International Journal of Scientific Research & Engineering Trends
Volume 6, Issue 5, Sept-Oct-2020, ISSN (Online): 2395-566X

Literature Review on Utilization of Waste EPS in Paver Blocks

Post Graduation Student Anupama U, Assistant Professor Sadhasivam
Department of Civil Engineering,
JCT College of Engineering and Technology
Coimbatore, Tamilnadu, India

***Abstract*- Plastic is one of the critical issues that the world is facing. Over 300 million metric tons of plastics are produced every year. Among those expanded polystyrene is the fourth largest solid waste produced in the world. Polystyrene is an active contributor occupying more space in the landfill. 14 million tons of EPS is produced every year. These like any other plastics are non biodegradable hence they take centuries to decay. Nowadays EPS is being used in numerous applications due to its different properties.EPS is also being used in the construction industry due to its properties like lightweight,inert, thermal insulation and binding. The project focuses on using waste EPS to make paverblocks. The use of waste EPS in pavement block is a partial solution to the environmental and ecological challenges associated with the use of EPS. The aim of this project is to reduce environmental pollution by using waste EPS to produce pavement blocks. The EPS material is first shredded and melted by using limonene. Hence the project is helpful in reducing EPS waste in a useful way. This paper includes review of various studies conducted on utility of waste EPS material used in the construction industry. Moreover this paper will draw our focus toward the impingement on the various properties of concrete when partially replacing with waste expanded polystyrene.**

***Keywords*- Environmental hazard, Expanded polystyrene, Paver Blocks, Plastic, Properties, Recycling, Waste Management.**

I. INTRODUCTION

Plastics are a wide range of synthetic or semi-synthetic organic compounds that are malleable and so can be molded into solid objects. Polystyrene is just another form of plastic. Polystyrene (PS) is a synthetic aromatic hydrocarbon polymer made from monomer known as styrene. Polystyrene can be solid or foamed. General-purpose polystyrene is clear, hard, and rather brittle. It is an inexpensive resin per unit weight. It is a rather poor barrier to oxygen and water vapour and has a relatively low melting point. Polystyrene is one of the most widely used plastics, the scale of its production being several million tonnes per year. Polystyrene can be naturally transparent, but can be coloured with colourants.

Expanded Polystyrene (EPS) is a lightweight cellular plastic material consisting of small hollow spherical balls.it is 98% air and 2% plastic. It is this closed cellular construction that gives EPS its remarkable characteristics. EPS is produced in a wide range of densities providing a varying range of physical properties. These are matched to the various applications where the material is used to optimise its performance and strength.despite from its uses being a non degradable material it poses an threat to the world. Polystyrene is the fourth largest solid waste produced in the world.Polystyrene is an active contributor occupying more space in the landfill. 14 million tons of EPS is produced every year. By volume eps products fill up to 25-30% of the landfill volume. It is necessary to find an effective waste management strategy for EPS. Several attempts are being done inthis regard. Eps is also widely used in construction industry. EPS is used widely in the building and construction industry. EPS is an inert material that does not rot and provides no nutritional benefits to vermin therefore does not attract pests such as rats or termites. Its strength, durability and lightweight nature makes it a versatile and popular building product. Applications include insulated panel systems for walls, roofs and floors as well as facades for both domestic and commercial buildings.

It is also used as a void-forming fill material in civil engineering projects, as a lightweight fill in road and railway construction, and as floatation material in the construction of pontoons and marinas. Considerable quantities of EPS are also used in packaging applications. Its exceptional shock absorbing characteristics make it ideal for the storage and transport of fragile and expensive items such as electronic equipment, wines, chemicals and pharmaceutical products. The outstanding thermal insulation and moisture resistant properties of EPS enables freshness extension of perishable products such as produce and seafood. Moreover, its compression resistance means that EPS is ideal for stackable packaging goods. The majority of EPS packaging manufactured is used in the transport of fruit, vegetables and

seafood. EPS packaging is used extensively for both the domestic and export market. EPS has a positive strength to weight ratio making it an effective and popular solution for the use in gliders, light and model planes and also surfboards.When safety is paramount, EPS comes into its own. It is used in the manufacture of children's car seats and cycling helmets, where its protective qualities such as strength and shock-absorbency are vital.EPS also has applications in horticulture as seedling trays. Granulated EPS can also be added as a soil conditioner to promote aeration of the soil.

