinforcement in order to study and analyse the material's performance. The ecological benefit of effectively repurposing a waste material is another advantage, and this was a major driving force for the work. Accordingly, it can be inferred from the study that PET strip bricks have high modulus of rupture and compression strength, both of which are due to PET's higher inclination to connect with cement matrix. Compared to the control value of fly ash bricks, the bulk density value of sample B appears to produce better outcomes. No bricks from any sample were forced to break during the impact test, although clay bricks on average broke into two pieces, and control bricks on average broke into four pieces. [13]

2.13. Evaluation of The Compressive Strength of Hybrid Clay Bricks:

(Azeez, o., ogundare, o., oshodin, t. E., olasupo, o. A., & olunlade, b.a) (2011).

He noted that on the basis of the results discussed above, it can be said that: Ilesa hybrid bricks achieved the best service performance under compressive loading at 6% cement. Ilesa hybrid bricks are more reliable and workable under load than conventional Akure masonry. [14]

2.14. Use of Waste Plastic as A Construction Material:

(Daftardar, a., shah, r., Gandhi, p., & garg, h.) (2012)

The major objective of this effort, which is to reduce plastic waste globally, is successfully accomplished. It uses a machine called an extruder, which is environmentally friendly and effectively uses waste plastic to create bricks that are stronger, lighter, and better at absorbing water than traditional bricks. It has numerous uses because the brick may also be used as building blocks by enlarging the mold. It can be used for fence in place of the conventional wires. It is used as a building block and in floor interlocks as well. It also stands out as being economically advantageous because it will readily avoid the costs associated with landfill disposal and incinerator burning. [15]

2.15. Study of Plastic Bricks Made from Waste Plastic:

(Bhushaiah, r., Mohammad, s., & rao, d. S.) (2013).

He noted that Recycling plastics after their useful lives are through while generating economic value and causing the least amount of environmental harm possible is the secret to their sustainable management in the circular economy. Concrete impregnated with waste plastic has been the subject of numerous studies, and the findings have been generally positive and beneficial. The current work conducts a thorough analysis of some of these findings and identifies some common, practical themes in the stated attributes. In addition, the paper includes findings from experimental work on bricks constructed from non-recyclable waste thermoplastic granules, which made up 0 to 20% of the bricks' weight, with the remaining 4 kg of fly ash, cement, and sand. The bricks were baked at temperatures of and for 28 days while being cured in water. [16]

2.16. Design, Fabrication and Performance Evaluation of a Manual Clay Brick Moulding Machine:

(Kolawole, s. K., & odusote, j. K.) (2013)

He concluded that Mild steel that is readily available locally can be used to create clay brick moulding equipment that satisfies the requirements for imported moulding equipment. The bricks that have been moulded are reasonably durable, hard, and environmentally friendly. They can therefore be used for walls, pavements, and other structural elements. [17]

2.17. Manufacturing of Bricks in the Past, In The Present And In The Future: A State Of The Art Review:

(Shakir, a. A., & Mohammed, a. A.) (2013).

He noted that This essay has evaluated previous research on brick manufacturing methods and materials. It is clear from the review indicated above that there are gaps in the earlier studies that need to be taken into consideration. The key ideas that can be used as a conclusion and as a guide for future work to close the gap in the work done so far are listed below. Avoid using natural resources like sand, clay, and shale to make bricks. The majority of the studies looked into the potential for creating clay bricks from garbage. Find a substitute fuel and encourage the use of renewable energy in brick plants that still use the old manufacturing methods Bricks shouldn't be burned during the production process, and going forward, the bricks business should operate on an ecological foundation because there haven't been many research done on how to create bricks in an eco-friendly manner. [18]

2.18. Design of Brick Machine Control System Based On PLC:

(Ye, h. M., sun, q. T., lu, s. Q., & liu, x. F.) (2014)

He Concluded that the use of PLC to implement automatic control of brick machines has ideally resolved production technology stability issues and enhanced device reliability and production efficiency. Additionally, it ensures the quality of product creation. [19]

2.19. Design and Fabrication of a Plastic Reinforced Brick Manufacturing Machine:

(Machine, b. M.)(2015)

He noted that Manufacturing of the plastic reinforced brick machine was successfully finished. A set of reinforced and unreinforced bricks were created and tested on the machine. In India, plastic recycling is progressing at a rapid rate. Up to 60% of plastic garbage from diverse sources, including industrial and urban waste, gets recycled. Thus, the problem of waste plastic piling up may be greatly managed by the successful manufacture of the Plastic Reinforced Brick Manufacturing Machine. Additionally, the method yields a brand-new alternative building material for construction. This device also reduces the amount of plastic garbage that ends up in landfills. By incorporating plastic waste as an aggregate in the production of bricks, landfill filling is reduced inverters, transformers, and motor simulation outputs show that the hybrid powered automated CSEB machine design is workable. Future prototype manufacturing will involve the use of PLC, sensors, and actuators to automate the production process. The mechanical characteristics of the CSEBs generated in this manner will meet the specifications needed for civil construction materials. [20]

2.20. Manufacturing And Testing of Plastic Sand Bricks

(N, kumar, p.t.,sujithra, r., selvaraman, r., &bharathi, p.) (2016)

He noted that Additional benefits of plastic sand bricks include reduced greenhouse gas emissions, cost and resource efficiency, and more. In addition to being known as "Eco-Bricks," plastic trash that would otherwise be hazardous to all living things can be utilized to make plastic sand brick, which can be used for construction. When compared to bricks made of fly ash, it strengthens the compressive strength. The presence of alkalies in the water was significantly reduced by the use of plastic sand blocks. Further study would enhance the quality and durability of plastic sand bricks because of their many benefits. [21]

2.21. Fabrication of Plastic Brick Manufacturing Machine And Brick Analysis:

(Mohan, c. G., mathew, j., kurian, j. N., moolayil, j. T., & sreekumar, c.) (2016)

The machine was finished in accordance with the revised specifications. To identify the problems, it was tested in the workplace. The machine efficiently transforms plastic into useful shapes like bricks and paving tiles, and it also lessens the quantity of plastic garbage produced by our throw-away culture. With higher waste plastic ratios, the compressive strength drops. The highest load at crushing for the different percentages of 5%, 10%, and 15% plastic trash was 172.63 KN, 183.06 KN, 192.55 KN, and 186.14 KN, respectively. Additionally, the bricks' compressive strengths were 9.86, 10.46, 1/1, and 10.63 N/mm2. This might be explained by a weakening of the bond between the sand and the waste plastic. The machine was finished in accordance with the revised specifications. It Sand brick and plastic waste mixtures are feasible, nevertheless, as there was no water absorption. The manufactured brick also doesn't include any salt or alkalis. Waste plastic brick mixes can only be employed in circumstances requiring low-degree workability, as seen by the reduced compressive strength values. However, the brick demonstrated greater compressive strength and durability at the particular ratio. There are several uses for civil engineering, including the use of precast bricks, partition wall panels, canal linings, and other materials. [22]

2.22. Design and application of hydraulic pressure system for new fly ash brick:

(Wu, s., zhou, w., ke, j., & yan, h.) (2016)

He noted that He mentioned that a new hydraulic pressure system for new fly ash brick was offered in the current study, along with its design and computation. The design of the hydraulic system is covered in detail, and the issues that arise during design are described. The system's design has taken into account the computation and design of temperature, pressure, and other issues. The tests were carried out to confirm the system's functionality. The waste ash issue can be resolved in plants using this product. [23]

2.23. Automatic brick manufacturing system:

(Bhesaniya, j. J., koshiya, h. L., sakariya, b. V., kalwaniya, m. S.,) (2016)

He concluded that the software runs properly in the portion following the connection of all the brick manufacturing system's components and their connection to the PLC/SCADA. As a result of our effort, we have taken additional brick and increased their strength. We attended a performance during the monsoon season. [24]

2.24. Experimental Analysis of Compressed Earth Block (CEB) With Banana Fibres Resisting Flexural and Compression Force:

(Mostafa, m., & uddin, N) (2016)

He noted that He mentioned that a new hydraulic pressure system for new fly ash brick was offered in the current study, along with its design and computation. The design of the hydraulic system is covered in detail, and the issues that arise during design are described. The system's design has taken into account the computation and design of temperature, pressure, and other issues. The tests were carried out to confirm the system's functionality. The waste ash issue can be resolved in plants using this product. According to the experimental results, the blocks made by incorporating banana fibers throughout the mixture (B-CEB) outperformed the block made entirely of cement (CEB) in terms of compressive and flexural strength. In comparison to CEB with no fibers (mix #1), the average compressive strength of blocks with 60 mm and 70 mm natural banana fibers (mix #3 and mix #4, respectively) recorded the greater stresses. [25]

2.25. Automatic brick manufacturing system:

(Kumar, p. M., kumar, p. N., pavithran, p., & rajamurugan, g.) (2018).

