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REPLACING BALLASTS WITH NON-BIODEGRADABLE MATERIAL

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Abstract - *The main aim of this project is to manufacture an artificial aggregate and then use it as ballast. In the present circumstance the utilization of plastic is expanding step by step, albeit numerous means were taken by the legislature to decrease its utilization. These plastic takes up to 1000 years to get disintegrated. Removal of enormous amount of plastic packs may cause contamination of land, water bodies and air (particularly when they are scorched). In this project we have manufacture artificial aggregate and which can be used in place of natural aggregate. This artificial aggregate is made up of plastic, lime, steel particle. After the manufacturing of artificial aggregate the result are compared with conventional Ballast.*

Key Words: **Artificial aggregate, Conventional aggregate, strength of aggregate and optimum% of replacement.**

1. INTRODUCTION

Railway plays an important role in transportation which helps to move passengers and freights from one place to another. The Railway structure consists of different parts such as rails, sleepers, tie and ballast. The ballast is the main component of railway structure as it holds the railway tracks and also distributes the train load to the ground without any kind of failure. Ballast in which aggregates plays an important role in distributing loads and holding the rails in position.

This project is related to rails in which we focused on the manufacturing of aggregate. The project is based on making of aggregate comprises of non-biodegradable materials, mainly plastic.

The attempt was to present you the aggregate which is economical, durable and eco-friendly.

This project was based on trial and error method in which we made aggregate of different materials of different compositions. That means during making of our project there was an effort to keep balance between theoretical part, industrial aspects, the construction, the manufacturing techniques and more.

2. OBJECTIVES OF THE STUDY

- To study the structural behavior of artificial aggregate.
- To analyses the physical parameters of artificial aggregate with natural aggregate.
- To distinguish the ideal % supplanting of artificial aggregate with natural aggregate in railroad track.
- To compare the conventional aggregate with artificial aggregate.
- To diminish the plastic waste in nature
- To recognize an elective material for natural aggregate because of its demand.
- To reduce the cost of aggregate.

3. MATERIALS

a) PLASTIC

Plastic is main content in this artificial aggregate. In this PETE – Polyethylene Terephthalate is to be used. This aggregate have 63% of Plastic by weight. Melting point of Polyethylene Terephthalate is 260°C.

b) LIME

Lime is useful for to form the silicates and aluminates of calcium. This also give aggregate some binding property during casting of aggregate. Lime used in this aggregate is wall putty. Proportion of Lime in aggregate is 32%.

c) GRINDED STEEL

Grinded Steel is added to give aggregate strength and to increase its density to add weight to it. This Grinded steel is waste of Fabrication shops. Proportion of Steel in aggregate is 5%.

4. METHODOLOGY

The principal to cast artificial aggregate is to combine properties of Plastic, Lime & Steel to form a homogenous material. This is done by heating of mentioned Plastic in furnace till its melting point. When plastic is melted it will be in liquid form. Once liquid form is achieved precaution is needed to avoid burning of plastic. For these proper vessels is required for slow and steady melting of plastic.

After melting of Plastic 200gms of Wall putty (Lime) is added and then it is mixed well. This will form thicker liquid; this will help steel to bind properly.

Once the wall putty is properly mixed grinded steel is added and it is mixed properly to form a homogenous liquid. The mixture is poured in mould. Mould used are 2 x 2 x 4 cm. The casted aggregate is kept to cool down for at least 24hrs before performing any tests. For proper removal of aggregate from mould, the moulds were coated with oil before placing of melted mixture.

Test performed on this aggregate are Sieve analysis, Impact value, Water absorption, Abrasion. If it is required to have more strength, natural aggregate can be added with this, which is about 40% natural and 60% Artificial aggregate.




5. RESULTS

a) Water Absorption Test

Water Absorption tested as per IS 2386 Pt III should not be more than 1%.