II. LITERATURE REVIEW

Jeevan Ghuge, Saurabh Surali, Dr.B M Patil,S B Bhutekar considered the utilisation of plastic waste in manufacturing of paver blocks (2019). In this paper the use of plastic as a bnder is studied. For the study 3 cubes of 0.00205m^3 were casted, concrete blocks were casted each with plastic as a binder and without using water. In this process plastic collected from different sources burnt in a close chamber and melt it to the liquid state. And then that liquid plastic added into other ingredients for making plastic paver block. After sufficient curing of both ordinary and plastic concrete block it has to be checked under compression testing machine (CTM) to know its compressive strength under gradually applied compressive force on the specimen. After placing the paver block on the platform and applied the load on a smooth surface steadily and uniformly at the rate of 35N/sq.mm/minute till the block failed. The test results describe that average compressive strength of ordinary concrete paver block on its complete curing of 28th day is 19.54 N/mm2 where in case of plastic paver block it is 16.05N/mm2. From the obtained results it is clear that plastic paver block has almost equal strength as that of ordinary one. It can be concluded that plastic paver block can be used in the park, footpath and yards of the residential as well as commercial building because the compressive strength is sufficient for the smooth utility of user.

Mahaveer Prasad, Devesh Jayswal studied Use of plastic waste in concrete mix (2017). The concrete mix was design to study the effect of replacement of sand by fine plastic waste material. The polyethylene wastes are cutted into small pieces and grinded into fine grains. Portland cement mixed with fine plastic wastes material and water using different percentages of wastes as 0%, 5%, 10%, 13% were made. Portland cement and fine polyethylene waste mixed with water to get a homogenous concrete to cast on the small mold. The best compressive strength for product was found in the mixture has 5%, 10%, and 13% polyethylene. The yield points for them are 970, 797, and 874 N, for immerged 7 days, respectively, and 1520 for mixed of 5% and 1296 N 10% after immerged 28 days. The stress-strain behavior is plastic behavior which has several stages of deformation. It works as semi crystalline polymer, flexible concrete and not brittle as Sand-Portland cement concrete. Therefore, their stress – strain diagram exhibited both elastic and plastic deformation before fracture. Moreover, the products with 5% to 13% waste plastic material have good workability to make holes without any problem. However, when the percentage of waste decrease or increase, the workability will be weak and power was generated during the cutting operation.

T Subramani, VK Pugal studied the experimental study on plastic as a coarse aggregate for structural concrete (2015). In this project Plastic waste materials were utilized to produce structural concrete. Then it was heated at a particular temperature so that the necessary brittleness was obtained. After extrusion the molten plastic was cooled down and collected in boulders of 100 mm size approximately. These plastic boulders were crushed down to the size of aggregates. 20mm down size aggregate was used. The plastic with 5%, 10%, 15% replacement for coarse aggregates were used. An intensive experimental program is performed to study the effect of internal curing on different types of concrete properties:

(i) fresh properties (slump and density); (ii) mechanical properties (compressive strength, flexural strength, splitting tensile strength).It is identified that plastic waste can be disposed by using them as construction materials. Since the plastic waste is not suitable to replace fine aggregate it is used to replace the coarse aggregate.The compressive strength and split tensile strength of concrete containing plastic aggregate is retained more or less in comparison with controlled concrete specimens. However strength noticeably decreased when the plastic content was more than 20%. Has been concluded 20% of plastic waste aggregate can be incorporated as coarse aggregate replacement in concrete without any long term detrimental effects and with acceptable strength development properties.

B Shanmugavalli, K Gowtham examined the reuse of plastic waste along with fly ash and quarry dust in paver blocks (2017). The aim of this project is to replace cement with plastic waste in paver block and to reduce the cost of paver block when compared to that of convention concrete paver blocks. Plastic wastes are heated in a metal bucket at a temp of above 150˚. As a result of heating the plastic waste melt. The materials quarry dust, aggregate and other materials are added to it in right proportion at molten state of plastic and well mixed. Blocks of 3 different mix proportions were casted. Tests were done to determine compression and moisture content. The cost of paver block is reduced when compared to that of concrete paver block. Paver block made using plastic waste, quarry dust, coarse aggregate and ceramic waste have shown better result. It also shows good heat resistance. Though the compressive strength is low when compared to the concrete paver block it can be used in gardens,

pedestrian path and cycle way etc. It can be used in Non-traffic and light traffic road

Raimundo Kennedy Vieira, Raimundo Pereira de Vasconcelos considered optimization of expanded polystyrene lightweight aggregate in pres-cast concrete blocks by a completely random experimental design with mixture and process variables (2016). The aim of this study was to determine the optimum design mix to produce pre-cast concrete blocks by a completely random experimental design (CRED) with mixture and process variables. The polymerized concrete was studied its composition: Cement, and water defined as the mixture compounds. To choose the best model, all the possible models were assessed through the ANOVA, which tested each possible model.