The software runs properly in the portion following the connection of all the brick manufacturing system's components and their connection to the PLC/SCADA. As a result of our effort, we have increased brick strength and taken more brick products. We attended a performance during the monsoon season. [26]

2.26. Development of An Electro-Hydraulic Brick Making Machine Human Orbital Market Africa

(Asiyanbola , mccleskey, c. M., & Robinsons, j. W.) (2017)

He concluded that Only the moulding box has been created to specifications, with the Moulding Box assembly having the highest need for precision, therefore the project Development of Brick Making Machine is still in progress. The pressing box assembly and the ejecting box assembly are two further assemblies that are currently nearing completion. Some of the initial assemblies had to be adjusted in order to use H-beams that were on hand and satisfied dimension requirements. Metal reinforcements were then added to give the thin parts the necessary metal thickness to prevent failure during loading.

Results from the ANSYS stress study of the original 10 mm thick moulding box that failed under load. But they decreased after the reinforcement. As a result, more work is still needed on the ejecting box and pressing box assemblies. At the start of this project, there were a number of broad objectives, including design of the machine and assessment of its performance. At the time of writing According to the report, fabrication continues in order to achieve the project's goals. [27]

2.27. Design of Hybrid Powered Automated Compressed Stabilized Earth Block (CSEB) Machine:

(Ayyappan, a., milan, s., sreejith, k. T., & kanakasabapathy, p.) (2018, april).

He concluded that Solar panels, DC-DC converters, batteries, inverters, transformers, and motor simulation outputs show that the hybrid powered automated CSEB machine design is workable. Future prototype manufacturing will involve the use of PLC, sensors, and actuators to automate the production process. The mechanical characteristics of the CSEBs generated in this manner will meet the specifications needed for civil construction materials. Solar panels, DC-DC converters, batteries. [28]

2.28. Survey with design & development of mathematical modelling for ash brick production hydraulics machine:

(Dhande, m. S., himte, r. L., nanoti, v. M., & modak, j. P.) (2018)

He noted that the II 1 term's absolute al index, which is II 1 = 0.55, is highest. This suggests that the pi term II1 has the greatest impact on productivity. This is so because there is a direct correlation between productivity II1 and the positive a1 index. Consequently, production will increase if the values of II1 grow. the piword is related to the operator's anthropometric data in relation to. the stool he or she is seated on. The rationale behind This may be the case if the stool's height and other parameters were created with ergonomics in mind. Sitting comfortably while working. The workstation design-related metric, II4, has the next-highest positive index of the two. This also suggests that higher workstation data II4 values will contribute to higher productivity. Regarding environmental influences, the third II3 phrase has a negative index. Due to the operator's constant exposure to Hawkshaw, Nagpur's hot and dry weather, this contributes to a loss in production. The operator's productivity could increase if they operate in an ergonomically constructed workspace with better environmental conditions, as shown by the three pi terms (1). The other terms of pi have very little impact on productivity. [29]

2.29. Preparation of bricks using sand and waste plastic bottles:

(Selvamani, g. D., sabarish, p., thulasikanth, y., & vinoth kumar, e.) (2019)

In this project, plastic is employed as the binder material to prevent water absorption and to provide the brick good plasticity. As a result, this kind of bricks can withstand earthquake loads. High compressive or crushing strength is a feature of these plastic bricks at the ratio (1:3). Additionally, it has a lower absorption value than standard, burned clay bricks. Therefore, using plastic sand bricks at a ratio of 1:3 is preferred for construction. The amount of water absorption was significantly decreased by using plastic sand blocks. In order to prevent ground water seepage, these plastic sand bricks are utilized as foundation bricks below the plinth level. The study discussed above also aids in easing the problem of disposing of plastic garbage and transforms that wasteful substance into a practical building material. The main disadvantage of these waste plastic sand bricks is their propensity to catch fire in regular fire. As a result, this kind of brick can be utilized for septic tank building as well as underwater and underground construction. because they can resist heavier loads than regular bricks. Therefore, the primary goal of this project was to use plastic trash as a building material, thereby reducing plastic waste in the environment. Since plastic is used in underground construction, it naturally degrades as well. [30]

2.30. Utilization of plastic waste for making plastic bricks:

(Kognole, r. S., shipkule, k., patil, m., patil, l., & survase) (2019).

He noted that Waste plastic, which is readily available everywhere, can be used to make bricks. Plastic sand bricks can contribute to a cleaner, healthier world by lowering environmental pollutants.

Bricks made of plastic sand instead of clay use less clay in their construction. Plastic sand bricks provide customers a different brick option at a reasonable price. Plastic sand bricks do not absorb any water. After comparing plastic sand bricks to fly ash bricks and third-class clay bricks, we come to the conclusion that they are useful for the construction sector. [31]

2.31. Potters kiln bricks: using manual brick making machine:

(Inuwa, m. U. A.) (2019)

He concluded that the purpose of this study is to enhance the calibre of refractory bricks produced by manual brickmaking equipment at a compaction pressure of around 300 pound-force per square inch (p.s.i) (2 MPa). This is a stabilisation standard for kiln building that is equal to ASTM D1633-00 in order to address various issues with kiln construction. This research also takes into account the sourcing of the brick's basic materials (kaolin clay and sawdust), as well as performing thermal and mechanical testing on the refractory bricks made using the machine. To fulfil the necessary standard, a lot of work was put into finding the proper material, measuring it, formulating different batches, combining and creating the line blend, creating the bricks, then drying and firing them. After being fired at a temperature of roughly 1300°C, the bricks made by the machine were tested for things like porosity, bulk density, and rupture modulus. The insulating bricks made using the data from this study's analysis are appropriate for use in building kilns that can be burnt to a temperature of 1300°C (to enable high temperature storage. [32]

2.32. Design and Implementation of Brick Making Machine Integrated With Smart IIOT Application:

(Premkumar, m., devi, g., & sowmya, r.) (2020)

He concluded that the integrated, intelligent brick-making equipment was created to provide a fair production rate for a reasonable investment. It is a computerised model with a straightforward algorithm. It is a versatile machine that can make a variety of high-quality brick varieties by just changing the mould. The machine's production cost was roughly $44,650. Fast completion of the task is built into the machine's architecture. By achieving mass production, the plant becomes more effective, which lessens workload and lowers production costs. Brick is a fundamental component of construction and provides many Indians with a basic income. a. One of the major problems is child labour, which is unexpectedly prevalent in the brick making industry. By using an automated brick-making machine, child labour can be decreased. An organization's output rate will rise by implementing these machines. The demand for the various types of bricks that can be produced by automated brick-making equipment will increase in the future. The suggestions are as follows. a. One of the major problems is child labour, which is unexpectedly prevalent in the brick making industry. By using an automated brick-making machine, child labour can be decreased. An organization's output rate will rise by implementing these machines. [33]

2.33. Design and Fabrication of Compressed Earth Block Machine for Low-Cost Housing in Nigeria:

(Egenti, c., khatib, j. M., & etin-osa, c.e) (2020).

