Master Thesis

Determination of suitable combinations of artificially generated track geometry for the determination of limits for the maintenance and renewal of light rail tracks.

Abstract

A track with periodic inspection and preventive maintenance procedures, should last for decades without significant reconstruction. However, with maintenance costs taking up a large sum of the life cycle cost of rail infrastructure, it is essential to enhance and optimize the planning of the maintenance procedures. Performance monitoring and track data analysis is widely used and studied in the case of conventional and high speed trains. However, maintenance standards do not exist specific for light rail systems.

This thesis provides an approach that helps infrastructure managers in their decision-making, assessment and planning maintenance of LRT tracks. This is done by describing how the data is treated in order to be suitable for analysis; as well as how to amplify track irregularities representative of a deteriorated track conditions by using multi-body simulations. Different track geometry quality indicators; such as standard deviation, track geometry index, and ride comfort, are utilized.

The output of this research, to what is referred to as limits, is in the form of standard deviations and power spectral density curves for each track irregularity parameter. These limits can be reproduced specific to different tracks and conditions.

Keywords: Track geometry quality, track maintenance, LRT, data treatment, track irregularities, power spectral density, comfort level, track geometry index, multi-body simulations.

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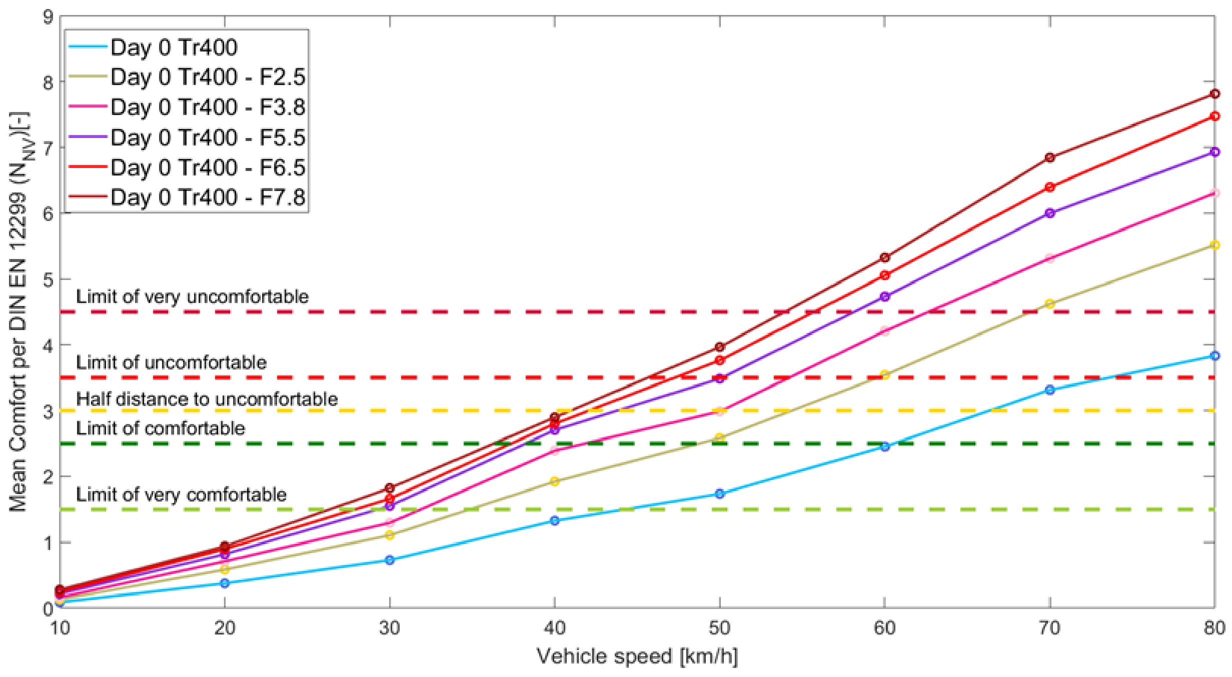
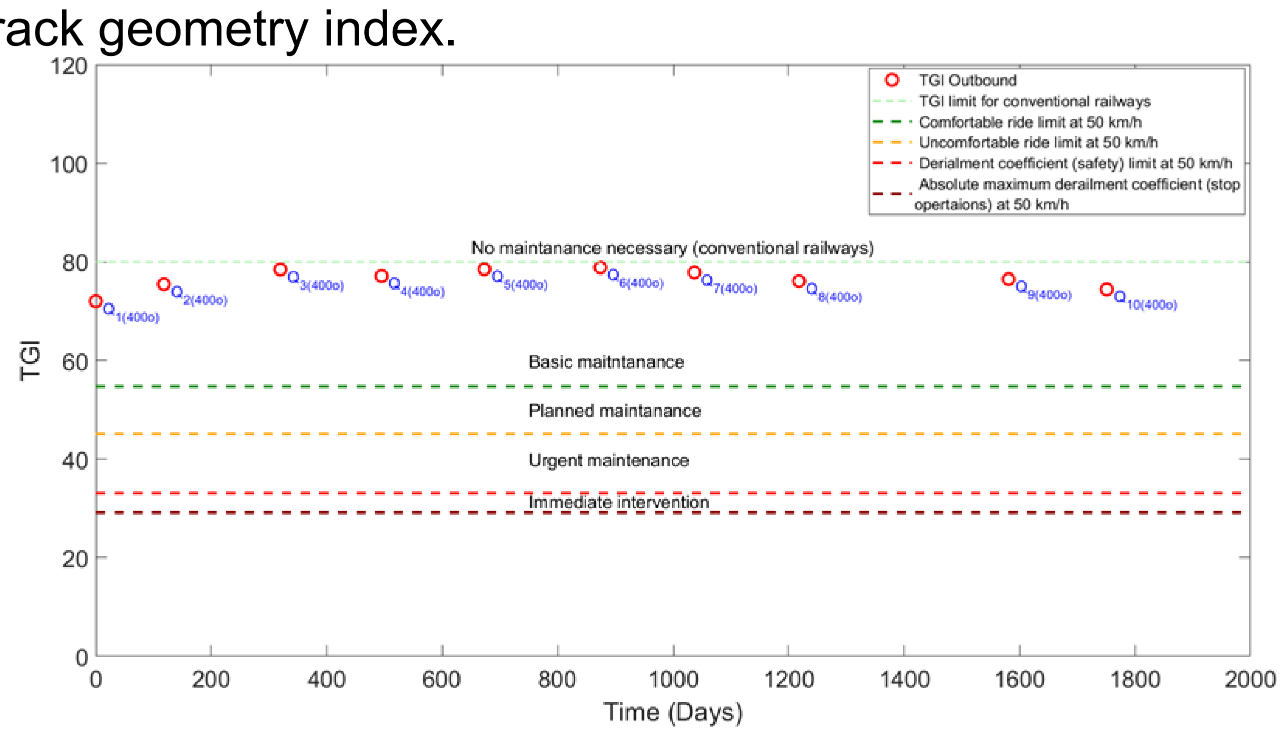
Tasks:

- Treatment of track data to be suitable for use in multi -body simulations.
- Analysis in spatial and frequency domains.
- Multibody simulations in SIMPACK using different amplifying magnitude for track irregularities.
- Utilization of ride comfort to determine maintenance limits.
- Showing maintenance limits in the form of standard deviations and power spectral density curves.

Ride comfort at 50 km/h was used to find standard deviation limits, which were then used to calculate the track geometry index.





	Vertical Irregularity SD based on SSB track	Lateral Irregularity SD based on SSB track	Gauge SD based on SSB track	Cross Level SD based on SSB track	Twist SD based on SSB track	TGI Limit based on SSB track	TGI Limit based on Indian Railways
Basic maintenance	13.6 (3.0 per 13848-5)	1.7 (1.8 per 13848-5)	2.7	10.5	10.6	54 ≤ TGI ≤ 80	50 ≤ TGI ≤ 80
Planned maintenance	16.8	2.1	3.4	12.9	13.5	45 ≤ TGI < 54	36 ≤ TGI < 50
Corrective maintenance	21.9	2.7	4.4	16.9	17.2	33 ≤ TGI < 45	< 36
Immediate Intervention	24.0	3.0	4.8	18.5	18.8	29.0	-

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