International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 02, 2019
ISSN: 1475-7192

An Experimental Investigation on Replacement of Aggregate with Hdpein Absorbent Pavements

G. Amirthagadeshwaran and R. Jeya Prakash

Abstract--- *The paper reports "An experimental investigation on replacement of aggregate with HDPE plastic waste in rigid pavement" in which the natural aggregate is partially replaced by the HDPE waste HDPE plastic in the permeable pavement. The main objective of this project is to use the waste HDPE plastic in an efficient way in the construction of road pavement which leads to a green ecosystem. Permeable pavements help in improving the flow of water, groundwater recharge and increase lifetime of pavement. By using the HDPE plastic as an aggregate in the concrete reduce the cost and weight of the pavement. Waste HDPE plastic of pellets shape was used as a partial replacement for aggregate by10%, 20%, 30%, 40%, and 50% with concrete mixture. All of the concrete mixtureswere tested at room temperature. The test includes performing slump, compressive strength, flexural strengths, and split tensile strength. Curing ages 7, 14, 28 days for the concrete mixture were applied in this work. This observation of investigation illustrates that reducing waste HDPE plastic as a natural aggregate substitution in concert gives a good approach to reduce the cost of material and solve some of the solid waste problems posed by HDPE plastic.*

Keywords--- *HDPE (Highly Density PolyEthelene) HDPE Plasticaggregates, Rigid Pavement.*

I. INTRODUCTIONS

The social-environmental problem such as disposal of waste HDPE plastic is a major concern. To overcome the hurdles the modifiers (waste HDPE plastic) are used. In general, there are two types of roads rigid pavement and flexible pavement. Now we are considering the replacement of aggregate with HDPE plastic waste in the rigid pavement. Rigid pavement development of industries and urban areas waste generation also increases, which is unfavorably carrying out the environment. The construction of new infrastructure which shows that the demand for the aggregates in future increases. Additional aggregate is required to fulfill the demand of the road sector. There is a gap between the demand and the supply of the aggregates because the giant amount of aggregates is required in housing and transportation nowadays. There is a quiet increment in the utilization and demand of the natural aggregates in India due to housing, road, construction and infrastructure development. Sturdiness, sustainability, and the economy have made it the world's most widely used construction material. As the HDPE plastic waste is lighter than the natural aggregate so the concrete made from such aggregate possesses.

This project is to use the waste HDPE plastic in an efficient way in the construction of road pavement which leads to a green ecosystem. Permeable pavements help in improving the flow of water, groundwater recharge and increase the lifetime of pavement. By using the HDPE plastic as an aggregate in the concrete reduce the cost and

G. Amirthagadeshwaran, Assistant Professor, Nandha Engineering College (Autonomous), Erode, Tamilnadu, India.
E-mail: gamirthagadeshwaran@gmail.com
R. Jeya Prakash, Assistant Professor, Nandha Engineering College (Autonomous), Erode, Tamilnadu, India.
E-mail: jprakashraja@gmail.com

Received: 15 Feb 2019 | Revised: 14 Mar 2019 | Accepted: 30 Mar 2019

weight of the pavement. These HDPE plastics are substantially non-biodegradable thus can be used as a modifier in concrete and aggregates to increase their strength. This learning grants the appropriate exploitation of waste HDPE plastic on aggregates and aggregate to enhance pavement performance, to protect the environment and to provide low-cost roads. The present study investigates the use of waste HDPE plastic as a coating over aggregates and as a filler material of HDPE plastic.

II. OBJECTIVES

1. To characterize the HDPE plastic aggregates to use rigid pavement construction.
2. To study the properties of HDPE plastic waste used in concrete.
3. To study influence HDPE plastic aggregates in concrete to conventional concrete.
4. Various percentages of HDPE plastic aggregates are considered to add with concrete.