He noted that locally, a successful fabrication of a mobile SCEBs machine that can produce blocks with dimensions of 300 by 152 by 110 mm and a compressive strength of 3.53 N/mm2 using 5% cement stabilization. According to the IRA of 1.031 bc/1, min, the block has a reasonable water absorption rate. This machine is suggested for the low-cost manufacture of clay stabilized blocks in Nigeria, particularly in the state of Edo since it has an abundance of laterite soil, which is essential for the production of CSB. [34]

2.34. Brick manufacturing machine:

(Jadhav, c. C., kadam, n. S., khote, a. S., patil, s. H., pansare, a. B.) (2021).

He concluded that The job we completed is essential to the brick business. It is highly practical for quickly creating bricks. It costs less than other machines of a similar nature. It is the finest answer to the issue at hand. Using this project, bricks can be made in the lowest amount of time. [35]

2.35. Sustainable eco-friendly fly ash brick using soil filled plastic bottles:

(Vigneshwar, p. V., anuradha, b., guna, k., & kumar, r. A.) (2021).

He noted that Regular building supplies have historically been significantly more accessible than they have been interested in recent history. The removal of waste plastics, however, is the biggest challenge as ongoing usage of Poly Ethylene Terephthalate containers has a risk of being transformed into a cancer-causing material and only a small portion of PET bottles are being reused. However, late check quarry trash is abundantly available. Currently, efforts are being undertaken to create a fly debris block using plastic bottles filled with soil and readily available steel that has been fastened to the outside of the bottles for thermal protection. The qualities of the manufactured plastic bottle bricks include perfect and, in any case, completing, with unimportant the manufactured plastic bottle bricks have qualities like excellent and, in any case, finishing, with minimal water absorption, increased compressive quality, cost finance, and corrosive protection from meet the rising need for conventional construction materials. This experimental work contributes to our understanding of the reuse of PET bottles for transient housing. [36]

2.36. Design of Status Analysis System for Brick machines Based on Industrial Internet of Things:

(Xu, z., liu, x., li, x., gao, x., xie, r., & xia, y) (2020)

He concluded that the study develops an industrial internet of things-based status analysis system for brick machines. Data gathering, feature analysis, grouping, and status evaluation are all completed by the system. First, the IIoT module sends the database server the brick machine's operational data. Preprocessing and feature extraction are then included in the analysis of the data that was obtained. Additionally, the K-Means technique is used to classify the data. The brick machine's condition is broken down into shutdown, standby, abnormal, voltage loss, and normal based on the clustering results. The efficiency of the suggested status analysis system for brick machines is demonstrated by the testing findings This study develops an industrial internet of things-based status analysis system for brick machines. Data gathering, feature analysis, grouping, and status evaluation are all completed by the system. First, the IIoT module sends the database server the brick machine's operational data. Preprocessing and feature extraction are then included in the analysis of the data that was obtained. Additionally, the K-Means technique is used to classify the data. The brick machine's condition is broken down into shutdown, standby, abnormal, voltage loss, and normal based on the clustering results. The efficiency of the suggested status analysis system for brick machines is demonstrated by the testing findings. [37]

2.37. Fabrica ng a semiautomatic brickmaking machine:

(Elemi, n., undie, p., muze, s., & ajibade, b.) (2021)

He concluded that both the compressed earth bricks and the firebricks produced by the semi-automatic brickmaking equipment are equally sturdy and long-lasting. While firebricks are insulating and can be used to build kilns, ovens, fireplaces, etc., compressed earth bricks are utilised for building construction. However, a special benefit of this approach is that, depending on actual requirements, users can control the quality of their own bricks by boosting the quantity of constituents in the composite. Additionally, as each brick is branded appropriately because the bricks are created with a personal semi-automatic brickmaking equipment, it is possible to include logos and distinguishing characteristics in the mould. The brickmaking machine's semi-automatics nature is also a huge benefit because customers may choose how many bricks, they want to make using the touchscreen control. All that is required is to consistently check to make sure there are adequate materials in the trough behind the machinery.[38]

2.38. Brick manufacturing machine:

(Chetan c. Jadhav) (2021)

He noted that the brick-making industry, the project we completed is crucial. Making bricks is incredibly simple and convenient. It costs considerably less than other computers. It is the best option for the issue that has come up. This project allows us to produce bricks in the smallest amount of time. We set up a more affordable brick-making machine. This project consists of a motor, mesh gears, storage for input materials, and an inclined bed for the extruder. [39]

2.39. Design and Analysis of Brick Making Machine:

(Venkatesh, c., suresh, g., vivek, m. S., reddy, k. A., reddy, y. S., & reddy,n) (2022)

He noted that Based on the results of the Ansys simulation, the maximum equivalent stress on the longitudinal side of the moulding box was 176.76 mPa, and the overall deflection was 0.778 mm. In order for the mould to withstand the applied force, it must be beneath the yield strength of the material (mild steel), which was used to make the mould. The part wouldn't fail during the operation since the greatest equivalent stress on the lateral side of the mould box is 76.12 MPA and the total displacement is 0.69 mm, which is below the permissible stress. We determined the highest equivalent stress to be 104 MPA and the total deformation to be 2.7 mm by structural analysis of the frame. With a manageable investment, this sophisticated and integrated brickmaking equipment is intended to provide a realistic production rate. The device has been built to finish the task quickly. It achieves mass manufacturing, which boosts the plant's productivity and decreases effort while also lowering production costs. [40]

2.40. Reference model:

Generally, a brick making machine is a machine that produces bricks using electrical vibration and hydraulic pressure. These machines are produced in different types with different automation levels and capacities. Brick making machines are one of the most crucial machines in the construction industry because all the hollow blocks, solid blocks, paving blocks, and curb stones that are used in the construction field are produced by these concrete brick machines. Brick making machine has different names based on the bricks it produces. When this machine produces hollow blocks, it is called a hollow block machine. It is called a concrete block machine when it produces solid concrete blocks. When you use interlocking Molds in your production line, it is called an interlocking brick machine. Also, some customers order their machine as a double-hopper machine, this machine is generally called a paving block machine because it can produce double-layer paving bricks. [38]

Figure2.1: Reference Model

2.1. LITERITURE GAP:

Table 2.1: Literature Gap

Title	Author	Year	Motor	Hydraulic pump	Mold
An Experimental Study On Properties Of Fly Ash Bricks. [4]	Kumar, r., & hooda, n	1992	Yes	No	Yes
A Review Paper on PLC Based Automatic Fly Ash Brick Machine. [5]	Kendesarin Pimraksa	2001	Yes	Yes	Yes
A New Eco-Friendly Material for Making Brick. [6]	Chen, y., zhang, y	2001	Yes	No	Yes
Review of flyash brick making technologies [8]	Das, a., & segaran, r. G	2005	No	Yes	Yes
Description o f oates' brickmaking machine. [9]	Clift, j.e	2006	Yes	Yes	Yes
A Review Paper on PLC Based Automatic Fly Ash Brick Machine. [11]	Singh, b., & kumar, a.	2008	Yes	Yes	Yes
Design of new interlocking bricks making machine. [12]	Ramli, m. R. B	2010	Yes	No	Yes
Evaluation of The Compressive Strength of Hybrid Clay Bricks. [14]	Azeez, o., ogundare,o.	2011	Yes	Yes	Yes
Use of Waste Plastic as A Construction Material. [15]	Daftardar, a., shah	2012	No	Yes	Yes
Fabrication of Plastic Brick Manufacturing Machine And Brick Analysis. [22]	Mohan, c. G., Mathew.	2016	No	No	Yes
Automatic brick manufacturing system. [24]	Bhesaniya, j. J., koshiya.	2016	Yes	Yes	Yes

CHAPTER 3

Design and Fabrication

3.1 DESIGN:

3.1.1 Problem:

According to our project the force required during compaction from one side of the ram is given as 1791.8N, two side of the ram will produce a total force of 3583.6N to compact the aggregate in the mould.

