

COMPOSITE RAILWAY SLEEPER

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Abstract - The worthy replacement of traditional sleepers is composite sleepers. They are rover to timber and concrete sleeper in almost every respect. The land pollution from the stray waste plastic is reduced by using composite sleeper and it makes certain that the destruction to the forest is less.

The most important elements of the railway track system are railway sleepers. Recently, ties produced using recycled materials are of interest. Considerable amount of money can be kept from ending up in the landfills, by recycling plastic waste. As composite ties are excellent and it can be a long term solution because it requires less maintenance, they are strong, durable, and reliable and have longer life span than common rail road ties.

A random load distribution along the sleepers-ballast interface may occur due to different loading conditions like poor maintenance of sleeper or bad quality of ballast. The random load distribution which is not considered during sleeper design and the track system design can effect on the performance of the sleepers and even damage the whole railway system.

Key Words: Traditional Sleepers, Rover, Stray, Ballast etc.

1. INTRODUCTION

Indian Railway track system the railway sleeper is one of the most important elements. They distribute load of rail on ballast and resist cutting and abrading actions of a bearing plates as well as ballast materials. The lateral and longitudinal moment also resist by the sleepers.

In Railway track system various type of material are use for the manufacturing of sleepers. In track system durability and strength plays an important role.

Concrete, steel are material use for recent development of sleepers, it is commonly used in countries. In India more than two billions sleepers are used for installation of railway track system. The uses of concrete sleepers provide high gauge holding capacity than the other, but this sleeper is heavy in weight as compare to timber sleepers. In comparison of timber and concrete, this sleeper has more than 50 years life span as compare to timber sleepers. Steel sleepers give more strength as compare to timber, but cost of steel sleepers is high. Therefore, it requires moderate use. The steel sleeper requires periodic maintenance.

As compare to this all we have to moderate new technology for the Indian railway track system i.e., composite railway sleeper which is environmental friendly and good performance in comparison of other railway sleepers. The

composite railway sleepers reduce the maintenance and repair cost then other sleepers. These types of sleepers give the durability and life span up to 50 years. In India, composite railway sleeper are use for construction of railway road bridges after the use of this sleeper the 3.0 lacks cum per annum are reduce as compare to wooden. In all countries the use of timber sleepers are totally banned in year 1998-1999 and tests are taken as try and error basis in the channel sleepers the composite railway sleepers are also in trial basis.

The technology of composite railway sleeper has been developed in several different parts of countries. The composite railway sleepers are the best alternative for timber sleepers. The composite railway sleeper improve green footprints and it is green in concept as well as it consists of 3R (Reuse, Recycle, Reduce) methodology of reduced waste.

There are expended research and development works in to material for sleepers the use of pre stress are also increasing. The specification and properties are increasing for Indian continent.

2. METHODOLOGY

Composite Sleeper

The proprietary mixture of plastics is composed for composite sleeper (mainly shredded HDPE), rubber from whole post-consumer tyers, rubber buffing from retreaders, other waste materials, chemical additives and various fillers and reinforcement agents like fiberglass or vermiculite. Approximately 20% of overall mixture content in rubber. Following is 5 stages of manufacturing process that establishes efficiency and consistency in production:



Fig. 2 Composite sleeper

2.1 Raw Material Selection and Handling:

The composite sleepers consists of mixture of shredded HDPE, rubber form whole post-consumer tyres, rubber from retreaders, other waste materials, chemical additives, fiber as

reinforcement and fillers. The composite sleeper may include following materials.

2.1.1 HDPE (High density polyethylene):

As a chief component with fiber as reinforcement or fillers to enrich properties polymer composite sleeper assimilate a polymer material recycled HDPE. Hence, toxic preservatives will not be required by sleepers. No water absorption problem which cause loss of strength.



Fig. 2.1.1 HDPE

2.1.2 Crumbled Rubber:

Elastic property to the sleeper is provided by crumb rubber and it will also reduce cracks problem in sleepers. Maintenance cost reduces due to reduction in cracks and also increases lifespan of sleeper.



Fig. 2.1.2 Crumbled Rubber

2.1.3 Glass reinforcement:

For sleepers fibers act as reinforcement. Fiber is both strong and stiff in tension and compression.



Fig. 2.1.3 Glass Reinforcement

2.1.4 Fillers (CaCO3, Mica):

Fillers are flexible and elastic and they have excellent mechanical and thermal properties. They are moisture proof and have high flexural and tensile strength.

By combining above materials (on the basis of properties) a superior quality of material can be achieved for railway sleepers.



Fig. 2.1.4 Fillers

Composition of composite sleeper which we are using is given below-

- Recycled HDPE - 55%
- Crumbled Rubber - 12.5%
- Glass reinforcement - 12.5%
- Fillers (CaCO3, Mica etc.) - 20%

2.2 PROCESS

2.2.1 Compounding and mixing:

To create a homogeneous material raw materials are mixed, melted and compounded. Continuously, mixing and melting together various components that have very different physical properties including weight, density, melting and mixing parameters is the key to this stage.