III. LITERATURE REVIEW

1.Pratiksha Singh Rajput, "Use of HDPE plastic Waste in Bituminous Road Construction" global journal of engineering science and researches in June 2015.Disposal of waste materials including waste HDPE plastic bags has become a serious problem and waste HDPE plastics are burnt for apparent disposal which causes environmental pollution. The cleaned HDPE plastic waste is cut into a size such that it passes through 2.36 mm sieve using shredding machine. The aggregate mix is heated and the HDPE plastic is effectively coated over the aggregates. In this study the shredded HDPE plastic waste is mixed in hot aggregate and the HDPE plastic modified mix is prepared using 6%,8%,10%,12%, and 14% HDPE plastic by weight of bitumen .it has been found that the Marshall stability value is maximum when 12% HDPE plastic waste is added to the mix.

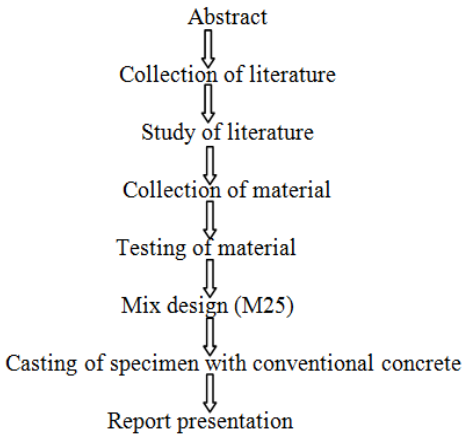
2. Mr. RahulJichkar, Shubhamin gale, et al, "Comparison in Strength of Pervious Concrete Block by Using Natural aggregates and HDPE plastic-Coated aggregates", The shredded HDPE plastic waste was thoroughly mixed with heated aggregate forming a layer on the surface of the aggregates. 300gm of waste HDPE plastic was used to coat the aggregates by using 3% waste HDPE plastic to the weight of aggregates. All of the aggregates tests were done at the laboratory. The test conducted on HDPE plastic-coated coarse aggregates and natural coarse aggregates are the crushing test, Los Angeles abrasion value test, impact value test, water absorption test, and specific gravity test.

3. Manoj Chopra, Marty Wanielista "Comparison Strength of Pervious Concrete Pavements" The result is a concrete with a high percentage of interconnected voids that, when functioning correctly, permit the rapid percolation of water through the concrete. Unlike conventional concrete, which has a void ratio anywhere from 3-5%, pervious concrete can have void ratios from 15-40 depending on its application. Pervious concrete characteristics differ from conventional concrete in several other ways. Compared to conventional concrete, pervious concrete has a lower compressive strength, higher permeability, and lower unit weight, approximately 70% of conventional concrete.

4.Aman Khimta, Sahil Arora "Use Of Waste HDPE plastic In Bituminous Concrete" International Journal of Civil Engineering and Technology (IJCIET) Nowadays, due to increment in t variation in daily or seasonal

temperature, it has put us in demanding situation to think of some alternative for improving the pavement characteristics and quality by applying some necessary modification which shall satisfy both economic aspects. The usage of waste HDPE plastic can be a promising alternative and it will also solve the waste HDPE plastic disposal problem which is favorable to the environment. HDPE plastic wastes may be in terms of bottles, carry bags and other u can be used in shredded form. This paper presents research conducted to study the behavior of bituminous concrete mix modified with waste HDPE plastic. The various properties of bituminous concrete with or without HDPE plastic were checked.

IV. METHODOLOGY



V. MATERIAL TESTING

1. Water

Fresh potable water having p^H value water is 7 is used for making concrete and for curing the concrete cubes, prism, and cylinder.

2. Cement

Ordinary Portland cement of 53grade is used for this present study. The specific gravity of cement is, and the other properties of cement are given in Table-1.

Table 1: Physical properties of cement

Property	Value	Requirement (IS12269-1989)
Specific gravity	2.85	ISH99-1959
Initial setting time	30 min.	Minimum 30 min.
Final setting time	390 min.	Maximum 600 min.
Fineness modulus	1.50%	<10%
Sound ness	5.80	Maximum 10mm
Standard consistency	27.20%	-

3. Aggregates

Commonly two types of aggregates are used in construction. The two types of aggregates are River sand and M Sand.