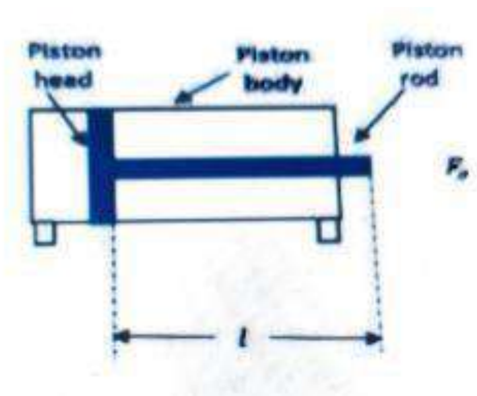

Figure 3.1: Piston Head

The following parameters listed below were the parameters used to calculate for the area of the piston head, pressure in the hydraulic cylinder, cycle time, required velocity, mass flow rate volume, volume flow rate, required power and tank capacity, the following dimensions was according to our project.

Bore Dia (D) 72mm

Efficiency of pump (E)=70%

Rod Dia (d) = 50mm

Compaction force (F) = 3583.6N

Stroke length (l) =250mm

Density (p)0.880x 10 kg/m^2 (ISO 68)

Extension length for compaction (l/3) =83.3mnm

Compaction time (t_1) =2.5 see

Ejection Time (t_2) =2.0 sec

Retraction time (t_3) =1.5 sec

eqn(1) Area of piston head (4) is given by equation (1)

$$A = \frac{\pi D^2}{4}$$

$$A = \frac{3.14 \times 72^2}{4}$$

A = 4069.4mm

eqn(2) Pressure in the hydraulic cylinder (P) is given by equation (2)

$$P = \frac{Fe}{A}$$

$$P = \frac{3583.6}{4069.44}$$

P=0.98MPa

eqn(3) Cycle time (t) is given by equation (3)

$t_1+t_2 + t_3 = t$

t = 2.5+2.0+1.5

t= 6.0 sec

eqn(4) Required velocity for compaction (V_1)

$$V_1 \left(\frac{l}{3}\right) \div t_1$$

$$V_1 \frac{250}{3} \div 2.5$$

V_1 = 0.0333m/s

Required velocity for Ejection

$V_2 = (\frac{2l}{3}) \div t_2$

$V_2 = (\frac{2(250)}{3}) \div t_2$

$V_2 = 0.0833 m/s$

eqn(5) Mass flow rate of oil into cylinder for compaction (m_1)

$m_1 = pAV_2$

$m_1 = (0.88 \times 10^3)(4069.44)(0.0333)$

$m_1 = 0.1192 kg/s$

eqn (6) Mass flow rate of oil into cylinder for compaction (m_2)

$m_2 = pAV_2$

$m_2 = (0.88 \times 10^3)(4069.44)(0.0833)$

$m_2 = 0.298 kg/s$

eqn (7) Volume capacity of cylinder needed for full extension (V) is given by equation (8)

$V = \frac{\pi D^2}{4} \times l$

$V = \frac{3.14(72)^2}{4} \times 250$

$V = 1017360 \text{ mm}^3$

eqn (8) How rate: is given by equation (9). The volume obtained in Eq. (8) was converted from mm to litres, while time in Eq. (3) from sec to mins

$Q = \frac{v}{t}$

$Q=\frac{1.0173}{0.1}$

Q=11.017 lpm

eqn (9) Power of motor (Pw): the minimum motor power required to drive the hydraulic gear pump is given by equation, the pressure was converted into lpm.

$$Pkw=\frac{(Q4pm)-P(bar)}{600XE}$$

$$Pkw=\frac{11.173-1.17}{600(0.7)}$$

Pew 0.238 kW

EQ(10) Capacity of fluid in tank (T): is given by equation (11)

T_c=4Q

T_c =4×12

T_c= 48litter

3.2 ANALYSIS:

3.2.1 Hopper:

A usually funnel-shaped receptacle for delivering material (such as grain or coal) also any of various other receptacles for the temporary storage of material. A freight car with a floor sloping to one or more hinged doors for discharging bulk materials. called also hopper car.

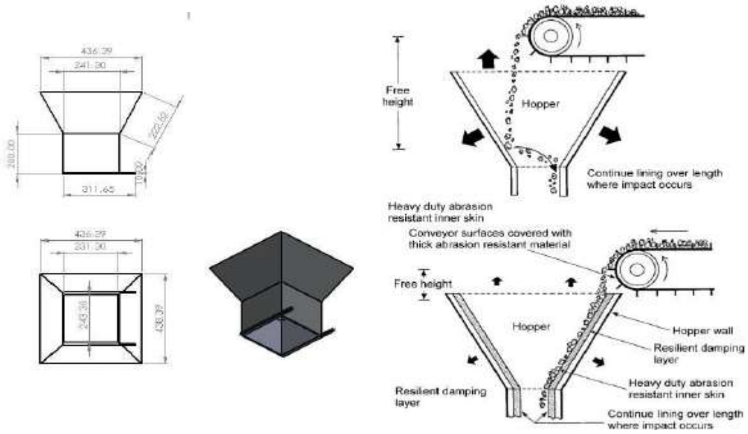

Figure 3.2: Hopper

3.2.2 Hydraulic jack:

Hydraulic systems use the pump to push hydraulic fluid through the system to create fluid power. The fluid passes through the valves and flows to the cylinder where the hydraulic energy converts back into mechanical energy. The valves help to direct the flow of the liquid and relieve pressure when needed.

Figure 3.3: Hydraulic Jack

3.2.3 Body of machine:

In the body of machine every part is assemble in it like hydraulic jack motor hydraulic pipes hopper and head of a mold is present in that body of machine the mold is fitted with the body due to high pressure in the body of hydraulic pump is fitted at the end of the that it creates more pressure with the base of body and head of mold due to which the brick compress easily and compress more and more.

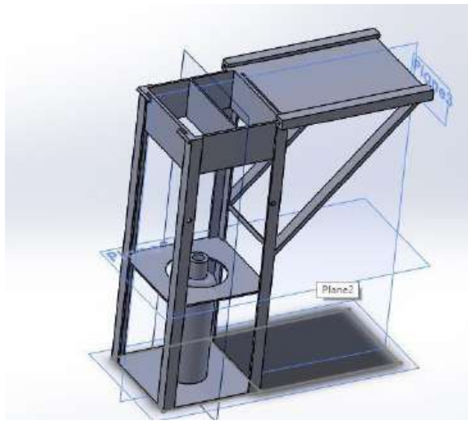

Figure 3.4: Body of Machine

3.2.4 Head of Mold:

Head is used to tolerate the power of hydraulic jack fitted with the mold with the help of pin, made of Mold steel to tolerate high pressure

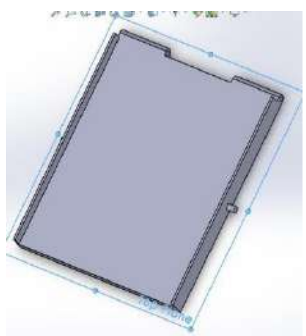

Figure 3.5: Head of Mold

3.2.5 Pin :

Pin is used to connect the body and head of the hopper. Its dimension is 4.5mm diameter and 214mm in length. It is made of treated iron.