The linear-linear model was preferred, since that do not present evidence of lack of fit, and it is capable of relating how to react the process variables, when are changed the variable mixture condition levels. The optimum experimental condition, obtained for the polymerized concrete, was: The size of the polystyrene beads was 4.8 mm sized polystyrene beads, 5.0% polystyrene that replaced the aggregate, 18.3% cement, 73.4% aggregate and 8.3% water. In this condition, the blocks made with polymerized concrete show a compressive strength above 15 Mpa, allowing its utilization in paving. Considering this level of variable studied, the optimum condition in the polymerized concrete is: 4.8 mm sized polystyrene beads, 5.0% polystyrene beads that substituted the aggregate, 18.3% cement, 73.4% aggregate and 8.3% water. The results indicate that it is possible to produce a polymerized concrete with compressive strength above 15 MPa for 28 days. Thus, the goals of this works were achieved and the material obtained could be used as block for paving or in walls. This level of strength was obtained without and surface treatment in beads used or addition of additives. It allows many possibilities for the use in this of civil construction where the use of non-structural concrete. For future works, it is recommended its analysis as an element for thermal and acoustic insulation.

S. Agyemana,b, N.K. Obeng-Ahenkorac, S. Assiamahd, G. Twumasid experimented exploiting recycled plastic waste as an alternative binder for paving blocks production (2019). This study sought to explore the potential of using plastic waste as a binding material for paving blocks production. Concrete paving blocks (cement: quarry dust: sand = 1:1:2) by weight or volume were produced to serve as Control having tested the compressive strength and water absorption properties. Composite paving blocks less in plastic (LP) on a mix ratio of 1:1:2 and high in plastic (HP) on a mix ratio of 1:0.5:1 by weight or volume were also produced and tested in the laboratory for compressive strength at 7, 14, and 21 days curing via water sprinkling and water absorption test were done after the 72 -h of soaking. The study revealed after 21 days old that paving blocks in HP and LP having compressive strengths of 8.53 N/mm2 (water absorption = 0.5%) and 7.31 N/mm2 (water absorption = 2.7%) respectively were higher than the Control value of 6.07 N/mm2 (water absorption = 4.9%). The authors recommended that the paving blocks made from the recycled plastic waste should be used in non-traffic areas such as walkways, footpaths, pedestrian plazas, landscapes, monument premises and in waterlog areas due to their low water absorption property and relatively low compressive strengths compared to global specs thresholds of 5–25% and low-density to moderate concrete strength 0.69–17.24 N/mm^2 respectively.

Mr. Nitin D Arsod, Mr. Pratik V Kannao, Mr. Palash L Botare, Mr. Kartik V Nehare, Prof. Preeti V Ban studied a paper on experimental investigation on concrete paver block and plastic paver block (2019). The research work is determination of the effect of use PVC plastic waste powder as replacement of cement in percentage 0, 10, 20, and 30. Cube specimens of 36 numbers were cast cured and tested cube for 7, 14, and 28 days compression strength. PVC was powdered to fine powder and mixed along with sand and cement uniformly. Then 10mm coarse aggregate is mixed along with this. Then small pond was created and calculated quantity of water is poured in the pond. As PVC plastic is mixed, it requires more water. Because, plastic has the basic property of high resistance to water and non-absorbents. The finishing, shape, interlocking and appearance of the paver block are good. From our experimental study, we concluded that 10% replacement of cement with PVC plastic is applicable. Skilled labour not required for installation paver block.