The material whose particles are of size as are retained on I.S Sieve 4.75mm is termed as coarse aggregate.

i. Aggregate test

- specific gravity
- sieve analysis

Fig.1: Aggregate

Specific gravity test on aggregate

G = (w2-w1)/ (w2-w1)-(w3-w4)
= (0.980-0.600) / (0.980-0.600) - (1.690- 1.470)
G = 2.375

Sieve analysis

A sieve investigation is anexercise or method used to assess the particle size distribution of granular material by allowing the material to pass through a series of sieves of progressively smaller mesh size and weighing the amount of aggregate.

Table 2: Sieve analysis test on aggregate

s.no	IS Sieve	Portable size (mm)	Mass retained (g)	Cumulative % retained	Cumulative fineness %
1	4.75 mm	4.75	32	3.2	96.8
2	2.36 mm	2.36	33	3.3	93.5
3	1.18mm	1.18	134	13.4	80.1
4	600 micron	600	374	37.4	42.7
5	300 micron	300	341	34.1	8.6
6	150 micron	150	81	8.1s	0.5

ii. Coarse aggregate

The proportions of the coarse aggregate hang on the nature of work. The coarse aggregate cast-off in this investigational is of 20mm size crushed angular in shape. The aggregates are free from dirtformerly used in the concrete.

- Specific gravity
- Water absorption
- Impact value
- Fineness modules

Table 3: Physical properties of coarse aggregate

S.No	**Property**	**Coarse aggregate**
1	Specific gravity	2.60
2	Water absorption (%)	0.39
3	Moisture content (%)	0.60
4	Aggregate impact value (%)	11.55
5	Fineness modules	6.67

Fig 2: Coarse aggregate

VI. FRESH CONCRETE TEST

Fresh concrete is the stage of concrete in which concrete can be molded and it is in a HDPE plastic state. The latent strength and sturdiness of concrete of a given mix proportion are very reliant on the degree of its compaction.

- Slump Cone Test
- Compaction factor test
- Flow test.

Slump Cone Test

Slump is a quantity of consistency or the virtual ability of the concrete to flow.

Table 4: Slumptest on fresh concrete

S.NO	W/C RATIO	SLUMP VALUE
1	0.45	25mm
2	0.50	60mm
3	0.55	75mm

Fig. 3: Concrete

Flow Test

The flow table test or flow test is a method to determine the consistency of fresh concrete. Flow table test is also used to identify the transport table moisture limit of solid bulk cargoes.

Table 5: Flowtest on fresh concrete

S.NO	W/C RATIO	
1	0.45	0.844
2	0.50	0.852
3	0.55	0.89

Compaction factor test

The compaction factor test is the workability assessment for concrete steered in a laboratory. The compaction factor is the ratio of weights of partially compacted to fully compacted concrete.

Table 6: Compaction test on fresh concrete

S.NO	W/C RATIO	COMPACTION FACTOR
1	0.45	0.830
2	0.50	0.949
3	0.55	0.973

VII. HARDEN CONCRETE TEST

The water origins the acclimatization of concrete through a progression called hydration. Hydration is a chemical reaction in which the major compounds in cement form chemical bonds with water molecules and become hydrates. The hardened concrete tests are

- Compressive strength test,
- Flexural strengths test,
- Split tensile strengthtest.

Fig. 4: Harden concrete

Results for M25 grade of concrete

Table 7: Conventional Concrete Compression strength

Trail No	Conventional concrete	7 Days N/mm²	14 Days N/mm²
1	1:1:2	16.30	24.30
2	1:1:2	16.50	24.80
3	1:1:2	17.0	25.0
4	1:1:2	17.25	25.30

VIII. ADVANTAGES& DIS-ADVANTAGES

Advantages

1. The strength of the road gets increased.
2. Better resistance to water & water stagnation.
3. No stripping & no potholes.
4. Increases binding & better bonding of the mix.

Received: 15 Feb 2019 | Revised: 14 Mar 2019 | Accepted: 30 Mar 2019

5. Better soundness property.

6. The conservation cost of the road is virtuallyzilch.

7. No effect of radiation like UV.

Dis-Advantages

1) Cleaning process -Toxic present in the co-mingled HDPE plastic waste start leaching.