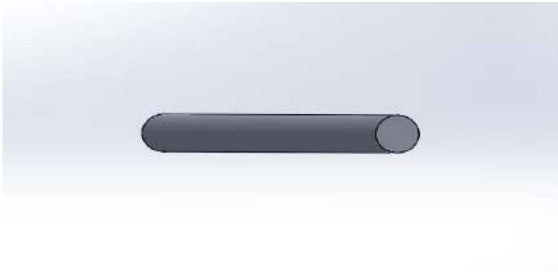

Figure 3.6: Pin

3.2.6 Compressor:

Compressor is used to compress the brick in Mold with the help of hydraulic jack. It is the main component in the compress brick machine. It compress the brick, which is composed of plastic waste and many other components like cement sand fly ash etc

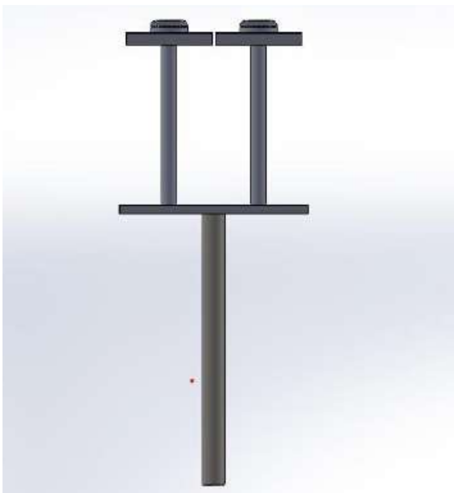

Figure 3.7: Compressor

3.4 Assembly view:

3.3.1 Front view

It is the complete assembly of our project.

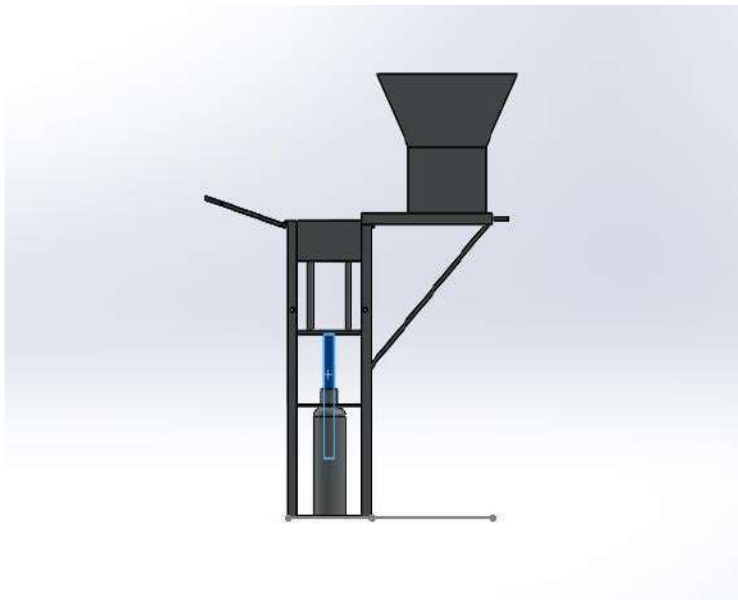

Figure 3.8: Front View of Assembly

3.3.2 Side view:

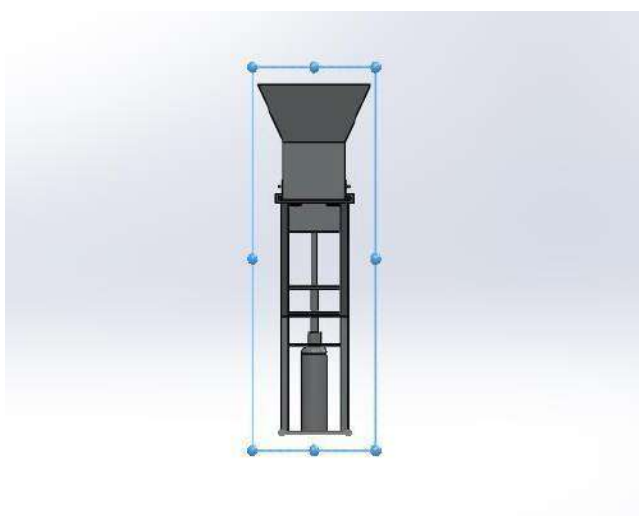

Figure 3.9: Side View of Assembly

3.3.1 Top view:

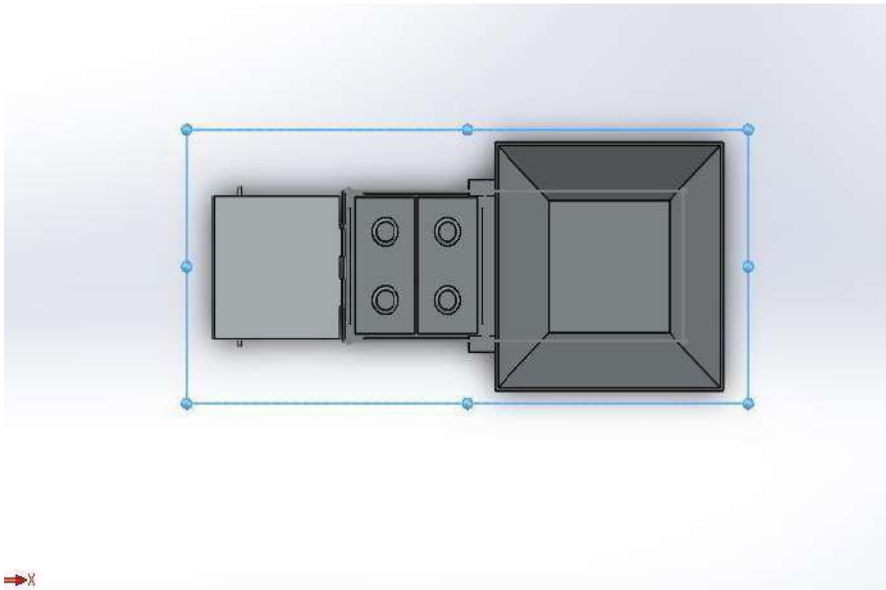

Figure 3.10: Top View of Assembly

3.3.2 Exploded View:

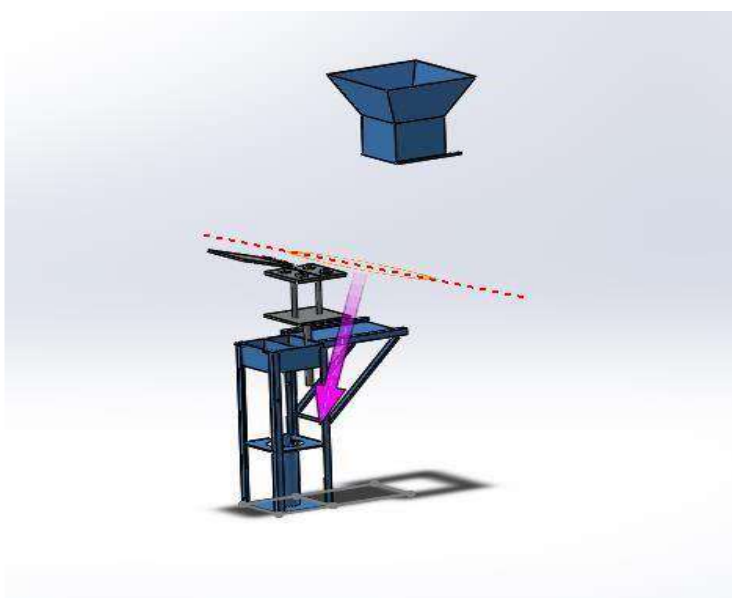

Figure 3.11: Exploded View

3.2 Fabrication:

We have fabricated the frame for our project in which mold is welded.

Figure 3.12: Frame

The top side of the frame of our project where we harden the welded parts for high compression.

Figure 3.13: Frame

Observation of the accurate side of the moter and jack where the jack and moter fit accurately.

Figure 3.14: Frame

Observing and leveling the mold with the frame.

Figure 3.15: Frame

Fabrication of mold for the brick for the accurate size of bricks size.

Figure 3.16: Mold

The final view of our frame is completed according to require dimensions.

Figure 3.17: Final frame

Hydraulic jack is used for compression of bricks by the flow of hydraulic fluid with the help of hydraulic pump.

Figure 3.18: Hydraulic Jack

Hydraulic pump is used for the movement of hydraulic fluid with high pressure with the help of electric motor.