2.2.2 Shaping, Forming and Cooling:

The mixture from stage two is now, filled in the moulds which produce attractive and "clean" sleeper that has a close resemblance to wood sleepers, and profile are 7"*9", with no unwanted curvature, twisting, or deviation from a perfect rectangular shape.

Then the moulds are filled, and the cooling begins itself in the mould till the outer shell is hardened of the sleeper to a specific point. After the completion of this stage the outcome is simple: It contains no creosote and weak stress point, reduce warping and each sleeper is identical.

Then manufacturing process is then at final stage. The process implemented is optimal moulding process which is easily operated and controlled and produced a product which is consistent and internally sound.

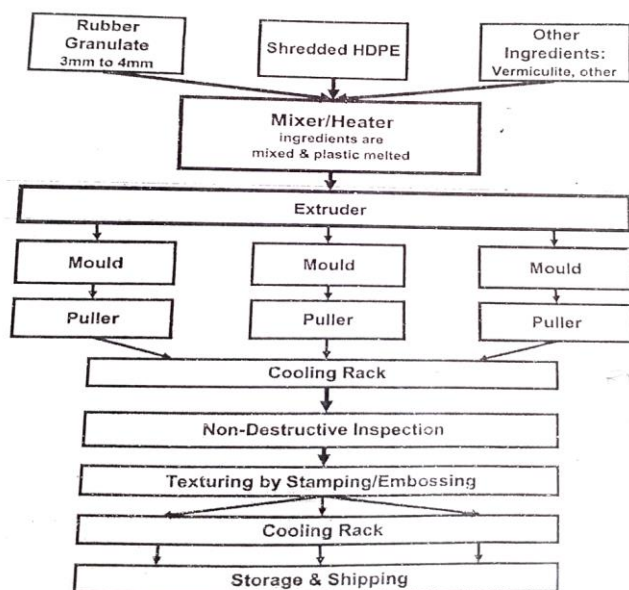
2.2.3 Texturing:

The unique texturing process is implemented that presses a cross hatched pattern onto the bottom and two vertical sides of the sleepers. This improves the grip between the sleepers and the rock bed ballast and also improves lateral resistance. It also improves rail stability and prevents derailment.

2.2.4 Quality Assurance:

After the actual production is complete, to assure the quality and avoid structural voids within the sleepers each sleeper is tested by non-destructive inspection method. And the complete product quality assurance is done.

2.3 Flow diagram for prepared of composite sleepers



3. COMPARISON

3.1 Composite sleepers

3.1.1 Advantages

1. Use of plastic in sleepers will reduce disposal problems of plastic on land that causes choking of sewerage system.
2. It offers greater resistance to greases and oils.
3. It has low weight, fire resistance and low electricity conductivity.

4. Sound and vibration are well exhausted by these sleepers.
5. In composite sleepers all type of flexibilities such as designing grooving, notching and drilling holes are available.
6. They don't require any toxic preservatives.
7. Composite sleepers have longer life span as compare to ordinary sleepers.
8. The use of composite sleepers in Indian railway has reduced annual requirement of wooden sleepers approximately 6%.

3.1.2 Disadvantages

1. Initial cost is more.
2. Skilled labour is required during, placing of sleepers on the track.

3.2. Concrete sleepers

3.2.1 Advantages

1. Strong stability
2. With the characteristics of water resistance, sun resistance and corrosion resistance, concrete sleepers have a longer service life span.
3. Concrete sleeper can with stand fire hazards.
4. The material of concrete sleeper is compost of cement, sand, stone etc. It has very good insulation. It is suitable for track circuited line.
5. Concrete sleepers need less maintenance, having lower cost.

3.2.2 Disadvantages

1. Concrete sleepers are very heavy to transport.
2. Difficult to handle.
3. Concrete sleepers can't be applied in bridges and crossings.

4. CONCLUSIONS

This study depicts that composite sleeper are good alternative for timber and concrete sleepers. It has good strength than the other traditional sleepers. Composite sleepers are effective load transferring without any reduction. Plastic are highly resistance against degradation from weather influence, therefore, it can be recycled and used as a useful product. Hence, it supports for eco-friendly environment. More in general, to provide proper track stiffness from a point of view of wear and vibration composite sleepers can provide a good solution.

This sleeper has comparable chemical and physical properties to traditional sleepers. It is recycling form waste material to high end application. These sleepers having no leaching into ground wastes. It having low life cycle cost and long expected life time of over 50 years. They are flexible

multi role and easy to fasten the railways. They need less ballast around them. This sleepers are lighter than even the suburban concrete sleepers so easier to install as equipment itself is lighter so the composite sleeper are better option for the traditional sleepers.

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