2) During the road laying progression- the existence of chlorine will undeniably release noxious gas.

IX. CONCLUSION

The experimental investigation is to find out the M25 grade design ratio of conventional concrete test report on this section. Here using the ratio of concrete mix is 1:1:2.IS 10262-2009 and IS 456 – 2000 codes are using to stumble upon the conventional concrete test. The normal concrete with water-cement ratio of 0.4 and 7 days and 14 days compressive, split tensile strength and flexural strength were studied.

REFERENCES

[1] Aman Khimta, "Use Of Waste HDPE plastic In Bituminous Concrete"
[2] Manoj Chopra, Marty Wanielista, "Compressive Strength of Pervious Concrete Pavements"
[3] A. M. AmdeAndS. Rogge, "Development Of High Quality Pervious Concrete Specifications For Maryland Conditions"
[4] Pratiksha Singh Rajput,R. K. Yadav"Use of HDPE plastic Waste in Bituminous Road Construction", *International Journal of Science Technology & Engineering* | Volume 1
[5] Mr. Rahul Jichkar, Shubhamingale, et al "Comparison in Strength of Pervious Concrete Block by Using Natural aggregates and HDPE plastic Coated aggregates," *International Research Journal of Engineering and Technology (IRJET).*
[6] A.A.M. Sharif, s shahidan, et al "Strength development of pervious concrete containing engineered biomass aggregate"
[7] Jibrael and Peter, J Ecosys Ecograph 2016, "Strength and Behavior of Concrete Contains Waste HDPE plastic".
[8] Pratiksha Singh Rajput, R. K. Yadav, "Effect of HDPE plastic Waste on Properties of Road Aggregate" *International Journal for Innovative Research in Science & Technology*| Volume 2.
[9] Nivetha. R, Keerthikumar. B, et al, "Experimental investigation of rigid pavement using demolished waste" *International Research Journal of Engineering and Technology (IRJET).*
[10] Dr.E.K. Mohanraj, Dr. S. Kandasamy and N. Rajkumar, Study on Concrete using Waste Materials by Partial Replacement of Aggregates to reduce Global Warming Gases, *Indian Journal of Science and Technology*, 2011 Vol:04, No: 03, pp.159-163.
[11] Anzar Hamid Mir, "Use of HDPE plastic Waste in Pavement Construction: An Example of Creative Waste management" *IOSR Journal of Engineering (IOSRJEN).*
[12] Silvia Priscila,S., and Dr. Hemalatha, M. (2018). Heart Disease Prediction Using Integer-Coded Genetic Algorithm (ICGA) Based Particle Clonal Neural Network (ICGA-PCNN). *Bonfring International Journal of Industrial Engineering and Management Science*, 8(2), 15TO19.
[13] Sharifzadeh, M. (2015). The Survey of Artificial Neural Networks-Based Intrusion Detection Systems. *International Academic Journal of Science and Engineering*, 2(4), 11-18.
[14] Rajavenkatesan, T., Mohanasundaram, C., Ajith, A.S., &Vignesh, P. (2017). Photo Voltaic Cooling Can. *International Journal of Communication and Computer Technologies*, 5(1), 17-22.
[15] Gowshika, E., &Sivakumar, S. (2017). Smart LPG Monitoring and Controlling System. *International Journal of Communication and Computer Technologies*, 5(1), 23-26.
[16] Soorya, B., Shamini, S.S., &Sangeetha, K. (2017). VLSI Implementation of Lossless Video Compression Technique Using New Cross Diamond Search Algorithm. *International Journal of Communication and Computer Technologies*, 5(1), 27-31.

[17] Bennet A., Sankaranarayanan, Kandasamy R., Aruna, Kavitha, Thamizhoviya.(2016). Performance evaluation of enhancing the capacity of spectrum sharing cognitive radio networks. *IIOAB Journal*, 7(9).