Figure 3.19: Hydraulic Pump

Chapter 4
Experimentation & Results Discussion

4.1. Experimental Methodology:

A rectangular Steel Mold with (222.25*107.88*69.86mm) dimensions was manufactured. There were four side plates, a base plate, and a top plate on the brick Mold. Illustrates the cutting of four plates with a thickness of 12.67 mm and dimensions of 222.22 x 107.88mm. It was positioned on a flat surface, the base plate's thickness was reduced to 5 mm, significantly reducing the possibility of deflection. In order to make it simple to apply pressure to the molten mixture and facilitate the easy removal of the brick, the top plate was fastened with a knob-shaped component. An Allen key of 8 mm was used to assemble the plates after they were drilled with 8 mm holes.

4.2. Experimental Manual:

For the purpose of proving the results of the dynamical model and the stability analysis for the multiple brick machine we can perform a simulation calculation and experimentation on the developed brick machine. The Structural parameter of brick machine is that the Mold is (222.25*107.88*69.86 mm) and the thickness of Mold plate is 12.7 mm the height of the body is 3ft. Two bricks should be made at a time. The temperature of mixture is 200°C-300°C

4.3. Experimental Parameters

- Brick Tensile Stress
- Plastics durability
- Plate thickness
- Hydraulic Jack
- Time period
- Temperature on which the plastics melts
- Grade of Sand uses

These parameters can provide valuable insights into the performance, stability, and overall capabilities of the shell and tube heat exchanger.

4.4. Experimental Test Results:

4.4.1. Experimental Setup:

The schematic of the experimental set-up used for the present investigation is shown in Figure 1. The main components in the set up include Electric Motor, hydraulic jack, Heater, Mixture, Molds, the electric motor is placed in the Mixture which is used to mix the sand and plastic mixture. The Heater is placed in the mixture which is used to melts to plastic. The hydraulic jack is used the give shape to the brick. The helical coil copper tube is placed in the shell. The cold gasses flow inside the tube and hot water.

4.4.2. Before Process:

- Before process the temperature of mixture is at room temperature which is 20-35 ℃
- The temperature of the heater is at 300℃.
- Pressure exerted on single brick is almost 5 to 6 bar.

4.4.3. After Process:

- After process the temperature of melted mixture is almost 200-300 ℃
- Complete time period of making the brick is 30sec to 60sec. The brick manufacturing limit is
- about to 40-60 brick. /Hour

4.4.4. Table of Experimental Result:

Table 4.1: Experimental Results

Block Number	Sample 1 (90:10)	Sample 2 (80:20)	**Sample** 3 (75:25)
Length(mm)	175	175	175
Breath(mm)	100	100	100
Area(mm2)	17500	17500	17500
Max Load on Crushing (KN) Of our Project	50.65	60.4	65.3
Max Load on Crushing (KN) of Reference Model	50.65	60.17	53.6

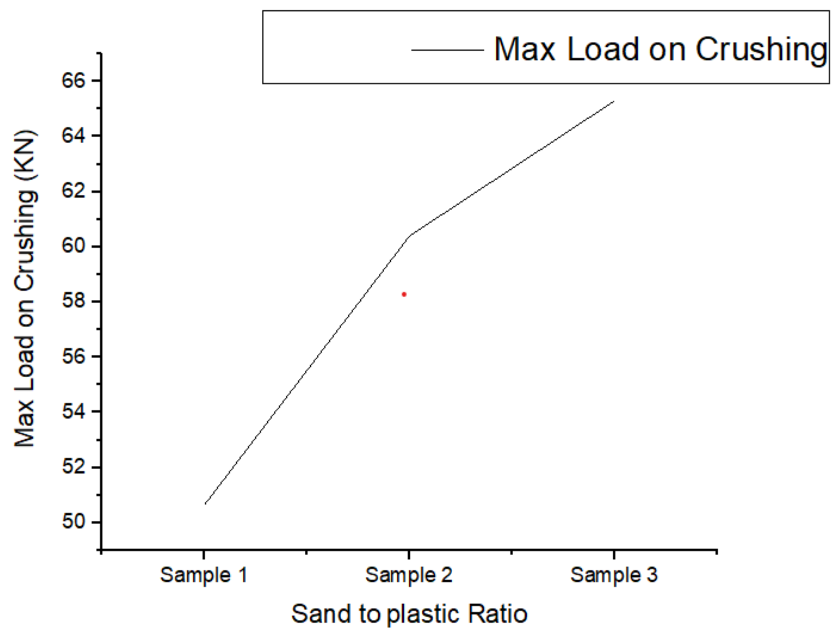

Figure 4.1: Graph of our project

4.4.5. Description Of Graph:

Increasing the plastic-to-sand ratio can potentially lead to an increase in the strength of the resulting bricks, up to a certain point. The plastic can improve the adhesion between sand particles, enhancing the overall structural integrity and reducing the risk of cracking or crumbling, while increasing the plastic-to-sand ratio in bricks can enhance their strength by improving cohesion and adhesion between sand particles. It is important to carefully optimize the composition, processing, and manufacturing methods to achieve consistent and reliable results. Thorough research and experimentation are essential to determine the most suitable plastic-to-sand ratio for specific construction applications.

As in the reference model, sample have good result. It is due to the greater ratio of Plastics as we know that the plastic has the ability to bonding its compound with the sand as the according to it that the greater number of plastic ratios so that the strength of the brick is well in all the above tested sample.

According to sample the as we increase in the plastic percentage so that the strength and durability of the brick will increases.

