

Problems and Solutions for Rail Joints of Railway Tracks in Bangladesh

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Abstract

The main objective of this paper is to find out sustainable solutions for problems creating by rail joints for a country like Bangladesh where development in railway is much needed but ensuring all these criteria with its limited resources is a major challenge. Rail joints are one of the most fundamental and critical components of railway track. The joint bars also prevent lateral or vertical movement of the rail ends. Standard, Compromise, Insulated, Expansion joints are the most common types of rail joints. Significant portions of total rail failures are due to rail joints as rail joints bear huge stresses. So, reasons for these failures should be noticed and remedial measures should also be taken. Unlike other developed countries, Bangladesh is far behind from the implementation of high speed rail. Continuous welded joint and other modern rail technologies can be instrumental in keeping pace with the current world.

Keywords *Rail Joints, Stress, Welded Joint, Safety, High Speed Rail.*

1 Introduction

Rail communication has traditionally been the main mode of mass transport for both commercial and cargo usage dating back to the British rule. Bangladesh Railway (BR) is playing a vital role in the economic growth and development of Bangladesh by hauling both goods and passengers. Railway is an efficient means of transport as a rail carries more traffic than a four lane road and is an extremely energy efficient means of transport (Railway Budget India, 2009-2010). It is reliable, time efficient, comfortable and the safest mode of transport. With wider connectivity and more efficient technology, rail communication is considered to be environment friendly, comfortable and affordable in a densely populated country like Bangladesh.

Rails, sleeper, ballast, joints, point and crossings are the major components of railway track. Among the components rail joints play one of the most vital roles, since rail joints connect the rail to create a large railway network like Trans-Siberian Railway of 9289 km. Without rail joints it would have been impossible to connect this vast railway network. Proper connections between rails make a highly efficient and dynamic railway system. So, significance of rail joints cannot be undervalued. An ideal rail joint should hold the two ends of the rails having same strength and stiffness as rail which it joins and provide space for expansion and contraction (Srinivas, 2016). A typical rail joint is shown below (please see Fig-1).

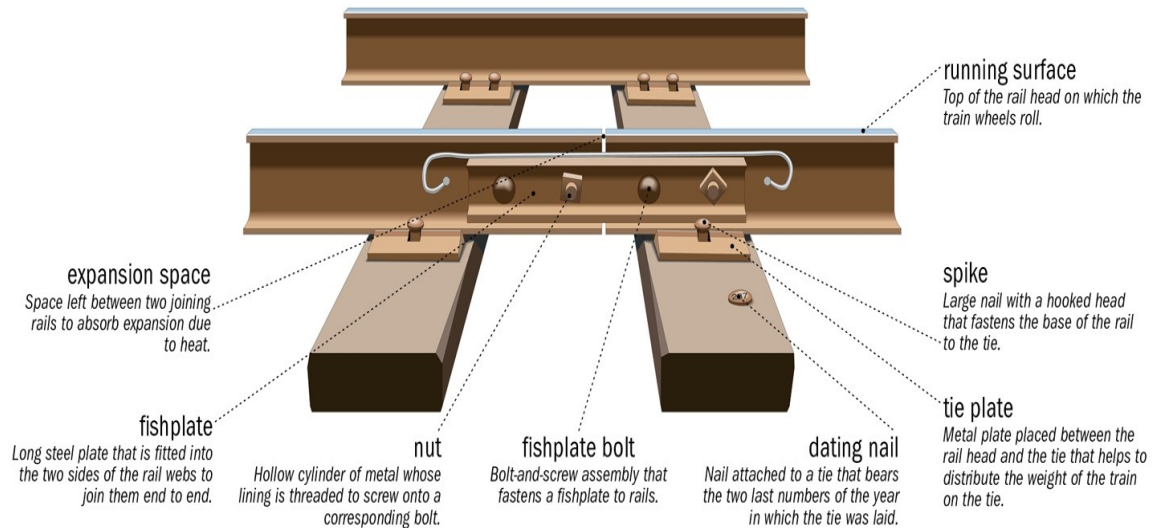


Figure 1. A typical Rail Joint (www.visualdictionaryonline.com)

According to the method of joining, rail joints are of 3 types: continuously welded rail (CWR), non-welded rail i.e. mechanically jointed rail and a combination of welded and non-welded rail e.g. long welded rail. According to positions of sleepers there are 3 types of rail joints: suspended joints, supported joints and bridge joints. Again, according to position of joints rail joints are of 2 types: square joints and staggered joints (Chandra and Agarwal, 2007). Rail fasteners are mechanical type rail joints which hook up between rail and sleepers. Good fastenings should be capable of giving protection to the sleeper against variable forces, provide insulation in case of electrified tracks and should be economical and durable (Srinivas, 2016). Table 1 shows various kinds of rail fasteners according to their purpose and type.

Table 1. Different types of rail fasteners (Chandra and Agarwal, 2007)

Purpose and type	Details of fittings and fastenings
Joining rail to rail	Fish plates, combination fish plates, bolts, and nuts
Joining rail to wooden sleepers	Dog spikes, fang bolts, screw spikes, and bearing plates
Joining rail to steel trough sleepers	Loose jaws, keys, and liners
Joining rail to cast iron sleepers	Tie bars and cotters
Elastic fastenings to be used with concrete, steel, and wooden sleepers	Elastic or Pandrol clip, IRN 202 clip, HM fastening, MSI insert, rubber pads, and nylon liners

In case of rail joints, recent trend is using continuous welded rail (CWR) because they need less maintenance cost than jointed track, remain accurate alignment for a longer time, need no expansion joint and is suitable for high speed rail (Chadwick, 2014). In the context of Bangladesh where safety, cost and speed are the major drawbacks in case of railway using CWR technology will significantly improve and revolutionize the entire railway system.

