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Review on Effects of Polymer Coated Coarse Aggregate in Railway Prestressed Concrete Sleepers (B.G)

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Abstract - The present study is for a detailed experimental investigation of conventional prestressed concrete sleepers and modified prestressed concrete sleepers with modify construction material such as plastic coated coarse aggregate for enhanced structural properties ductility and durability aspects. So that introduction in the field of sleeper manufacturing industries will benefit increased life span and load carrying capacity of prestressed concrete sleepers with quality production.
Keywords – Prestress, Railway, Sleepers, Concrete, Polymer Coat

I. INTRODUCTION

The railway sleepers are importance functioned to uniformly transfer and distribute loads from the rail to under laying ballast bed. Sustain and retain the rails at the proper gauge by keeping anchorage for the rail fastening system. Although the dynamic effect have evidently over the failures of railway concrete sleepers. Most of the design criteria are on the basis of the static sectional capacity of the concrete sleeper. Theoretical concepts of strength, ductility, stability and fracture mechanics refer to static behaviour of prestressed concrete sleepers.

The present study investigates the potential use of waste plastic as a modifier for plastic coated coarse aggregate and prestressed concrete railway sleeper (B.G). Plastic waste consisting of carry bags, cubs etc. Can be used as a coating coarse aggregate can be used railway sleeper construction. Performance test were conducted to determine the properties of plastic coated coarse aggregate such as density, specific gravity, absorption, and crushing value. As 100% replacement of natural coarse aggregate with plastic coated coarse aggregate is not feasible partial replacement at various percentage were examined. The prestressed concrete sleeper is an imperative component of ballasted railway tracks. Its main function is to distribute axial loads on rails to the soil beneath. The prestressed sleeper is subjected to sagging moment at the rail seat section and hogging moment at mid-section. The emphasis of this paper is on ductility aspect of new modify material over conventional material used in the railway sleeper manufacture. The test specimens are casted in sleeper factory at Patil rail infrastructure Pvt Ltd, Tirumangalam in accordance with Indian railway standard (IRST: 39-1985). The prestressed concrete sleepers are tested under two point static loading from the experimental study first crack load are observed.

II. LITERATURE REVIEW

V.Pashant (2013) Polymer concrete has not advanced to the degree of widespread commercial application, but as research produced improved techniques and better monomers, polymer concrete should be at the core of significant advances in concrete construction.

Ganiron.U (2013) Polymer fibre being added to the cement as an admixture gave efficient characteristic on the performance of the concrete with respect to its properties as to better strength, durability, elasticity and shrinkage. Concrete may adopt the plastic's property in terms of elasticity itself. Giving higher strength results tend the concrete to deform but would certainly return to its original shape as unloaded.

Abhishek Jain (2013) Polymer concrete is a composite material in which aggregates are bonded together with resins and not the cement. Polymer concrete is composed of aggregates that include silica, quartz, granite, limestone, and other high quality material. The aggregate must be of good quality, free of dust, and should be dry. Failure to fulfil these criteria can reduce the strength between polymer binder and the aggregate. Polymer concrete has many advantages such as high tensile, flexural, and 'compressive strength', long- term durability with respect to freeze and thaw cycles, good resistance against corrosion and chemicals, good adhesion to most surfaces, etc.

Rajasekaran.S (2013) Waste plastics, mainly used for packing are made up of Polyethylene Polypropylene polystyrene. Their softening varies between 110^0C – 140^0C and they do not produce any toxic gases during heating but the softened plastics have

tendency to form a film like structure over the aggregate, when it is sprayed over the hot aggregate at 160^0C. The Plastics Coated Aggregates is a better raw material for the construction of flexible pavement. Plastics Coated Aggregates was then mixed with hot bitumen of different types and the mixes were used for road construction. Plastics Coated Aggregate- Bitumen mix showed improved binding property and less wetting property. Higher Marshall Stability value in the range of 18-20KN and the load bearing capacity of the road is increased by 100%.

Prashant.V (2013) Use of plastic waste in the bitumen is similar to polymer modified bitumen. The blending of recycled low density polyethylene to asphalt mixtures required no modification to existing plant facilities. Polymer modified bitumen has better resistance to temperature, water etc.

Praveen Mathew (2013) The suitability of recycled plastics as coarse aggregate in concrete a rising of the bond strength and the heat of hydration regarding plastic aggregate were solved. plastic coarse aggregate is not feasible, partial replacement at various percentage were examined. The percentage substitution that gave higher compressive strength was used for determining the other properties such as modulus of elasticity, split tensile strength and flexural strength. Higher compressive strength was found with 20% natural coarse aggregate replaced concrete. Plastic coarse aggregate concrete has shown a substantial reduction in split tensile strength and elastic modulus.

Sreedevi.G (2013) The stretches resurfaced using plastic coated aggregates have shown improved functional performance in terms of better surface condition, delayed pothole and crack initiation and progression, desirable skid resistance and surface texture.

Rishi Singh Chhabra (2014) The waste tyres can be used as well sized aggregate in the various bituminous mixes if it is cut in the form of aggregate and can be called as rubber aggregate. This not only minimizes the pollution occurred due to waste tyres but also minimizes the use of conventional aggregate which is available in exhaustible quantity.