4.4.6. Graph Between Reference Model and Our project

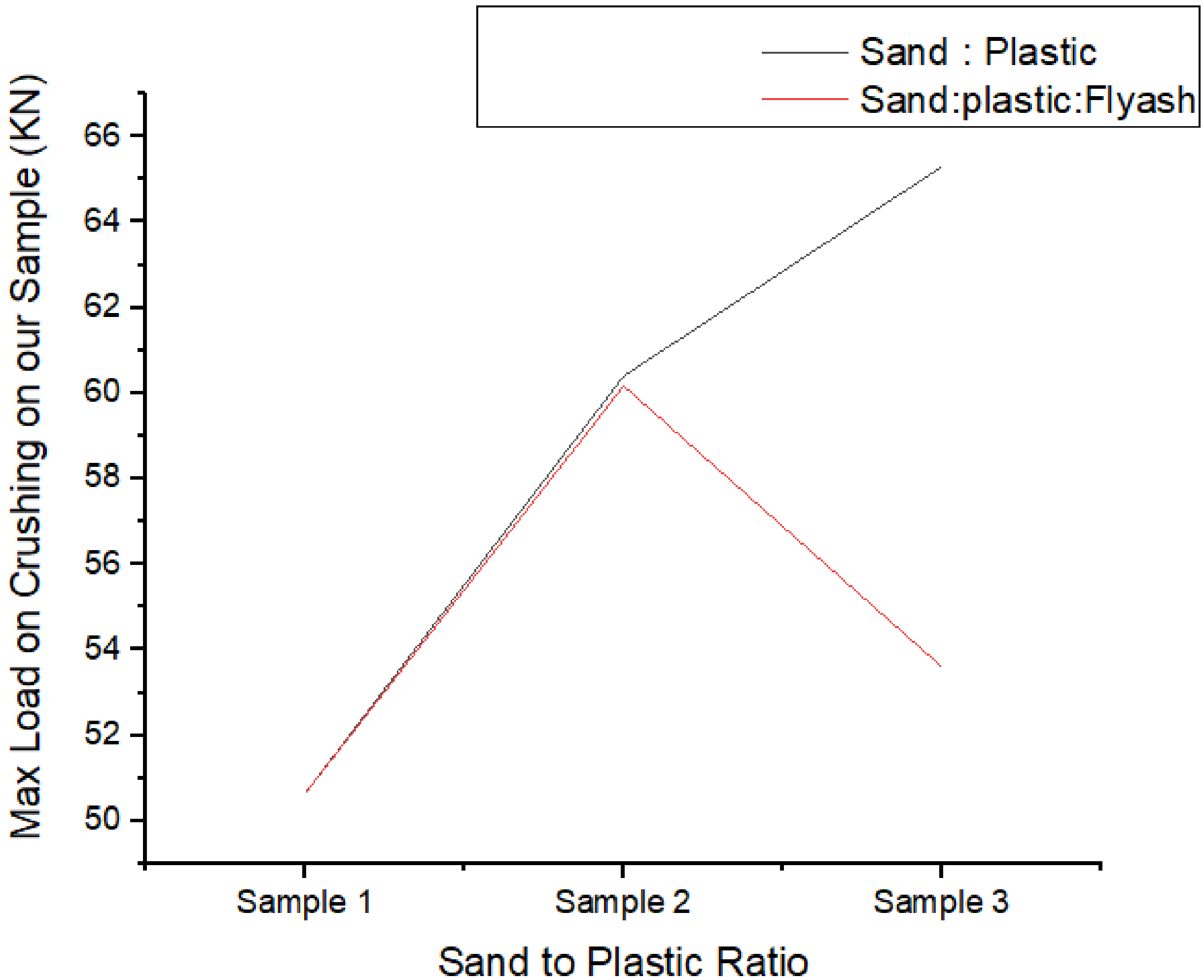

Figure 4.2: Graph comparison of both the project

4.5. Comparison Of Experimental Results:

As we have concluded that the plastic has holding capability so that the relationship between the plastic ratio and the strength of sand-plastic bricks is not as straight forward as assuming that increasing the plastic ratio will always lead to increased strength. The strength of these bricks depends on several factors, including the type of plastic used, the processing techniques, the curing methods, and the overall composition of the mixture. And the reference model have the fly ash as we increase the percentage of the flyash the strength of the brick was decrease so in between both the project as we increase the plastic ratio the strength of the brick was increase

4.6. Justification of Experimental result:

As we know that the strength of both the Reference model and our project is almost same but at 3rd sample in which the fly ash percentage was greater than the plastic brick was resist to less force. it means that the plastic has the capability to with hold and it conclude that we should use that plastic brick in manufacturing houses as the plastic brick have the ability of holding sand particles.

4.7. Conclusion:

As we know plastic brick is very helpful in cleaning our environment by recycling and using it as a raw material. As we know that the plastics brick are very good strength and also that it cannot absorb water so it is also good for the manufacturing our houses from plastic bricks. As according to the above result our brick and the reference model brick the in which the plastics, flyash and sand is used as we increase the plastics percentage according to weight so that the strength of the bricks is increase and in the reference model as the fly ash percentage is increase the strength of the brick was decreases so we concluded that the fly ash cannot make bonding with the plastic and sand and we should use only sand and plastic as a raw material in a bricks

4.8. Safety Precaution

- Beware of melted plastic on touching it can damage the skin.
- Beware the machine body from corrosion.
- A corrosion monitoring, inspection detection is very important.
- Temperature of the Mixture should be check with the passage of time.
- Rust can damage the shiny surface of the Mold which can affect the brick shape

Chapter 5
Conclusion & Future Recommendation:

5.1. Conclusion:

bricks have emerged as a promising alternative to traditional construction materials due to their potential to address both environmental and structural challenges. These bricks are typically made from recycled plastic waste and offer several advantages, such as reduced environmental impact, improved insulation properties, and potentially lower costs. Additionally, they can contribute to waste reduction by utilizing plastic that would otherwise end up in landfills or oceans. The adoption of plastic bricks could potentially revolutionize the construction industry and promote sustainable building practices.

5.2. Future Recommendations:

While plastic bricks hold significant promise, there are several considerations and recommendations for their future development and implementation:

5.2.1. Further Research and Development: Continued research into the composition, strength, durability, and long-term behaviour of plastic bricks is essential. This includes studying their performance under different environmental conditions, loads, and stresses.

5.2.2. Standardization: Developing industry standards for the production, testing, and application of plastic bricks is crucial to ensure their reliability and consistency in construction projects. This can help gain the trust of architects, engineers, and builders.

5.2.3. Technological Innovations: Invest in technological advancements for producing plastic bricks more efficiently and with minimal energy consumption. This could involve exploring new manufacturing processes, automation, and the integration of other materials for reinforcement.

5.2.4. Lifecycle Analysis: Conduct comprehensive lifecycle assessments to evaluate the overall environmental impact of plastic bricks compared to traditional materials. This analysis should consider factors such as production, transportation, use, and disposal.

5.2.5. Regulations and Policies: Governments should consider implementing regulations and incentives that encourage the use of recycled materials in construction. This can stimulate the demand for plastic bricks and encourage innovation in the field.

5.2.6. Waste Management: Effective waste management systems are critical to providing a consistent supply of high-quality plastic waste for brick production. Governments and industries should work together to improve waste collection and recycling infrastructure.

Chapter 6
Environment and Sustainability

6.1. Effect on Environment:

According to higher use of plastic in environment the plastic are made but it cannot be biodegrade as by passing 100s of years so due to that reason the plastics brick are good option for utilizing the waste plastics as according to higher rate of building manufacturing. Plastic bricks, also known as eco-bricks or recycled plastic bricks, are a construction material made by compacting and binding plastic waste using various methods. These bricks are often promoted as a potential solution to address plastic pollution and reduce the demand for traditional building materials like concrete and clay bricks.

Plastic bricks provide a way to repurpose and recycle plastic waste that might otherwise end up in landfills or the environment, helping to mitigate plastic pollution Manufacturing traditional building materials like concrete requires significant amounts of energy and resources. Using plastic waste to create bricks can potentially reduce the demand for these resources. If the plastic bricks are replacing more energy-intensive materials like concrete, their use could lead to lower carbon dioxide emissions associated with manufacturing.

6.2. Sustainability of Plastic Bricks:

6.2.1. Longevity and Durability: The long-term durability of plastic bricks compared to traditional materials needs to be evaluated. They should be able to withstand the elements and structural stresses over time.

6.2.2. Toxicity and Leaching: Depending on the type of plastic used and the additives present, plastic bricks might release toxic substances into the environment, especially when exposed to heat and sunlight. Ensuring the non-leaching nature of these bricks is crucial.

6.2.3. End-of-Life Management: While plastic bricks can help manage plastic waste, they themselves may not be easily recyclable after use. Developing a plan for the end-of-life management of these bricks is essential to avoid creating a new waste problem.

6.2.4. Resource Intensity: The process of converting plastic waste into bricks involves additional energy and resources. If not managed properly, the environmental impact of this process could outweigh the benefits.

6.2.5. Perception of Plastic: There's a concern that using plastic in construction could perpetuate the idea that plastic is an acceptable and sustainable material, potentially undermining efforts to reduce overall plastic consumption.

6.2.6. Availability of Suitable Plastic Waste: Not all types of plastic are suitable for making these bricks, and the availability of clean and appropriate plastic waste can be a limiting factor.

6.3. Sustainability Developmental Goal OF Plastic Bricks:

Plastic bricks align with responsible consumption and production practices by repurposing plastic waste into a valuable construction material. This can reduce the demand for traditional building materials, such as clay bricks or concrete blocks, which have a higher environmental impact due to resource extraction and energy-intensive manufacturing processes. Plastic bricks can contribute to creating more sustainable cities and communities by addressing waste management challenges. By utilizing plastic waste to create building materials like bricks, cities can reduce the amount of plastic waste ending up in landfills or the environment. This supports the development of cleaner, more efficient urban environments.

