100 YEARS ANNIVERSARY

INTERNATIONAL UNION OF RAILWAYS

IRS 40421

methodology and latest modifications

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IRS 40421: Scope

IRS 40421 “Rules for the consist and braking of international freight trains” is a valuable document which main purpose is to speed up operations at borders and transfer points.

It sets for cross border freight trains the requirements for **train composition** and **braked weight** according to:

- maximum speed: 120 km/h; 100 km/h; 90 km/h
- Brake regime: G or P

IRS 40421: Scope

Provide a **statistical analysis method** for the assessment of new train compositions helping to define new rules and to unify national authorisations.

This methodology has been applied in the framework of the CEF PSA UBS Action project for the two studies carried out using the UIC approved software TrainDy

More info at: https://uic.org/special-groups/traindy/

IRS 40421: Latest modifications

IRS 40421 1st edition is the result of the migration and updating of UIC Leaflet 421 based on:

- UIC project P496 “Rules for the consist and braking of international freight trains”
- UIC project P573 “Long Train”
- CEF-PSA UBS action project

- Update of the document technical content
- Improvement of the appendix B (IRS 40421 Methodology) with a new Flow chart
- New Appendix C: operating rules to be potentially ratified by Annex B methodology
- New Appendix D: Correct tightening of the couplers

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G-braked trains

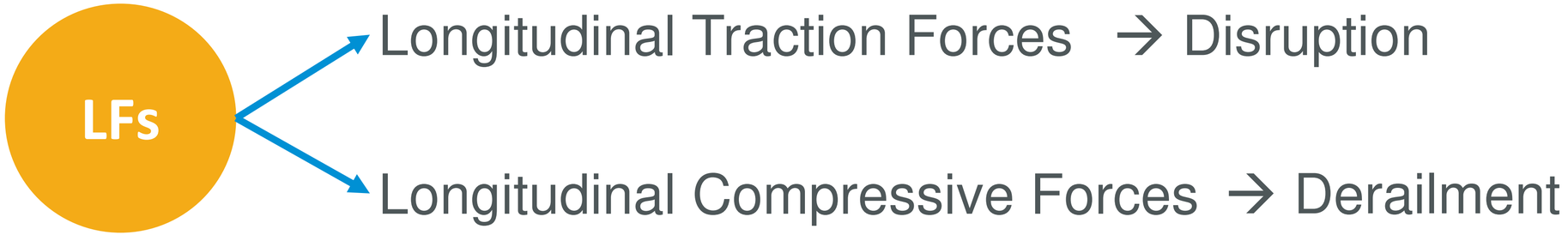
- Maximum speed 100 km/h
- Hauled mass up to 4000 t.
- Up to 12 axles authorised to be P braked
- Any other wagon that cannot be G braked it is then isolated
- No more than 3 consecutive wagons can be unbraked

P-braked trains

- Maximum speed 120 km/h
- Hauled mass up to 1600 t.
- Over 1200 t to be used the Long Locomotive (LL)
- If a wagon of the LL cannot be G braked it is then isolated

IRS 40421: Methodology for assessing LCF

Longitudinal forces (LFs) are the forces exchanged between two adjacent vehicles of a train at the level of buffers and couplers influenced by: velocity, brake regime, transition between traction and braking, length and composition of the train.



LCFs can cause a derailment when, depending on track geometry, they are over the acceptable value (**permissible LCF)** even just for one of the wagons

IRS 40421: Methodology for assessing LCF

The permissible LCF can be determined according to **UIC Leaflet 530-2** or **EN 15839**

The permissible LCF of a wagon mainly depends on :

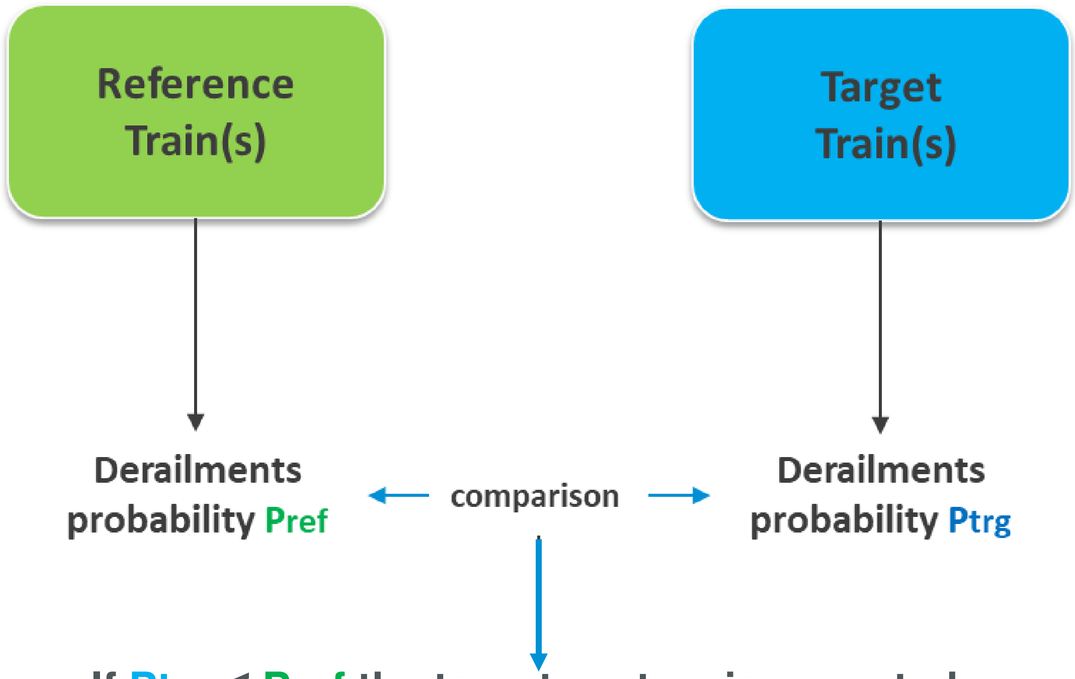
- The curve configuration (values given for 190 m S-shaped curves, switches area)
- The weight of the wagon
- The type of wagon (Axle wagons, Bogie wagons)
- Other design parameters (length, torsional stiffness, type of buffer and radius of buffers…)

IRS 40421: Methodology for assessing LCF

- Using the **relative approach** of IRS 40421, it is possible to estimate whether a new target system is safe compared to a reference system (recognised as safe on the basis of feedback over a significant period of time).

- The principle is based on the comparison of the **derailments probability (from LCF assessment**) of the two systems through simulation

- For the reference system the trains to be simulated are built according to **real distribution of probabilities** of several parameters (total length of the train; wagon characteristics; load distribution…)



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Thank you for your attention.