2 Present Status of Bangladesh Railway

Bangladesh Railway, at present is in poor condition and is inefficiently managed. Since, the partition of India in 1947 there was hardly any expansion of railway whereas, road network increases tremendously (Hasan, 2009). While the road network has increased significantly, no matching expansion of the rail network has been made. Roads have been given special attention and allocated maximum money (average 76% of total transport sector). The negligence over the decades has left the railway sector with a very poor capacity to serve the people. So, lack of funding for further modernization for railway is the major concern for development of the railway track. Weight restriction, speed restriction, aged jointed tracks and safety issues are the dominant burdens considered in this case (Hasan, 2009). In some recent field visits it has been found that in maximum cases joints are aged or worn out. Fish bolts are placed out from the fish plate. Fastenings are old and rusted, which is also a big problem. Most of the cases track is maintained manually, Mechanized track maintenance is

yet to be established. For these reasons BR cannot perform efficiently and lag behind from many of the modern technologies. Overcoming these drawbacks has become the prime challenge for Bangladesh Railway. Fig-2 shows rail joints and fastenings used in rail track near Kamalapur Railway Station.



Figure 2. Rail joints and fasteners near Kamalapur Railway Station.

From the above figure it can be seen that joints and fastenings are aged, rusted and need to be replaced immediately. Unless the joints are replaced and maintained properly BR cannot operate efficiently. However, recently some modern rail fasteners have been introduced in railway track. Elastic fasteners are used to connect rail and sleepers. Proper technological advancement is needed considering its cost and other factors, as resources are limited in our country.

Fish plated rail ends are less stiff than the rail itself. So the rail tends to 'pump' up and down at the joints under the weight of a passing train. As it pumps, it allows rainwater to penetrate beneath the sleepers at the rail ends eroding the track bed and making the pumping worse. Also, the rail ends wear as the wheels pass over them, and the bolts need regular checking and re-tightening. All of this means that traditional track joints require a lot of maintenance.

Distressing of rail joints is also a matter of severe concern as rail joints are subjected to huge stresses developed by wheels. Under these stresses fish bolt holes act as stress raisers and focal point of fatigue failure of rails. The remedial measures for safeguarding joints are proper packing of joint sleepers, optimum tightening of fish bolts, adjustment of expansion gap, track lubrication. So, proper maintenance should be operated to check the rail joints if they are distressed or worn out and make sufficient actions to mitigate the problem.

In the context of Bangladesh lack of speed is one of the major drawbacks in railway. Due to gradients, slow orders, passenger stations, track configuration and maintenance level, it is quite usual to indicate speed restrictions (Hasan, 2009). The speed of train is no less than 250km/h, the fastest speed of train reaches 486 km/h at present in China. With the pursuit of more comfortable and effective transportation tools, high speed

trains are more and more welcomed by most passengers. Because of the high speed, safety, reliability and durability of the train need to be paid more attention by researchers and designers.

3 Improvement Options

The ill effects of the rail joints can be removed by introducing continuous welded rail (CWR). To make the present railway system to a speedy, dynamic and secured system, there is no alternative but to introduction of CWR. The modern welded railway track incorporates systematic welding of rails, which provides it the potential to carry trains at faster speeds, better riding conditions, and reduce maintenance costs. To ensure more accurate and reliable track alignment, jointed track has now been almost entirely replaced by Continuous Welded Rail (CWR) on UK railways (Chadwick, 2014). So, in order to cope with the developed countries BR should install CWR as early as possible to get the benefit of it. Fig 3 shows a train running in a continuous welded track.



Figure 3. Continuous Welded Track (Chadwick, 2014).

Nowadays, there are three relatively successful types of high speed railways which are Europe high speed rail system, Japan high speed rail system and China high speed rail system. Germany and France are the representatives of Europe high speed rail systems. In Germany special W-clip fastening systems are adopted such as Vossloh 300 and Vossloh 336 fastening systems, and the main fasteners are SKL12 or SKL14. In France Nabla fastening systems are popularly used, main fasteners are blades. In Britain Pandrol company has been developing a series of Fast clip fastening system to meet the needs of high speed railway for dozens of years. In Japan Direct fastening systems are applied, main fasteners are still blades (Japan Railway and transport review). Recently China has made a great breakthrough on high speed technologies. On the tracks of high speed lines of Type VI, Type V fastening systems, WJ7 and WJ8 fastening systems are widely used. They are designed by China on the basis other high speed fastening system (Agico Group, 2015).

Introduction of Insulated Rail joint is also necessary. Insulated rail joints (IRJs) are widely used in the rail network for identification of trains within a track circuit; they also help identify broken rails if there are any in the network. The current design and installation practices, despite good efforts and available national standards, still identify IRJs as areas of high vulnerability for traffic and high damage potential for the track (CRC, 2013).

4 Concluding Remark

Increasing of Railway network is inevitable for our country's economic growth and connectivity. Proper installation and maintenance of rail joints will be a major breakthrough in developing a sustainable rail network. High performance rail fastenings, continuous welding rail and minimum number of curves are the basic technology for high speed rail. Proper placement and maintenance of rail joints can significantly reduce accidents due to rail joints. Adopting these technologies will definitely improve safety, speed, and carrying capacities of trains and overall scenario of Bangladesh Railway. However, further in depth investigation is also required.

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