EFFECTIVE UTILIZATION OF WASTE PLASTIC WITH SAND IN ADDITION WITH NYLON GRIDS IN PAVER STONES

Mageshwaran A[1], Vino S[2], Sathish Kumar C[3], Vijayakumar M[4], Praveen Kumar T[5]
[1]Assistant Professor Department of Civil Engineering, Muthayammal Engineering College, Rasipuram
[2,3,4]UG Student Department of Civil Engineering, Muthayammal Engineering College, Rasipuram

ABSTRACT

Plastic waste which is increasing day by day becomes Eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. The ultimate aim of our project is to utilize these waste materials and produce precast paver blocks with addition nylon grids and sand in a effective manner. various percentages to obtain high strength bricks that possess thermal and sound insulation properties to control pollution and to reduce the overall cost of construction. This is one of the best ways to avoid the accumulation of plastic waste which is an non-degradable pollutant

Then the specimens were tested for some physical and mechanical properties like water absorption, apparent porosity, frictional behavior and high compressive strength. Then finally compared with traditional stones (or) Blocks

Keywords: Recycled plastics, pavement, physical properties, and nylon grids.

INTRODUCTION:

Paver block paving is versatile, aesthetically attractive, functional, cost effective and requires little or no maintenance if correctly manufactured and laid. Most concrete block paving constructed in India also has performed satisfactorily but two main areas of concern are occasional failure due to excessive surface wear, and variability in the strength of block. Natural resources are depleting worldwide at the same time the generated wastes from the industry and residential area are increasing substantially. The sustainable development for construction involves the use of Non-conventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways conserving the environment

The block shapes has evolved steadily from non-interlocking, partially interlocking to fully interlocking pavers have different designation i.e. those which partially, fully, multiply interlocking blocks are called interlocking concrete block pavements(ICBP) and non-interlocking are designated as concrete Pavement (CBP) Paver concrete blocks application has a tremendous steps worldwide over time especially on metropolitan cities and towns.

SCOPE

- The major advantage of this precast paver stones increases the ground water table level by permit the rain water to reach the sub grade.
- Paver block shows good fire resistance capacity and also less wear and tear to the road surface.

MATERIALS:

- Waste Plastic
- M -Sand
- Nylon grid

MANUFACTURED SAND

Manufactured sand (M-Sand) is a alternative of river sand produced from hard granite stone by crushing, which is composed of mineral particles and finely divided material. The composition of sand varies depending on the local rock conditions and sources. The characteristics of concrete mainly depend upon the properties of materials used. Grading, mineralogical composition, shape and texture of the aggregate

affects the fresh and hardened properties of concrete.

NYLON GRIDS

Nylon is a thermoplastic silky material that can be melt-processed into fibers, films or shapes. Nylon is made of repeating units linked by peptide bonds, Nylon polymers have found significant commercial applications in fabric and fibers (apparel, flooring and rubber reinforcement

Construction industry use this nylon paving systems as a reliable source of grid panels that can cope with heavy HGV traffic and heavy load areas. It has very quick to use interlocking system which makes it incredibly easy to install. Whether it be heavy free standing traffic or flowing traffic, our superior strength plastic paving grids can hold up to 400 tonnes/m^2. They are robust and light weight for fast transportation, setup and installation.

Nylon grids

CONTROL MIX DESIGN

Mix Ratio

Block type-1

Paver blocks were casted using mix ratio provided below

Mix ratio = 1: 0.14: 0.05
River sand = 1
Plastic= 0.14
Nylon grid= 0.05

Block type-2

Paver blocks were casted using mix ratio provided below

Mix ratio = 1: 0.23: 0.08
M-sand = 1
Plastic = 0.23
Nylon grid= 0.08

Block type-3

Paver blocks were casted using mix ratio provided below

Mix ratio = 1.5: 1.5: 0.25: 0.1
River sand=1.5
M-sand= 1.5
Plastic = 0.25
Nylon grid = 0.1

In order to find the strength of plastic Sand stones that they possess high compressive strength with various mix proportions are made and they are tested by using compressive testing machine. The mix proportion were in the ratio of (1:0.14:0.05, 1:0.23:0.08, 1.5:1.5:0.25:0.1)

These are the ratio which represent the river sand, M-sand, plastics and nylon grids respectively.

In first step we should collect the waste plastic bags and the polyethylene bags are sorted out and remaining are disposed safely.

Next the collected waste bags are cleaned with water and dried to remove the water present in it after this the plastics are burned out by using stones and firewood. The stones are arranged to hold the drum and the firewood is placed in the gap between the stone. Then the sand is added based on the above ratios where the nylon grids are shredded and added to that melted plastic sand.

TESTS ON NYLON GRIDS

The following points are considered to check the suitability of nylon stones

- Thickness &No. of ribs and bars per unit length
- Thickness of bars (more than 2mm) Thickness of ribs
- Thickness of nodes Count the no. of ribs and bars per meter length by spreading the nylon grid on a flat surface.
- Good Friction on grid surfaces.

Percent Open Area

Samples of at least hexagonal at 135mm for each sides representative of the nylon grid are cut from the roll

The nylon grid pattern is drawn on a piece of paper Weigh the paper with the grid pattern accurate to 0.001 g Cut out the grid opening areas from the paper Weigh the cut out portions Percent Open Area is the ratio of the weight of the cut out portions to the total weight of the paper multiplied by 100.

