Sri Lanka – Steel Sleepers for the Sri Lanka Railways Hill Sections

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Passenger train in tea country

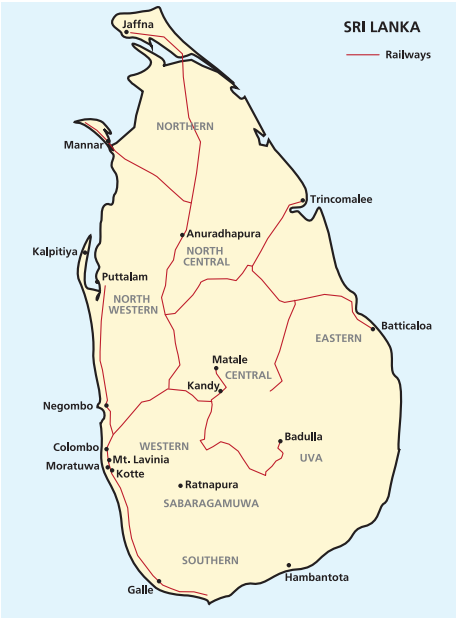
Steel sleepers replacing life expired timber sleepers

With the rising cost of timber and tighter environmental requirements, most World Railways started switching over to pre-stressed concrete sleepers in the 1970's and 1980's. The Railways of timber rich Sri Lanka, however, continued the use of wooden sleepers until recently. The present policy is to phase out the wooden sleepers to ensure conservation of forests . The price of timber has been increasing and the life of wood in track has been going down tilting the economics in favour of other types. Many track renewals over the Southern and Eastern Lines of Sri Lanka Railways (SLR) are being constructed using PRC sleepers. The Northern Line disrupted during the strife is being re-built with new rails on PRC sleepers and fresh ballast.

The Central Line (also known as the main line, being the first Railway of Ceylon) is special. It rises up into the tea country attaining the highest elevation for Broad Gauge in the World at nearly 2,000m at Pattipola. The gradients are steep (2.5% is very common) and the curves are sharp (100m radius). Consequently, long welded Rails and pre-stressed concrete sleepers had to be ruled out.

Steel sleepers require minimum use of ballast and have a low life cycle cost. It is ideally suited for the hill sections with steep gradients where use of mechanized track laying equipment is restrictive. Proposals for the use of steel sleepers of a design well established on the Bailadilla Hill Railways of India (also known as the KK Line) were initially made. However, the maximum axle load on SLR is only 20 T against that of 23 T in India. Freight traffic is rather modest against 30 GMT per annum on the KK line. Individual trainloads are also very low when compared to 5,200t on the KK line. It was therefore decided to use a value engineered sleeper section providing adequate strength.

While a UIC standard code of practice exists for the design of PRC sleepers, there isn't any for that of steel sleepers. Recourse had to be taken to the US or Australian codes and the



Indian Standard IS 800 for the structural steel design. The Indian practice of 1:2 load distributions under the rail seat and 1/6 centre binding reaction were adopted. Different profiles of sleeper bars were considered and

Initial trial installation

Close up of FD 1408 assembly

strength analysis was made by computer simulated softwares. Finally, a rolled profile section weighing 23.2kg/m was found to be most appropriate. Against a permissible stress of 17.1kg/sqmm, the calculated stresses did not exceed 15.08kg/sqmm. The Sri Lankan Government Design Bureau however desired that the worn-out (after 50-year life) geometrical properties should be taken into account and the centre binding reactions should be as for a beam on elastic foundations. This too was done using Prokon software to confirm that the permissible stresses would still not be exceeded.

The fastening system needed a lot of detailed examination. Considering the curvatures, the lateral forces were bound to be large and the system needed a good lateral support as well as suitability for fitment of check rails.

After detailed examination, the PANDROL FASTCLIP model Type FD 1408 was adopted. Its hold is positive, lateral support excellent and it is possible not only to insert insulating liners but also to provide for extra gauge on sharp curves by using nylon insulating liners of different sizes. It needs special tools for installation but yet offers a "fit and forget" arrangement.

Installation of the FASCTCLIP needs shoulders, which, in PRC sleepers, are cast into the concrete. In the case of SLR sleepers, hook-in shoulders have been used. These are loose pieces, which are slipped into the rectangular hole in the sleeper and hold the PANDROL FASTCLIP firmly in position. Another advantage of FD Clip is its low profile design, which protects the clip from getting entangled with any loose component of the rolling stock. It provides ample toe load on the rails, which is quite adequate to the requirements of SLR. The clip contact points on the shoulder are less vulnerable to corrosion expansion. This poses a problem on coastal lines. The FD system is also very easy to inspect that it is installed in the correct working position due to the fact that the clips are applied laterally to the rail. Materials in the insulator and pad provide greater longevity and are less susceptible to installation damage.

After successful trials in stages, initially 3,250 sleeper sets and later 50,000 sleeper sets with FD clips were ordered by Sri Lankan Railways, have been laid in track and have withstood two monsoons.

We are illustrating the SLR track with a few photographs. Notwithstanding the limited ballast and occasional inadequacy of drainage, these sleepers appear to be behaving well. ■

Finished track after rehabilitation