REFRENCES:

1. Adam Taylor, “Manufacturing of Brick Machine,” The Origins of Brick Manufacturing vol. 3, no. 2 pp 117-145, 2001
2. NC Majumdar, n. C., wadhwa, s. S., & hiralal, e. S, “Manufacture of building bricks by a semi-mechanized process,” Transactions of the indian ceramic society, vol. 2, no. 1, pp. 121-128, 2008
3. Kathleen ann Watt, “britain:building and technological change doctoral dissertation,” The rules of construction vol. 1, no. 3, pp. 546-576, 1990
4. Kumar, r., & hooda, n, “An experimental study on properties of flyash bricks,” International journal of research in aeronautical and mechanical engineering, vol. 2, no. 9, pp. 56-67, 1992
5. Kendesarinpimraksa, “A Review Paper on plc based automatic fly ash brick machine,” International research journal of engineering and technology, vol. 2, no. 5, pp. 1274-1278, 2001
6. Chen, y., zhang, y., chen, t., zhao, y., & bao, s, “Preparation of eco-friendly construction bricks from hematite tailings,” Construction and building materials, vol. 2, no. 4, pp. 2107-2111, 2001
7. Segaran, r g, “Solid wastes generation in India and their recycling potential in building materials,” Building and environment, vol. 4, no. 6, pp. 2311-2320, 2001
8. Das, a., & segaran, r. G., “Review of fly ash brick making technologies,” coak ash institute of India, vol. 1, no. 7, pp. 369-404, 2005
9. Clift j.e., “Description of oates' brickmaking machine,” Proceedings of the institution of mechanical engineers, vol. 1, no. 10, pp. 249-263, 2006
10. Askhedkar, r. D., & modak, j. P, “Hypothesis for the extrusion of lime-flyash-sand bricks using a manually driven brickmaking machine,” Bulding Research and Information, vol. 2, no.1, pp. 47-54, 2007
11. .Singh, b., & kumar, a., “A review paper on plc based automatic fly ash brick machine,” International research journal of engineering and technology, vol. 3, no. 8, pp. 1274-1278, 2008
12. Ramli, m. R. B. (2010). “Design of new interlocking bricks making machine” Building and environment, vol. 3, no. 2, pp. 608-620, 2010
13. Alan, s., sivagnanaprakash, b., suganya, s., kalaiselvam, a., & vignesh, v, “A study on mechanical properties of fly ash brick with waste plastic strips,” International journal of applied engineering research, vol. 10, no. 5, pp. 2165-2179, 2010

14. Azeez, o., ogundare, o., oshodin, t. E., olasupo, o. A., & olunlade, b.a, "Evaluation of the compressive strength of hybrid clay bricks," Journal of minerals & materials characterization & engineering, vol.8, no. 7, pp. 609-615, 2011

15. Daftardar, a., shah, r., Gandhi, p., & garg, h, "Use of waste plastic as a construction material," International journal of engineering and applied sciences, vol. 4, no.11, pp.277-322. 2012

16. Bhushaiah, r., Mohammad, s., & rao, d. S, "Study of plastic bricks made from waste plastic," Journal of engineering and technology, vol 3, no. 5, pp-654-656, 2012

17. .Kolawole, s. K., & odusote, j. K., "Design, fabrication and performance evaluation of a manual clay brick moulding machine," Journal of engineering science and technology review, vol. 6 no. 1, pp. 17-20, 2013

18. Shakir, a. A., & Mohammed, a. A, "Manufacturing of bricks in the past in the present and in the future: a state of the art review," International journal of advances in Applied sciences, vol. 2, no. 3, pp. 145-156, 2013

19. Ye, h. M., sun, q. T., lu, s. Q., & liu, x. F, "Design of brick machine control system based on plc," In applied mechanics and materials, vol.494, no. 5, pp. 1350-1353, 2014

20. Machine, b. M, "Design and fabrication of a plastic reinforced," Thirugnanasambantham institution of science anf technology, vol. 1, no. 3, pp. 876-889, 2015

21. N., kumar, p.t.,sujithra, r., selvaraman, r., &bharathi, p, "Manufacturing and testing of plastic sand bricks," International journal of science and engineering research, vol. 4 no. 5, pp. 150-155, 2015

22. Mohan, c. G., mathew, j., kurian, j. N., moolayil, j. T., & sreekumar, c, "Fabrication of plastic brick manufacturing machine and brick analysis," International journal for innovative research in science engineering and technology, vol. 5, no. 5, pp. 1092-2001, 2016

23. Wu, s., zhou, w., ke, j., & yan, h, "Design and application of hydraulic pressure system for new fly ash brick. In 2016 ieee international conference on aircraft utility systems (aus) (pp.895899).

24. Bhesaniya, j. J., koshiya, h. L., sakariya b. V. kalwaniya, m. S., & parmar, h. S, "Automatic brick manufacturing system," Int j science english technology, vol. 5, no. 4 pp. 344-349, 2016

25. . Mostafa, m., & uddin, n, "Experimental analysis of compressed earth block(ceb) with banana fibers resisting flexural and compression forces," Case studies in construction materials, vol. 5, no. 1, 53-63, 2016

26. Kumar, p. M., kumar, p. N., pavithran, p., & rajamurugan, g, "Automatic brick making machine," Dehli School of Architecture & Design, vol. 4, no. 5, pp. 2034-2040, 2018

27. Asiyanbola , mccleskey, c. M., & Robinsons, j. W, “Development of An Electro-Hydraulic Brick Making Machine,” Human Orbital Market Africa Commercial space with technology maturation, vol. 1, no. 11, pp. 3790-3802, 2017
28. Ayyappan, a., milan, s., sreejith, k. T., & kanakasabapathy, “Design of hybrid powered automated compressed stabilized earth block (cseb) machine, International conference for convergence in technology, vol. 1, no. 1, pp. 25-36, 2018
29. Dhande, m. S., himte, r. L., nanoti, v. M., & modak, j. P. (2018). Survey with design & development of mathematical modelling for ash brick production hydrualic machine. Ijirset, 7, 9604-9610.
30. Selvamani, g. D., sabarish, p., thulasikanth, y., & vinoth kumar, e, “Preparation of bricks using sand and waste plastic bottles,” International research journal in advanced engineering and technology (irjaet), vol. 5, no. 25, pp. 4341-4352, 2019
31. Kognole, r. S., shipkule, k., patil, m., patil, l., & survase, u, “Utilization of plastic waste for making plastic bricks,” International journal of trend in scientific research and development, vol. 3, no. 4, pp. 878-880, 2019
32. Inuwa, m. U. A, “Potters kiln bricks: using manual brick making machine,” Fine and Applied Arts Dept., Federal College of Education Kano- Nigeria” vol. 1, no. 3, pp. 96-101, 2019
33. Premkumar, m., devi, g., & sowmya, r. (2020). Design and implementation of brick making machine integrated with smart iiot application. International journal of computing and digital systems, vol 3, no. 9, pp. 1098-1110, 2020
34. Egenti, c., khatib, J. M, & etin-osa, c.e, “Design and Fabrication of Compressed Earth Block Machine for Low-Cost Housing in Nigeria,” International journal of sustainable built environment, vol. 1, no. 3, pp. 72-86, 2020
35. Jadhav, c. C., kadam, n. S., khote, a. S., patil, s. H., pansare, a. B., & wangikar, s. S, “Brick manufacturing machine” Air proceedings, vol. 1, no. 2, pp. 40-43, 2021
36. Vigneshwar, p. V., anuradha, b., guna, k., & kumar, r. A, “Sustainable eco-friendly fly ash brick using soil filled plastic bottles,” Materials today proceedings, vol. 1, no. 1, pp. 10-15, 2021
37. Xu, z., liu, x., li, x., gao, x., xie, r., & xia, y, “Design of status analysis system for brick machines based on industrial internet of things,” chinese automation congress, vol. 3, no. 25, pp. 6539-6543, 2022

38. Elemi, n., undie, p., muze, s., & ajibade, b, “Fabricating a semiautomatic brickmaking machine for the department of visual arts, university of cross river state,” Journal of social and environmental sciences, vol. 3, no. 1, pp. 27-35, 2021
39. Chetan c. Jadhav “Brick manufacturing machine,” construction engineering, vol. 1, no. 2, pp. 104-118, 2021
40. Venkatesh, c., suresh, g., vivek, m. S., reddy, k. A., reddy, y. S., & reddy,n, “D. Design and analysis of brick making machine,” International Journal of Research Publication and Reviews, vol. 6, no. 13, pp. 2415-2421, 2022