Mass per Unit area

Same procedure as used for geo textiles is applicable for the Mass per Unit Area of the nylon grids also. The value is expressed in units of 800g/m^2.

Tensile Strength of nylon grids

ASTM D4595 (minimum width of 200 mm and gauge length of 100 mm, etc.)

Tensile strength of nylon grid per meter width= Peak tensile load x No. of ribs per meter width/No. of ribs in the test Installation Damage of nylon grids (ASTM D 5818)nylon grids undergo damage during the construction The amount of damage depends on the type of aggregate, level of compaction, type of compaction equipment and construction practice.

TEST FOR PAVER STONES

Compressive Test

Plastic paver blocks of size hexagonal 135mm for each sides were casted. The maximum load at failure reading was taken and the average compressive strength is calculated using the following equation.

Compressive strength (N/mm^2) = (Ultimate load in N / Area of cross section (mm^2).

This is done to know the compressive strength of the bricks and paver blocks. This is also called crushing strength of bricks and paver blocks. Generally five specimens of bricks are taken to laboratory for testing and tested one by one. In this test a brick and paver block specimen is put on crushing machine and applied pressure till it breaks. The ultimate pressure at which brick is crushed is taken into account. All five brick specimens are tested one by one and average result is taken as brick's compressive /crushing strength. The plastic sand bricks and paver blocks of different ratios are tested one by one and in this the high compression is found and comparison made between the fly ash and normal bricks.

Comparison of compressive strength of Plastic sand bricks possessing various ratios

Mix design	Mix ratio (sand, plastic and nylon grid)	Compressive strength(n/ mm^2)
M1	1: 0.14: 0.05	6.65
M2	1: 0.23: 0.08	7.12
M3	1: 0.28: 0.1	8.19
M4	1.25 :0.3:0.13	8.8
M5	1.15 :0.34: 0.15	8.2

Comparison of Plastic sand paver stones with Ordinary cement mortar blocks

S.No	Type of Paver block	Compressive Strength(N/mm^2)
1	Plastic sand paver stones	8.8
2	Ordinary cement mortar blocks	7.17

WATER ABSORPTION TEST

This test checks on how the paver block absorbs water, specimen to be tested is immersed in water, room temperature are required when it has been immersed for 24 hr. plus or minus two hours then specimen is removed from water and drains the water on it, for too invisible water can be removed by damp cloth, its weight is taken and then dried at temperature of within 107^0c and should not exit a period of 24hrs.succesive weight are taken every 2 hrs. to determine the loss weight greater than 0.2 per cent, new weights are recorded.

In this the bricks first weighted in dry condition and they are immersed in water for 24 hours. After that they are taken out from water and they are wipe out with cloth. Then the difference

between the dry and wet bricks percentage are calculated

Water absorption test results

S.No	Type of brick	Brick dry weight (kg)	Water absorption in kg after 24 hrs
1	Fly ash brick	3.25	3.40
2	Burnt brick	3.02	3.35
3	Plastic paver stone	3.3	`3.66

FIRE RESISTANCE TEST

The Plastic is highly susceptible to fire but in case of Plastic sand bricks/Paver blocks the presence of sand imparts insulation. There is no change in the structural properties of block of bricks up to 650^{o}C above which visible cracks are seen and the blocks/bricks deteriorate with increase in temperature.

HARDNESS TEST

In this test a scratch is made on brick surface with steel rod (any hard material can be used) which was difficult to imply the bricks or blocks were hard. This shows the brick possess high quality.

CURING

The protection of concrete from loss of moisture within a reasonable temperature range is call curing. This is done in order to increase strength with decrease in permeability in concrete. The expected compressive strength of cured concrete is 80 to 100 per cent greater as compare to uncured one. Strength of concrete increases with age when conditions are favourable. Most people apply water on concrete flows or material made of concrete in order to avoid cracks development during or after construction.

CONCLUSION

In traditional method of road laying process it requires more workers and equipments and it takes more time to complete the project. In traditional method, roads have to face more wear and tear. By using this plastic precast method we can ignore this kind of issues and problems. It gives economic gains to the society and the cost of paver block is reduced when compared to that of concrete paver block.

By adopting precast Paver block made using plastic waste, M-sand and nylon grids have shown better results and benefits. This paver block may sustains heat upto 650^{0}c which shows good fire resistance capacity, less wear and tear to the road surface. It can be used in gardens, pedestrian path and cycle way etc. The major advantage of this precast paver stones increases the ground water table level by permit the rain water to reach the subgrade.

REFERENCES

[1] Nivetha, C. Rubiya, M. Shobana, S. Vaijayanathi, G. (2016). Production of Plastic Paver Block from the Solid Waste. ARPN Journal of Engineering and Applied Science. 11(2).

[2] Ganesh Tapkire. SatishParihar. PramodPatil. Hemra, R. Kumavat. (2014). Recycled Plastic used in Concrete Paver Block. International Journal of Research in Engineering and Technology, 3(09).

[3] Poonam Sharma. Ramesh kumarBatra. (2016). Cement Concrete Paver Blocks for Rural Roads. International Journal of Current Engineering and Scientific Research, 3(1), 114-121.

[4] Joel Santhosh. RavikantTalluri. (2015). Manufacture of Interlocking Concrete Paving Blocks with Fly Ash and Glass Powder. International Journal of Civil Engineering and Technology, 6(4),55-64.