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Original Research Paper

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POLYMERIC COMPOSITE RAILWAY SLEEPERS

Tribhuvan Singh	Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India
Dr. Vijay Kumar	Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India
Amit Kumar Gupta	Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India
Amit Kumar Singh	Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India
Amit Kumar Yadav	Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India

ABSTRACT Railway sleepers are one of the most important elements of the railway track system. Although timber sleepers are still the most common, use of pre-stressed concrete and steel materials is also increasing. In addition, ties produced using recycled materials are of interest, recently. By recycling plastic waste, considerable amount of money can be kept from ending up in the landfills. As composite ties are strong, durable, and reliable, they require less maintenance and have longer life than common railroad ties. Therefore, they can be an excellent, cost-effective and long-term solution. . An overview of on-going research and development on innovative fiber composite railway sleepers with investigation on their advantages and disadvantages are also presented.

KEYWORDS : Polymeric composite material, Railway sleepers

1. INTRODUCTION

Railway sleepers are one of the most important elements of the railway track system. They are the beams/ties laid underneath the rails to support the track]. Their function is to transfer the loads to the ballast, transversely secure the rails to maintain the correct gauge-width and to resist the cutting and abrading actions of the bearing plates and the ballast material.

Sleepers also resist the lateral and the longitudinal movement of the rail system. Different kinds of materials are used in sleeper production. Hardwood timber is the most widely used sleeper material. There are more than 2.5 billion timber sleepers installed in the railway track throughout the world . In order to have a reliable track system and maintaining the quality of the track system to a specified service level and ensuring. The safe track operation, a wide range of ingredients should simultaneously be considered. Strength and durability of the sleepers is one of those ingredients that play an important rule in track system. Beside wood, concrete and steel were widely applied in sleepers but recently the use of polymericcomposite, because of their remarkable properties was also increased. This paper presents an overview of advantages and disadvantages of the aforementioned materials and also introducing the polymeric composite as an alternative material for railway sleepers.

1.1 Sleeper Materials

Sleeper materials currently in use and researched as potential alternatives are grouped here as nonpolymeric and polymeric sleepers, which are also sub-grouped to give additional information.

1.2 Non-polymeric sleepers

There has already been a vast research and development effort into materials for sleepers since railways were introduced. Timber sleepers are still the most common, however, use of pre-stressed concrete and steel sleepers is also increasing.

1.3 Timbers

Timber sleepers have been widely used during recent decades. Like the others, it has advantageous and disadvantageous. The main advantage of the timber is their adaptability as it can be fitted with all types railway track. On the other hand while the cost of their maintenance is low in comparison to the other kinds, its application seems to be a little bit more alternate. Fungal decay and splitting at the ends of the timbers are the most common types of sleeper failures. The first one mostly refers to the environmental situation and the second one refers to the very large transverse shear loading exerted to the sleepers.

1.4 Softwood timbers

Softwood is wood from gymnosperm trees such as conifers, evergreen trees are often called softwoods. Softwood timber does not offer the resistance of hardwood sleeper to gauge spreading and spike hole enlargement [6]. In addition, softwood sleepers are not as effective in transmitting the loads to the ballast as the hardwood sleepers do, thus they should not be mixed with hardwood sleepers on the railway track.

1.5 Concrete

Concrete, because of its natural weakness in tension is not used in sleeper's products. Pre-stressed concrete is a method for overcoming this matter. It can be used to produce beams, floors and bridges with longer span. In this case the mentioned method is applied in timbers production by concrete.

Pre-stressed concrete sleepers have become widely and successfully accepted for railway sleeper usage especially in high speed lines. Their economic and technical advantages are the results of longer life cycles and lower maintenance costs. With their great weight, concrete sleepers assure optimal position permanence and stability even for traffic at high speeds. In fact, many pre-stressed concrete sleeper technologies have now been developed. Monobloc and twin-bloc pre-stressed concrete sleepers are most commonly use concrete sleepers. Twin-bloc, because of its less weight could attract more attention. Twin-bloc sleeper is made up of two concrete parts supported by steel reinforcements. Although, it has a prominent disadvantageous as it has tendency to twist when lifted which makes it difficult to handle an install these kinds of sleepers.

Concrete sleepers, beside their advantageous like more life-time and strength, have some disadvantageous too. Such these

disadvantageous are their heavy weight which required specialized machinery during laying and installation and also their production casts, while their initial cost is almost double that of hardwood timber sleepers. The investigation to the timber and concrete sleepers, reveal that the concrete sleepers higher sleepers have high stiffness characteristics and the design requires higher depth than the existing timber sleepers.

.6 Steel

Australia has developed a world reputation in technology related to the design and performance of steel railway sleepers.

2. LITRETURE REVIEW

(A) COMPOSITE RAILWAY SLEEPERS- BY wahidferdous, Allan Manalo , Gerard Van Erp , ThiruAravinthan , SakdiratKaewunruen , Alex Remennikov

A number of composite railway sleeper technologies have been developed but their applications in rail tracks are still limited. This paper rigorously reviews the recent developments on composite sleeper's
andidentifiesthecriticalbarrierstotheirwidespreadacceptanceandapplications.Currentlythecomposite sleeper technologiesthat areavailableranges fromsleepersmade withrecycle plasticmaterialswhich contains short or no fibre to the sleepers that containing high volume of fibres. While recycled plastic sleepers are low cost, the major challenges of using this type of sleepers are their limited strength, stiffness and dynamic properties which in most cases, are incompatible with those of timber. On the other hand, the prohibitive cost of high fibre containing sleepers limit their widespread application. Moreover, limited knowledge on the historical long-term performance of these new and alternative materials restricts their application. Potential design approaches for overcoming the challenges in the utilisation and acceptance of composite sleeper technologies are also presented in this paper.

(B) POLYMERIC COMPOSITE RAILWAY SLEEPERS

BY- Amir GHORBANİ, Seçkin ERDEN

Railway sleepers are one of the most important elements of the railway track system. Although timber sleepers are still the most common, use of pre-stressed concrete and steel materials is also increasing. In addition, ties produced using recycled materials are of interest, recently. By recycling plastic waste, considerable amount of money can be kept from ending up in the landfills. As composite ties are strong, durable, and reliable, they require less maintenance and have longer life than common railroad ties. Therefore, they can be an excellent, cost-effective and long-term solution.

This paper presents a review of recent developments on polymer composites as an alternative material for railway sleepers. An overview of on-going research and development on innovative fiber composite railway sleepers with investigation on their advantages and disadvantages are also presented

3. CONCLUSION

Polymeric composites may a good alternative for current railway sleepers as they have properties such as corrosion and chemical resistance, environmental durability, and high specific strength. They will create ecological benefits due to their recycleability, causing decrease of plastics in landfills, and reduction in forest degradation. Current trials of polymeric composites as railway sleepers have some succesful stories, which ended up with commercial patented products as seen in Axion International, while some trials were not found satisfactory as stated in reports of Indian Railways. While traditional materials have all well established continuous production lines, cost of production on industrial scale is still a question for polymeric composite sleepers. Hybrid structures to be obtained by combination of composites and traditional materials also exhibited satisfactory properties, which make them also an alternative. Developments up to date suggest further research on such alternative materials with regard to their advantages compared to existing railway sleepers.

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