Adewumi john babafemi, Branko savija , Suvash chandra paul examined the engineering properties of concrete with waste recycled plastic (2018). This paper presents a comprehensive review of the engineering properties of waste recycled plastic. An up-to-date, comprehensive review of existing research output on the performance of recycled waste plastic in concrete has been undertaken. The effects of recycled waste plastics when used as fine and coarse aggregates, and fiber on the fresh, mechanical, and durability properties of concrete were reported. The intrinsic non-reactive behavior of plastic aggregates reduces the performance of concrete under both mechanical and durability tests. Increased air content and weak bonding between the plastic aggregate and natural aggregate have been adjudged the main causes of the reduced performance of recycled waste plastic concrete. The shape, size, and surface treatment applied to the plastic aggregate are also important for the performance of plastic aggregate concrete. One way to improve the performance of plastic in concrete is surface treatment. Chemical surface treatments such as common household bleach (sodium hypochlorite) with caustic soda (sodium hydroxide) were used by some researchers and

led to significant improvements. It is concluded that when plastic was subjected to the chemical solution and dried, compounds originally dissolved precipitated on the surface of the plastic, forming crystals. These crystals dissolved in the water of concrete mix and decomposed in the high pH environment of the cement, forming oxygen. The use of recycled plastic aggregates in civil engineering applications, such as pavement and infrastructure, can be an alternative to disposing of them in landfill sites. Recycled plastic aggregates can also be used for producing concrete bricks (for general applications), blocks (for river bank protection), façade elements, non-structural concrete panels, and temporary shelters. For structural concrete applications, structures with lower imposed loads and where the durability is less important, a certain amount of plastic aggregates may be used in concrete. Plastic fibers can be used in concrete to control cracks, shrinkage, and creep rather than using expensive synthetic or steel fibers. This will reduce not only the dependence on the natural aggregates, but possibly also the cost of concrete. From an environmental point of view, recycling of plastic waste can be beneficial to humans and marine life.

Abhijit mandlik, Tarun sarthak sood, Shekhar karade, Sangram naik experimented Lightweight concrete using eps (2013). The study is to achieve a mix design for Lightweight EPS Concrete with density lesser than 1800kg/m³ and enough high compressive strength so that it can be used in construction purpose. Expanded polystyrene waste in a granular form is used as lightweight aggregate to produce lightweight structural concrete with the unit weight varying from 1200 to 2000 kg/m³. The polystyrene aggregate concrete was produced by partially replacing coarse aggregate in the reference (normal weight) concrete mixtures with equal volume of the chemically coated crushed polystyrene granules. This paper reports the results of an experimental investigation into the engineering properties, such as compressive strength, modulus of elasticity, drying shrinkage and creep, of polystyrene aggregate concrete varying in density. The main objectives of this study are the cement contents for the concrete mixtures used were 410 and 540kg/m³.

The possibilities offered by new cement-based materials suggest that it is possible to improve the compressive strength versus the specific gravity, or to reach equivalent strength for lower specific gravity. It has been found from experimental data which shows that the compressive strength depends on the inclusions' size of EPS beads, the smallest the size the highest the performance. The cost of EPS is less compared to that of normal concrete. Increase in the EPS beads content in concrete mixes reduces the compressive and tensile strength of concrete. All the EPS concrete without any special bonding agent show good workability and could easily be compacted and finished. The replacement by using EPS has shown a positive application as an alternate material in building nonstructural members, and it also serves as a solution for EPS disposal. Obtained results suggest that expanded polystyrene concrete has scope for nonstructural applications, like wall panels, partition walls, etc.

Pratichhya pradhan, Sanjeev Maharjan -Light weight concrete brick using expanded polystyrene (2016). In this research work a light weight brick using waste EPS and its cost estimation is done inorder to help the earthquake affected areas of Nepal. EPS lightweight concrete bricks consist of cement,sand, coarse aggregate and EPS (as a reuse). Eps beads are used in the mortar to prepare bricks in different quantiies by ensuring different aggregate to EPS ratios as 0%, 10%, 20%, 30%, 100%. Paper concludes that hand mixing and hand compaction can also result in satisfactory finishing. Furthermore, that the cost of EPS concrete bricks are dependent on amount of cement than on other ingredients.On the other hand it was confirmed that these light weight bricks can be prepared at reasonable cost (as compared to common bricks).

