

Influence of Wheelset Dynamic Behaviour on Rail Wear Prediction for Different Wheel-Rail Profile Combinations

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Introduction

The objective of this study is to predict rail wear as function of different operating conditions by using a predefined wear rate.

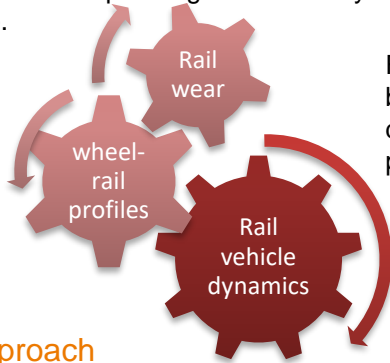


Figure 1: Interaction between rail vehicle dynamics, wheel-rail profiles and rail wear.

Approach

Simulations performed in the commercial vehicle dynamics software VI-RAIL consisted of:

- 9 wheel (s1002) – rail (UIC54) profile combinations (new, mid, worn)
- straight track (0-50m), transition curve (50-100m) and actual curve (100-400m)
- Different curve radii (300 to 10000m)

The dynamic results were used to determine the contact conditions and the amount of wear was calculated from the Archard's law.

Results

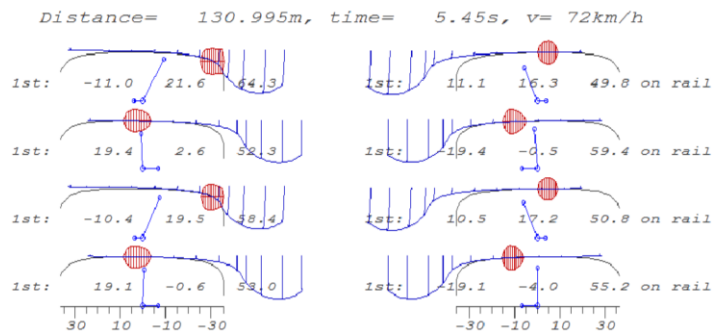


Figure 2: Wheel-rail contact points (curve radius 300m).

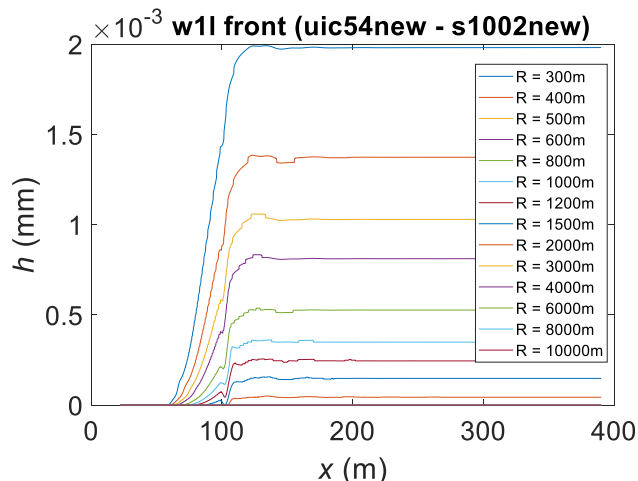


Figure 3: Maximum wear depth for different curve radii.

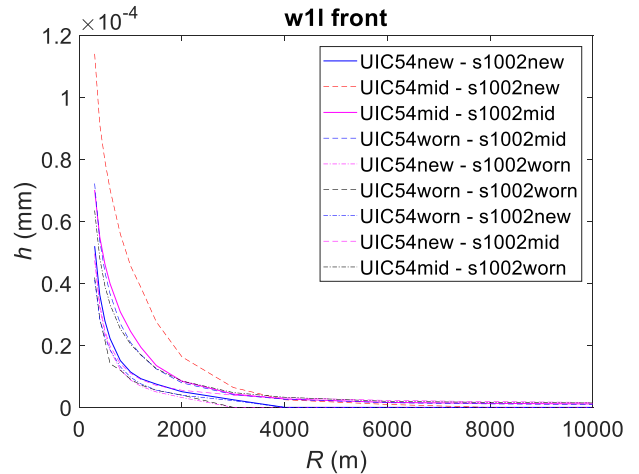


Figure 4: Maximum wear depth for different wheel-rail combination.

Besides the difference in wheel-rail profiles and track curve radii, the dynamics of the first and second wheelset in a curve also determines the rail wear due to creepages.

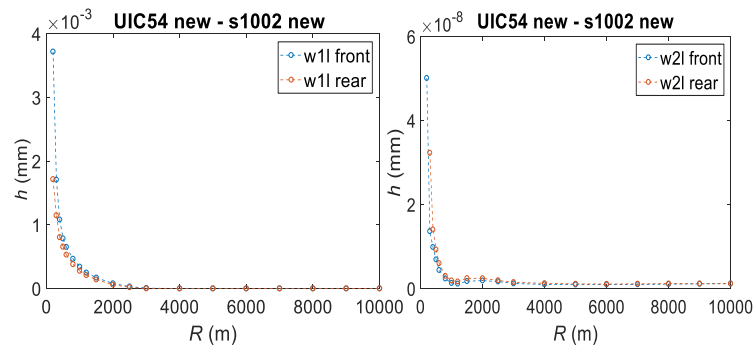


Figure 5: Wear depth for the first and second wheel.

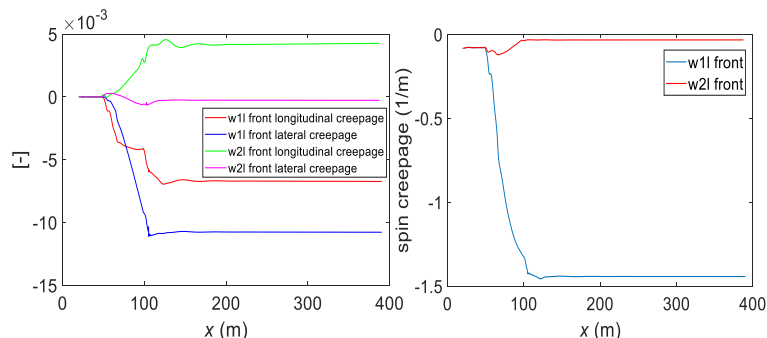


Figure 6: Creepages for first and second wheel.

Conclusions

Rail vehicle dynamics influences rail wear for different:

- Track geometry (curve radius)
- Wheel-rail profile combinations
- Wheelsets (first and second)

The obtained results will be implemented in a maintenance decision supporting tool for rail tracks.