Master Thesis

Determination of a track geometry quality index for ballasted tracks in light rail systems

Overview

Track Quality play an essential role in safe and efficient maintenance of track system. Track quality can be divided into track geometric quality and track structural quality. Track geometric quality is defined by the deviation of geometric parameters such as gauge, twist, alignment and vertical level from the standard values. Several compounded indices about track geometric quality, known as track quality indices (TQI) have been formulated so far by various railway infrastructure management companies to know the overall quality of track at any given time, so that cost effective and pragmatic approaches to maintenance related activities could be established. However these indices have been constructed for heavy rail networks. Thus using these indices for LRT systems are questionable as LRT systems and Heavy rail systems have some fundamental characteristic differences such as running speed, axle load, traffic density on line etc.

Foto: M. Rafique Shah

Objective

Main objective of this study was to formulate a modified track quality index which best suit the LRT systems.

Methodology

Initially literature review was carried out to comprehend the existing TQI(s) and geometric parameters used for constructing these indices. Indian railway's track geometry index (TGI) and European Standards EN-19848 were selected as bench marks. Data obtained from SSB (Stuttgarter Straßenbahnen AG) of various tracks of U-Bahn, were treated , filtered . A TGI was calculated to know the quality of tracks from 2013 to 2017.Correlation analysis was carried out to understand any association amongst irregularities of geometric parameters. Results from correlation analysis and knowledge from literature, were used to fabricate constraints to help in optimization. Through optimization technique a modified geometry index GI(Optimized) was formed.
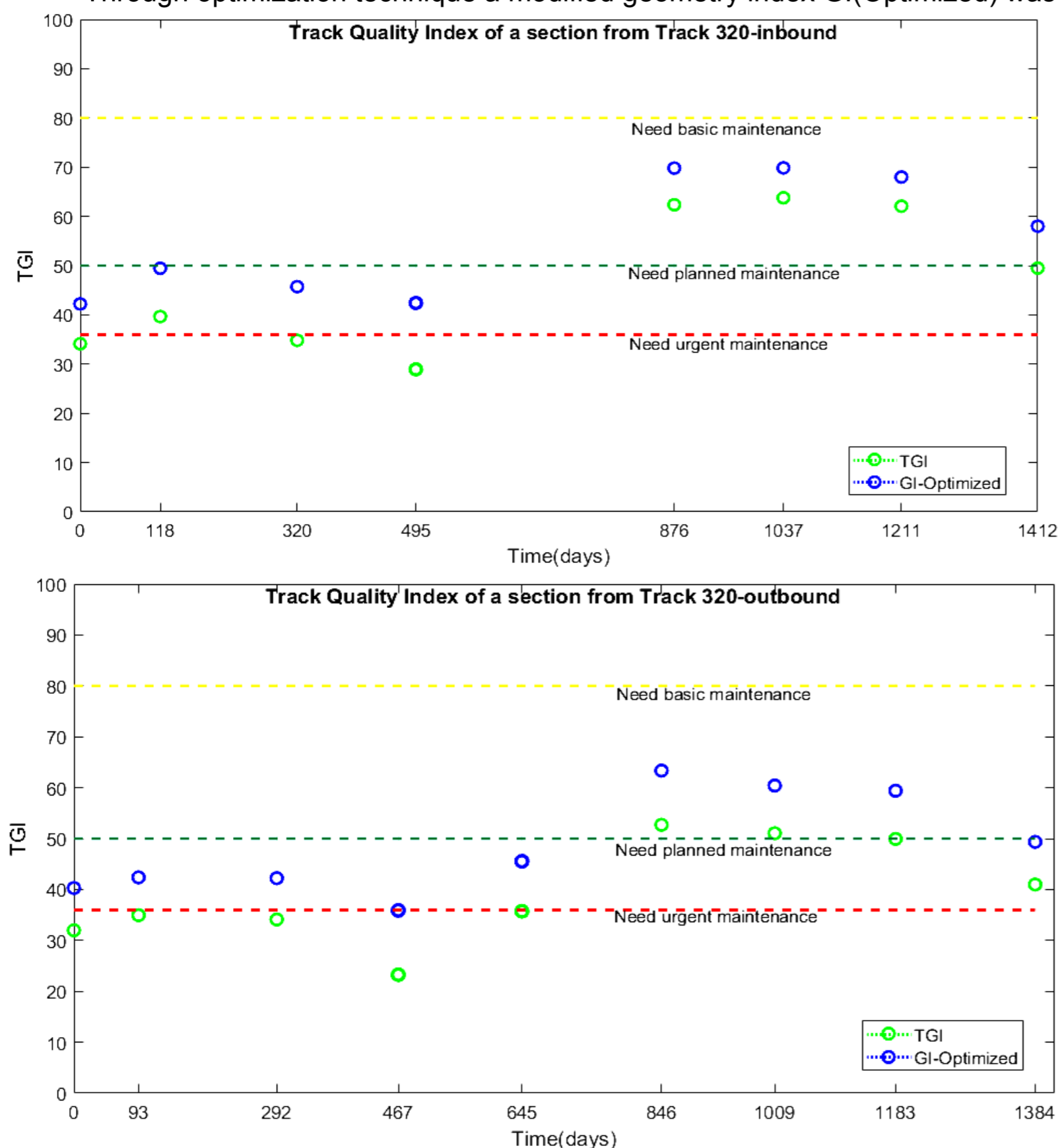

Figure on the top left shows the values of TGI and optimized GI for a small section of track 320 in inbound direction. GI-Optimized values are around 10 points higher than the original TGI values. On horizontal axis each day represents the particular date on which measurements of track geometry parameters were taken, day 0 was on 22nd May 2013 Similar pattern can be seen in the bottom left figure, which is a section form track 320 in outbound direction. Basic, planned and urgent Maintenance limit values are for heavy rail networks, their purpose here is to provide a hint and should not be seen as standard limits.

Conclusion

GI-Optimized is more suitable for usage in LRT system , it give better quality results. However there are some limitation associated with it which should be addressed in future studies Information about the traffic density, running speed and techniques to carry out maintenance of LRT system can help in juxtaposing, LRT system with heavy rail system resulting in better understanding of differences.

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