Result Required (Water Absorption Value)	Result Obtained	
	Artificial Aggregate	Artificial & Natural Aggregate
Max 1%	0.63%	0.89%

b) Sieve Analysis

Sieve Size	Result Required (Retention %)	Result Obtained	
		Artificial Aggregate	Artificial & Natural Aggregate
65mm Square mesh Sieve	Max 5%	4%	3%
40mm Square mesh Sieve	40% to 60%	46%	48%
20mm Square mesh Sieve	Not Less than 95% for hand broken	98%	97%

c) Impact Value:

Type of Gauge	Result Required (Impact Value %)	Result Obtained	
		Artificial Aggregate	Artificial & Natural Aggregate
BG and MG	20% max (with 25% relaxation)	31%	25%
NG	30% max (with 35% relaxation)	31%	25%

Relaxation on techno economics grounds shall normally be given prior to the issue of the tender document by CTE/CE in open line and CAO/Con for construction project.

d) Abrasion Value

Type of Gauge	Result Required (Impact Value %)	Result Obtained	
		Artificial Aggregate	Artificial & Natural Aggregate
BG and MG	30% max	35%	29%
NG	35% max	35%	29%

6. CONCLUSION

Throughout the railway system, the only thing which is not changed from starting, are the aggregates, which meet each and every expectation that are required by the ballast for proper functioning of railway. Till now, no other type of aggregate or product is made which is cheaper or better than

these aggregates to meet the expectations. But as mentioned earlier we have made or manufactured aggregate which cheaper than the natural aggregate and also possess properties similar to natural aggregate. The aggregate which is manufactured is made up of plastic so it may help to reduced plastic waste and make our aggregate eco-friendly. The stone brought from query are then bought in sizes of 40-60mm which are suitable for railway ballast. In this process the aggregate can be casted into any type of shape and size. The aggregate which is manufactured by this process also has similar properties as you have seen the results of tests performed on it.

By this process, the calculation of optimum percentage of replacement of natural aggregate by the artificial aggregate is also done, which will help in not full replacement of aggregate but the replacement up to some extent.

By certain efforts we made our aggregate cheaper and also matched its properties with the natural aggregate which we can consider it as a better aggregate than the natural aggregate.

REFERENCES

[1] Retrieved1018,2011,from:http://books.google.com
[2] Alex M. Remennikov & Sakdirat Kaewunruen. (2007). A review of loading conditions for railway track structures due train and track vertical interaction. Wollongong, Australia: Wiley InterScinece.
[3] (AREMA), A. R.–o.–w. (2000). Ballast.
[4] (ARTC), A. r. (2001). Cantrell Rail Services, Inc: Manual on what to do and what not to do when performing sub-grade maintenance.
[5] Agarwel, R. (n.d.). General Manager (Projects)/KRCL "Presentation on Ballast Less Track". Retrieved 10 07, 2011, from http://iricen.gov
[6] Ali Ebrahimi, James M. Tinjum and Tuncer B. Edil., (2010). Large-Scale, Cyclic Triaxial Testing of Rail Ballast". American Railway Engineering and Maintenance-of-Way Association (AREMA).
[7] ARTC, A. R. (2007, 01 04). Australian Rail Truck Corporation LTD (ARTC).
[8] Ravishankar et al. (2015) "Experimental study on artificial fly ash aggregate concrete."
[9] Ramya et al. (2015) "A study on the effect of concrete and the strength characteristics by utilization of the waste materials as course aggregate in concrete."
[10] Mathew.P et al. (2013) "Recycled plastic as the course aggregate for the structural concrete."
[11] Murugan and vali at el. (2017) "Overview of the Artificial Lightweight aggregate.
[12] Fang-Chih Chang , Ming-Yu Lee , Shang-Lien Lo , Jyh-Dong Lin (2010)' Artificial aggregate made from waste stone sludge and waste silt'Journal of Environmental Management 91 (2010) 2289-2294
[13] Harilal B and Job Thomas(2013)' Concrete made using cold bonded artificial aggregate' American Journal of Engineering Research (AJER) Volume-1 pp-20-25
[14] Mohammed Nadeem, Arun D. Pofale' Utilization of Industrial Waste Slag as Aggregate in Concrete Applications by Adopting Taguchi's Approach for Optimization Open Journal of Civil Engineering, 2012, 2, 96-105
[15] Prof. P. P. Bhangale'(2013) Study of Pond ASH (BTPS) Use as A FineAggregate in Cement Concrete International Journal of Latest Trends in Engineering and Technology (IJLTET) 123-131
[16] Raffaelecioffi,ClaudioFreone, Franceco Messina ,Francesco Colngelo(2012)'Artificial aggregate production from power plant solid waste by means of granulation process ' volume 2 232-239