Ling , I.H. and Teo , D.C.L- EPS RHA Concrete Bricks – A new building material.(2013). this paper introduces innov tive efforts of the combined use of RHA and EPS wastes for the production of EPS RHA lightweight concrete bricks.due to the combined benefits of RHA and EPS wastes, these wastes are used as partial replacement for cement and aggregate respectively in the production of economically affordable and environmental friendly new building material – lightweight concrete bricks. the research work undertaken to study the main properties; namely compressive strength, sorptivity and thermal conductivity of this new composite building material. The maximum size, specific gravity and fineness modulus of the EPS aggregate used were: 8mm, 1.05 and 5.50, respectively.

The combined use of EPS and RHA wastes as aggregate and cement replacement respectively has been successfully applied to the production of a more eco-friendly, lightweight concrete brick. The EPS RHA concrete brick sample C under full water curing at 28 days presents a good compressive strength of 17.51 N/mm2 which can be classified as Class 2 load-bearing brick according to MS76:1972. When compared to the control sample (sample A), sample C gives the best results in terms of compressive strength, sorptivity and thermal conductivity values. Hence, it shows good potential for local residential applications. Therefore, these EPS RHA concrete bricks have made these agricultural and industrial wastes a significant contributor to a holistic approach by the concrete brick industry to the global issue of environmental sustainability.

Adeeb Arif Mallick, Sohit Agarwall, Mukesh Pandey - Behaviour of light weight brick with the influence of EPS beads and silica fume (2020). The principal reason behind

this experimental investigation carried out here is to diminish the dead load of structures with the potential use of light weight bricks. EPS beads and silica fume are light in nature. The investigation work enhanced, with numerous literature study to find out the utilization of Expanded polystyrene(EPS) beads and silica fume in light weight brick can be used in military bases in cold regions due to its low thermal insulating quality. The main objective of this research is to prepare a light weight brick by partial substitution of Cement with silica fume and the replacement of fine aggregate with EPS beads. A total of 70 bricks containing two different sizes of EPS beads say Type A and Type B with different proportions (0%, 7%, 14%, 21%) of each Type were casted in order to check the mechanical properties such as compressive strength, water absorption, efflorescence, workability, and thermal conductivity of the brick. The compressive strength test was carried out at 7, 14 and 28 days of curing. As the percentage of EPS beads in the brick increased the strength of brick decreased while with the increase of EPS beads in the brick the water absorption as well as the thermal conductivity of brick decreased. There was slight presence of Efflorescence in some of the bricks while in most of the brick there was no efflorescence found.

N.A. Kamarulzaman , S.H. Adnan , K.A. Mohd Sari - Properties of cement brick containing expanded polystyrene beads (EPS) and Palm oil fuel ash (POFA) (2018). This paper assesses the mechanical properties of cement brick containing Expanded Polystyrene Beads (EPS) and Palm Oil Fuel Ash (POFA) as partial replacement of sand and Ordinary Portland Cement (OPC). The paper mainly focuses on determining the mechanical properties of brick containing EPS and POFA as partial replacement of sand and OPC. The dosage for EPS replacement is 20%, 30%, 40% and 50% EPS whereas 5%, 10%, 15%, 20% and 25% of POFA replacement. The mechanical properties of the bricks are density, compressive strength and water absorption. The bricks with 30%, 40% and 50% EPS replacement have density below 1680 kg/m3 which considered as lightweight brick. The brick with 50% EPS replacement recorded lowest density which is 1328 kg/m3 while 1629 kg/m3 for the brick with 25% POFA replacement at 56-days of curing. The water absorption testing for these brick are between 7.20%-18.19%. Brick with 0% POFA and 50% EPS replacement has the lowest water absorption properties whereas brick with 25% POFA and 0% EPS replacement has the highest water absorption properties.

Y. Zou, Researcher, ND c.j. Leo -Behavior of EPS geofoam as flexible pavement subgrade material in model tests (2016). The behavior of expanded polystyrene (EPS) geofoamused as subgrade and fill material under flexible pavement was investigated by carrying out a series of tests in a model pavement testing facility. In the experimental setup, pavement test sections that consisted of a wearing course, a gravel base layer, and a sand subbase were placed on EPS blocks inside a test tank. Traffic loading on the test pavement was simulated using a loaded wheel running on an oval-shaped test track. The investigation studied the effects of repeated traffic loading on the performance of the EPS geofoam, the influence of the EPS block size, and the presence or lack of lateral restraint. EPS geofoam was also constructed and tested and is considered as the baseline case. The performance of the EPS geofoam was benchmarked against the baseline case to analyze its performance and to determine possible problems that may occur when used in full-scale pavement sections.In terms of permanent (plastic) deformation at the subgrade level, EPS geofoam performs as well as, if not better than, compacted sand under repeated traffic loading.