Sakdirat Kaewunruen.S (2007) railway tracks in general, it is found that the impact energy can be lost up to 55%. This energy will damage the wheel and break the ballast gravel. The remaining of around 45% will be absorbed by the railway sleeper. Energy absorption capacity can clearly indicate the damage severity of the tested specimens. It is also discovered that, due to the effect of high strain rate, concrete material plays a dominant role in the dynamic failure mode of prestressed concrete sleepers.

Taherinezhad.J (2013) The behaviour of sleepers depends on the characteristics of other track components, especially, rail pads and ballast properties. Static and dynamic responses of Prestressed Concrete sleeper energy absorption and interaction with track components have received widespread attention. Cracks due to dynamic effects which appear on reel seat and mid-span are ranked as one of the prime concerns for Prestressed Concrete sleeper. It is noted that they decrease the structural stiffness and make the Prestressed Concrete sleeper susceptible to water and chloride ion penetration which may lead to a service life reduction.

III. CONCLUSIONS

The experimental programme deals with the study of static bending strength. Some conclusions are given below

A. Engineering properties of aggregates have been increased by the addition of plastic as a coating over aggregates (Ref-5)

B. Waste plastic softening varies between 110^0C -140^0C and they do not produce any toxic gases during heating. (Ref-10)

C. M20 Grade plastic coated coarse aggregate prestressed concrete sleeper to reach the ultimate load of 251KN. The Load carrying capacity increased nearly 10%.(Ref-3)

D. Load carrying capacity increased nearly 10% .

E. The static behavior of prestressed concrete sleepers can be increased by using higher fracture capacity which can be achieved by polymer coated coarse aggregate to concrete mix.

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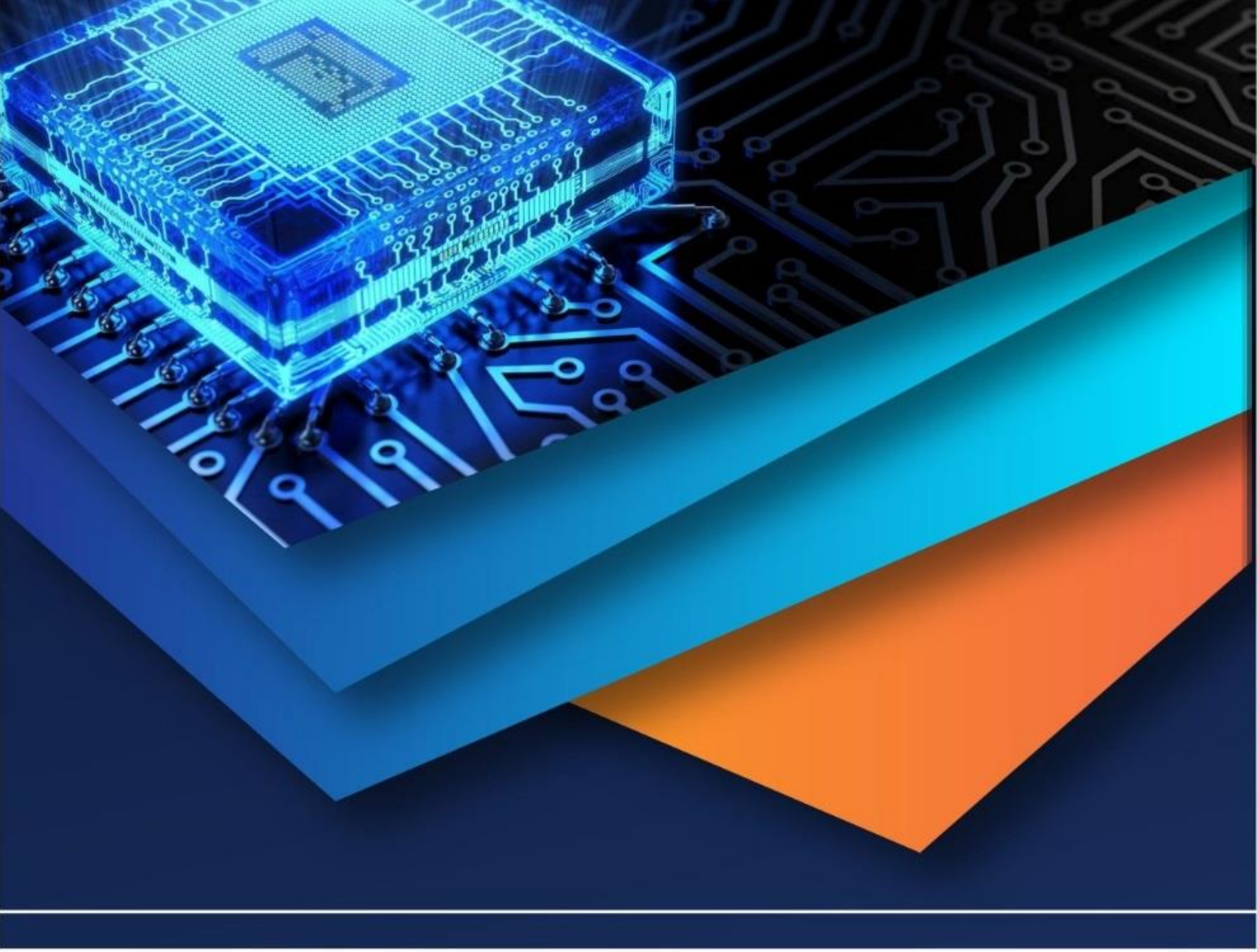

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