[18] Kumar P.R., Santhakumar K., Palani S. (2016). An intelligent approach for optimizing Energy consumption and Schedule length of Embedded multiprocessors ¹. *Journal of Intelligent and Fuzzy Systems*, 31(1).

[19] Arthy G., Marimuthu C.N. (2016). Immune RBF neural network algorithm for DSTATCOM. 2016 *International Conference on Computer Communication and Informatics, ICCCI* 2016.

[20] Somasundaram K., Saritha S., Ramesh K. (2016). Enhancement of network lifetime by improving the leach protocol for large scale WSN. *Indian Journal of Science and Technology*, 9(16).

[21] Sukumar P., Gnanamurthy R.K. (2016). Computer aided detection of cervical cancer using pap smear images based on adaptive neuro fuzzy inference system classifier. *Journal of Medical Imaging and Health Informatics*, 6(2).

[22] Thangavelu S.K., Kasthuri N., Sundaram V., Aravind N., Bilakanti N. (2016). A stand-alone EEG monitoring system for remote diagnosis. *Telemedicine and e-Health*, 22(4).

[23] Sengottaian S., Natesan S., Mathivanan S. (2017). Weighted delta factor cluster ensemble algorithm for categorical data clustering in data mining. *International Arab Journal of Information Technology*, 14(3).

[24] Upendra Roy B.P., Rengarajan N. (2017). Feasibility Study of an Energy Storage System for Distributed Generation System in Islanding Mode. *Journal of Energy Resources Technology*, 139(1).

[25] Arthy G., Marimuthu C.N. (2018). A novel center-tapped transformer based multilevel inverter with common DC source. *Journal of Vibro engineering*, 20(8).

[26] Jagan K., Sivasankaran S., Bhuvaneswari M., Rajan S. (2018). Effect of second order slip and non-linear thermal radiation on mixed convection flow of MHD Jeffrey nanofluid with double stratification under convective boundary condition. *IOP Conference Series: Materials Science and Engineering*, 390(1).

[27] Khed V.C., Mohammed B.S., Liew M.S., Alaloul W.S., Adamu M., Al-Fakih A., Karthikeyan J. (2018). Experimental investigation on pullout strength of hybrid reinforcement of fibre in rubberized cementitious composites. *International Journal of Civil Engineering and Technology*, 9(7).

[28] Deepa A., Marimuthu C.N. (2018). Modified RS encoder architecture with reduced critical path delay for high speed data communication. *Proceedings of the International Conference on Intelligent Sustainable Systems, ICISS* 2017.

[29] Kumar, S. S., Kasthuri, N., & Ashok, V. (2010, December). Blood flow analysis using euclidean distance algorithm and discrete wavelet transform. In *2010 International Conference on Communication and Computational Intelligence (INCOCCI)* (pp. 330-335). IEEE.

[30] Vijaya, G., &Arumugam, S. (2010). Utilization of Statistical Process Control in Defined Level Software Companies to Manage Processes Using Control Charts with Three Sigma. In *Proceedings of the World Congress on Engineering and Computer Science* (Vol. 1).

[31] Rathinavel, S., &Arumugam, S. (2011). Shoe print recognition based on redundant discrete wavelet transform and support vector machine. *European Journal of Scientific Research*, *65*(3), 312.

[32] Rameshkumar, A., &Arumugam, S. (2011). An analysis of linear and non linear controller on quasi resonant buck converter.*European Journal of Scientific Research*, *66*(1)

[33] Bennet M.A., Raglend I.J. (2011). Performance analysis of block artifact reduction scheme using pseudo random noise mask filtering. *European Journal of Scientific Research*, *66*(1)

[34] Satheesh, A., &Manigandan, T. (2012). Hybrid Technique for Maintaining Power Stability Using Multiple FACTS Controller. *Journal Of Information &Computational Science*, *9*(12), 3401-3412.

[35] Mohanraj, V., Chandrasekaran, M., Senthilkumar, J., Arumugam, S., & Suresh, Y. (2012). Ontology driven bee's foraging approach based self adaptive online recommendation system. *Journal of Systems and Software*, *85*(11), 2439-2450.