.

Teresa loez lara , Juan bosco hernandez ,carlos lopez cajun -Cellular concrete bricks with recycled expanded polystyrene aggregate (2013). A lightweight mortar with recycled expanded polystyrene aggregate instead of sandy materials is used to make cellular lightweight concrete. These bricks shows efficient mechanical properties and it could be used as masonry in construction since this material meets the required parameters. It composed of recycled expanded polystyrene as aggregate and commercial Portland cement as binder. Unlike most of the works reported in the literature, this mortar does not use pozzolans or additives or additional aggregates. Unlike concrete (with coarse aggregate), the failure paths always follow the interfaces of the polystyrene aggregate particles and cut through the cement paste and the aggregate particles themselves. The polystyrene brick cracks are similar to reported concrete cracks in the Compression and Tensiletest.

Prof.shilpi S. Bhuinyan , Shantanu Dahatonde-Design of EPS geofoam as a pavement block (2019). In their work the authrs say that EPS can be used as an infill material in the design of pavements. They state that by using EPS geofoam the minor settlements are reduced and it can lead to less maintenance cost. The EPS is an elasto-plastic hardening material whichalso softens stiffness wise under increasing confining pressure. As the cost of the Geo-foam is less as compared to soil and also it is 100 times lighter than soil therefore Geofoam is widely used in the world. Also it is much lighter than the soil or subgrade materials it is accepted worldwide

Andrea Petrella, Rosa Di Mundo and Michele Notarnicola -Recycled expanded polystyrene as lightweight aggregate for environmentally sustainable cement conglomerates (2020). In the present work the rheological, thermo-mechanical, microstructural, and wetting characteristics of cement mortars with recycled expanded polystyrene (EPS) were analyzed. The samples were prepared after partial/total replacement of the conventional sand aggregate with EPS having di_erent

grain size and size distribution. Lightness and thermal insulation were relevant features for all the bare EPS composites, despite the mechanical strengths. Specifically, EPS based mortars were characterized by higher thermal insulation with respect to the sand reference due to the lower specific mass of the specimens mainly associated with the low density of the aggregates and also to the spaces at the EPS/cement paste interfaces. Interesting results in terms of low thermal conductivity and high mechanical resistances were obtained in the case of sand-EPS mixtures although characterized by only 50% in volume of the organic aggregate. Moreover, sand-based mortars showed hydrophilicity (low WCA) and high water penetration, whereas the presence of EPS in the cement composites led to a reduction of the absorption of water especially on the bulk of the composites.
Specifically, mortars with EPS in the 2–4 mm and 4–6 mm bead size range showed the best results in term of hydrophobicity (high WCA) and no water penetration in the inner surface, due to low surface energy of the organic aggregate together with a good particle distribution. This was indicative of cohesion between the ligand and the polystyrene as observed in the microstructural detections. Such a property is likely to be correlated to the observed good workability of this type of mortar and to its low tendency to segregation compared to the other EPS containing specimens. These lightweight thermo-insulating composites can be considered environmentally sustainable materials because they are prepared with no pre-treated secondary raw materials and can be used for indoor applications.

Aman Mulla, Amol Shelake -Light weight expanded polystyrene beads concrete (2016). In this the EPS beads is used to partially replacement of coarse aggregate to reduce its density. The EPS beads used are spherical shape and size varying between 1.18 to 2.36 mm in diameter. Three mix proportions are created and tests are taken on that EPS beads concrete mix proportion. Tests for workability, compression test, split tensile strenghth test, density test are done. The conclusions arrived are even though it gives good workability the compressive strength is lower than the conventional concrete. Also concluded that designed all mix proportions re useful in cladding panels and tolt up panels. The concrete mix proportions are also useful as precast concrete members with low density and more workability.