[36] Kavitha, S., &Duraiswamy, K. (2012). Automatic detection of hard exudates from fundus images using adaptive neuro-fuzzy inference system. *Australian Journal of Electrical and Electronics Engineering*, *9*(3), 315-325.

[37] Ravi, S., Sudha, M., &Balakrishnan, P. A. (2012, May). Design and development of a microcontroller based neuro fuzzy temperature controller. In *2012 International Conference on Informatics, Electronics & Vision (ICIEV)* (pp. 103-107). IEEE.

[38] Rameshkumar, A., &Arumugam, S. (2012, April). PI Control of Quasi-resonant Buck Converter. *In International Conference on Advances in Information Technology and Mobile Communication* (pp. 477-485). Springer, Berlin, Heidelberg.

[39] Patchainayagi, S., &Banu, S. P. (2013). 'The Individual Vs. The Wife'–The Inner Conflict in the Selected Characters of Anita Desai & Margaret Laurence. *Life Science Journal*, 10(3).

[40] Vijayakumar, M., &Banu, S. P. (2013). Diasporic Perceptions and Cultural Disorientations in Jhumpa Lahiri's The Namesake. *Life Science Journal*, 10(3).

[41] Govindaraj, T., Ravi, S., &Balakrishnan, P. A. (2013, March). Design and development of maximum power point tracking in wind power optimization using fuzzy PLL controller. *In 2013 IEEE International Conference ON Emerging Trends in Computing, Communication and Nanotechnology (ICECCN)* (pp. 384-389). IEEE.

[42] Siva C., &Arumugam S. (2013). Fast reroute technique in BGP with secure Route Reliability Testing algorithm. *International Review on Computers and Software* 8(9):2221-2228.

[43] Prabhu, N., Agilan, S., Muthukumarasamy, N., &Senthilkumaran, C. K. (2013). Effect of Temperature on the Structural and Optical Properties of WO 3 Nanoparticles Prepared by Solvo Thermal Method. *Digest Journal of Nanomaterials &Biostructures (DJNB)*, 8(4).

[44] Ramkumar R.P., &Arumugam S. (2013). Improved Iris Segmentation Algorithm without Normalization Phase. *International Journal of Engineering and Technology* 5(6):5107-5113.

[45] Gandhi, P. K. (2013, December). Transient stability enhancement of single machine infinite bus system. *In 2013 International Conference on Advanced Computing and Communication Systems* (pp. 1-6). IEEE.

[46] Rajpriya, G., Ravi, S., & Zaidi, A. M. A. (2013, December). Design and development of MATLAB Simulink based Selective Harmonic Elimination technique for three phase voltage source inverter. *In 2013 International Conference on Advanced Computing and Communication Systems* (pp. 1-5). IEEE.

[47] Muthukumar, M., Karthikeyan, P., Lakshminarayanan, V., Senthil Kumar, A. P., Vairavel, M., &Girimurugan, R. (2014). Performance studies on pem fuel cell with 2, 3 and 4 pass serpentine flow field designs. *In Applied Mechanics and materials* (Vol. 592, pp. 1728-1732). *Trans Tech Publications Ltd.*

[48] Krishneswari, K., &Arumugam, S. (2014). An Enhanced Backpropagation Neural Network for Multimodal Biometric System. Computers and Software, 1208.

[49] Prabhu N., Agilan S., Muthukumarasamy N., &Senthil T.S. (2014). Preparation and Characterizations of Copper doped WO3 Nanoparticles Prepared by Solvo Thermal cum Chemical method. *International Journal of Chem Tech Research* 6(7):3487-3490.

[50] Prabhu N., Agilan S., Muthukumarasamy N., &Senthil T.S. (2014). Structural and morphological analysis of aluminum (Al) doped tungsten oxide (WO<inf>3</inf>) nanoparticles. *International Journal of ChemTech Research* 6(7):3491-3495.

[51] Maithili, G. (2014, March). A novel DC/DC converter for wind turbines with power quality using PQ algorithm. *In 2014 International Conference on Green Computing Communication and Electrical Engineering (ICGCCEE)* (pp. 1-7). IEEE.