Thomas Tamut, Rajendra Prabh -Partial replacement of coarse aggregates by expanded polystyrene beads in concrete (2014). The main objective of this investigation is to study the properties, such as compressive strength and tensile strengths of lightweight concrete containing Expanded Polystyrene (EPS) beads. Its properties are compared with those of the normal concrete i.e., without EPS beads. EPS beads are used as partial replacement to coarse aggregates. The results showed that the amount of polystyrene beads incorporated in concrete influences the properties of hardened concrete. At 28 days, it was found that compressive strength of 5%, 10%, 15%, 20%, 25% and 30% EPS incorporated concrete strengths were 91%, 77 %, 71%, 63%, 57%, and 45%, respectively when compared to concrete with no EPS case. The results showed Increase in the EPS beads content in concrete mixes reduces the compressive and tensile strength of concrete. All the EPS concrete without any special bonding agent show good workability and could easily be compacted and finished. Workability increases with increase in EPS beads content.The replacement by using EPS has shown a positive application as an alternate material in building nonstructural members, and it also serves as a solution for EPS disposal.

Hannah Nyambara Ngugi, James Wambua Kaluli, Zachary Abiero-Gariy -Use of Expanded Polystyrene Technology and Materials Recycling for Building Construction in Kenya (2017). In this paper authors discusses the potential of EPS as a construction material in Kenya. Use of EPS material reduces the rate at which natural materials such as wood and stones are extracted from the environment, hence promoting sustainable development. EPS buildings are fast to construct, cost saving and have thermal characteristics that are suitable for areas with extreme weather conditions. Structurally, EPS materials have performed well for both low and high-rise buildings of up to ten floors. In Kenya, lack of governing standards and unawareness amongst industry players has hampered adaptability of EPS building materials. It is concluded that Kenya needs to develop strategies to promote use of environmentally friendly EPS materials... EPS construction materials are sustainable in the sense that they can be re-used, thus reducing the rate of extraction of natural resources. However, there lacks quality control standards to guide production and use of EPS construction materials in Kenya.

Hassan H, Olasunkanmi BA, Esan MT, Zubair AS - Environmental Life Cycle Assessment of Thermal Insulation Tiles for Flat Roofs (2017). Envelope insulation and protection is an important technical solution to reduce energy consumption, exterior damage, and environmental impacts in buildings. Thermal insulation tiles are used simultaneously as thermal insulation of the building envelope and protection material of under layers in flat roofs systems. This study assesses the environmental impacts of the life cycle of thermal insulation tiles for flat roofs. This paper presents the up-to-date “cradle to gate” environmental performance of thermal insulation tiles for the environmental categories and life-cycle stages defined in European standards on environmental evaluation of building.

Akshay Kumar Bacha, Rahul Patil, Shrinath Hogade - A Replacement for Conventional Building Materials by EPS-Wire Mesh Panel (2016). In this study attempt is

made to understand the strength behaviour of the EPS wire mesh panel with normal conventional concrete by varying the thickness of plaster, and is examined under compression loading. Since the number of joints in an EPS Panel when used for wall construction will be less hence the strength of wall marginally increases. The EPS panel of size 1mx1m was used for testing Compressive strength of 2.26 N/mm2 and 2.64 N/mm2 were obtained for 25mm and 35mm plaster thickness. Since the number of vertical and horizontal joints can be minimized marginally by using the EPS panel in wall construction hence the strength is improved. As compared to the weight of conventionally built wall, EPS panel wall reduces the weight so in construction of multi story buildings EPS panels can be considered as the best suitable replacement for conventional methods of wall construction. EPS panels are most suitable for thermal insulated wall due to the presence of polystyrene in the panel.

III. SUMMARY OF LITERATURE REVIEW

EPS is one of a promising material to the construction industry. EPS is being used world wide in different construction materials to enhance its property or reduce its weight and cost. The main objective of using EPS is waste manangement as EPS counts as a major space filling materials in landfills.fro the above literature reviews it can be found that the compressive strength tends to decrease with the increase in percentage of addition of EPS, however adding an optimum amount can give compressive strength almost same as the conventional paver blocks. That is an optimum amount of 10% gives acceptable compressive strength value. It can also be found that EPS gives good thermal insulation and its weightlessness is utilized to produce lightweight constructon materials.

REFERENCE

[1] Jeevan Ghuge, Saurabh Surali, Dr.B M Patil,S B Bhutekar “the utilisation of plastic waste in manufacturing of paver blocks”. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 04 | Apr 2019 p-ISSN: 2395-0072.

[2] Mahaveer Prasad, Devesh Jayswal “Use of plastic waste in concrete mix”. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 04 Issue: 11 | Nov -2017 p-ISSN: 2395-0072

[3] T Subramani, VK Pugal “the experimental study on plastic as a coarse aggregate for structural concrete”. International Journal of Application or Innovation in Engineering & Management (IJAIEM) Volume 4, Issue 5, May 2015 ISSN 2319 – 4847.

[4] B Shanmugavalli, K Gowtham “the reuse of plastic waste along with fly ash and quarry dust in paver blocks”. International Journal of Engineering Research & Technology (IJERT) IJERTV6IS020162 Vol. 6 Issue 02, February-2017.

[5] Vieira, R.K., de Vasconcelos, R.P., Marangoni, D. and Vieira, A.K. (2016) Optimization of Expanded Polystyrene Lightweight Aggregate in Pre-Cast Concrete Blocks by a Completely Random Experimental Design (CRED) with Mixture and Process Variables. Open Journal of Statistics, 6, 594-604.

[6] S. Agyemana,b, N.K. Obeng-Ahenkorac, S. Assiamahd, G. Twumasid “exploiting recycled plastic waste as an alternative binder for paving blocks production”. Elsevier Case Studies in Construction Materials 11 (2019) e00246.

[7] Mr. Nitin D Arsod, Mr. Pratik V Kannao, Mr. Palash L Botare, Mr. Kartik V Nehare, Prof. Preeti V Ban “a paper on experimental investigation on concrete paver block and plastic paver block”. International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 7 Issue III, Mar 2019.

[8] Adewumi john babafemi, Branko savija , Suvash chandra paul “the engineering properties of concrete with waste recycled plastic”. Sustainability 2018, 10, 3875; doi:10.3390/su10113875

[9] Abhijit mandlik, Tarun sarthak sood, Shekhar karade, Sangram naik “Lightweight concrete using eps”. International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438.

[10] Pratichhya pradhan, Sanjeev Maharjan “Light weight concrete brick using expanded polystyrene” Proceedings of IOE Graduate Conference, 2016 pp. 361–364.

[11] Ling , I.H. and Teo , D.C.L”EPS RHA Concrete Bricks – A new building material.”. Jordan Journal of Civil Engineering, Volume 7, No. 4, 2013 - 361 - © 2013.

[12] Adeeb Arif Mallick, Sohit Agarwall, Mukesh Pandey “Behaviour of light weight brick with the influence of EPS beads and silica fume” International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-3, January 2020.

[13] N.A. Kamarulzaman , S.H. Adnan , K.A. Mohd Sari “Properties of cement brick containing expanded polystyrene beads (EPS) and Palm oil fuel ash (POFA)”. Journal of Science and Technology · December 2018.

[14] Y. Zou, Researcher, ND c.j. Leo -Behavior of EPS geofoam as flexible pavement subgrade material in

model tests". Geosynthetics International · January 2000.

[15] Teresa loez lara , Juan bosco hernandez ,carlos lopez cajun "Cellular concrete bricks with recycled expanded polystyrene aggregate". Hindawi Publishing Corporation Advances in Materials Science and Engineering Volume 2013, Article ID 160162, 5.

[16] Prof.shilpi S. Bhuinyan , Shantanu Dahatonde "Design of EPS geofoam as a pavement block". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 11 | Nov 2019 www.irjet.net p-ISSN: 2395-0072.

[17] Andrea Petrella, Rosa Di Mundo and Michele Notarnicola "Recycled expanded polystyrene as lightweight aggregate for environmentally sustainable cement conglomerates". Materials 2020, 13, 988; doi:10.3390/ma13040988.

[18] Aman Mulla, Amol Shelake "Light weight expanded polystyrene beads concrete".2016.

[19] Thomas Tamut, Rajendra Prabh "Partial replacement of coarse aggregates by expanded polystyrene beads in concrete". IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308.

[20] Hannah Nyambara Ngugi, James Wambua Kaluli, Zachary Abiero-Gariy "Use of Expanded Polystyrene Technology and Materials Recycling for Building Construction in Kenya". American Journal of Engineering and Technology Management 2017; 2(5): 64-71.

[21] Hassan H, Olasunkanmi BA, Esan MT, Zubair AS "Environmental Life Cycle Assessment of Thermal Insulation Tiles for Flat Roofs". Journal of Scientific and Engineering Research, 2017

[22] Akshay Kumar Bacha, Rahul Patil, Shrinath Hogade "A Replacement for Conventional Building Materials by EPS-Wire Mesh Panel". International Journal of Advanced Scientific Research and Publications (IJASRP)