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Railway applications — Railway rolling stock — Investigation of vehicles position on the reverse curve tracks during running and calculation of buffer overlap

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National foreword

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English Version

Railway applications - Railway rolling stock - Investigation of vehicles position on the reverse curve tracks during running and calculation of buffer overlap

Applications ferroviaires - Synthèse des calculs de la largeur des tampons pour appareils de choc et traction

Bahnanwendungen - Schienenfahrzeuge - Untersuchung der Fahrzeugstellungen im Gleis bei Durchfahrt von S-Bögen mit Ermittlung der Pufferüberdeckung

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European foreword

This document (CEN/TR 17373:2019) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

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Introduction

During CEN/TC 256/SC 2/WG 33/SG 2 meetings for the writing of the European Standard EN 15551, SNCF presented its experience about derailments in the space of time from 1976 to 1982 due to insufficient buffer overlap and proposed to modify the formulae written in EN 15551:2009, Annex J to make greater the width of buffer heads sufficient for safety operation service. The formulae SNCF proposed, based on the former assumptions acc. UIC-leaflet from January 1964, simply takes into account the maximal own play of the vehicles, instead of the 5 mm value given in UIC 527-1:2005, 3.2.2 and EN 15551:2009, K.6. Indeed, this 5 mm value is a realistic value for freight wagons but not for other types of vehicles. Regarding the modification of the formulae proposed by SNCF the other members of W 33 pointed out that:

— it is not possible to increase the internal half width of the buffer head over the limits specified by UIC 527-1:2005, Annex A and EN 15551:2009, 6.2.2;

— since 1965 there have been two language versions of UIC 527-1, a French version and a German version, and they have the following discrepancy in the formulae for calculation of the width of buffer head:

  — UIC 527-1 French version: calculates the half width of the buffer head with different formulae for vehicles with running bogies (e.g. coaches, wagons) or with power bogies (e.g. locomotives, power heads and motor vehicles). Thus, the width of the buffer head calculated for vehicles with power bogies will be greater than the width of the buffer head calculated for vehicles with running (non-power) bogies;

  — UIC 527-1 German version: calculates the half width of the buffer head with the same formulae for all types of bogie vehicles, namely: for vehicles with running bogies as well as for vehicles with power bogies.

— No cases of buffer locking due to an insufficient dimensioning of buffer width (with consequently insufficient buffer overlap) were really noticed in Germany, whereas also in German speaking countries the UIC 527-1 formulae in the German version have been used for decades to dimension the buffer heads width.

— The geometry of the outside half width of buffer heads (opposite to vehicle centre line) of SNCF derailed coaches have had a circular shape geometry that reduced the buffing surface in Geometry specified in UIC 527-1:2005, Annex A).

In order to develop a uniform methodology for the calculation of the width of buffer heads, WG 33 decided to create an ad hoc group whose mission was to analyse, by means of realistic simulations, realized with the multi-body Software SIMPACK, if the formulae, written in the standard EN 15551:2009, Annex J, provide the width of buffer head enough for required minimum buffer overlap and what the domain of use of these formulae was.

This document presents the work made by the WG 33 Ad hoc group and the conclusions of this Group.

The investigation is conducted for specified vehicles in different vehicle combinations (train sets) for defined running cases in curves.

The purpose of this investigation is evaluation of following parameters:

— lateral displacement of coupled vehicles on the track;

— lateral displacement of coupled vehicles to each other;

— buffer overlap between two specified coupled vehicles with given buffers.

For this purpose, the types of vehicles defining the train sets and different operational conditions are specified. Position of the vehicles on the track at the moment of maximum lateral displacement to each other (minimum buffer overlap) is recorded.

The worst cases of lateral displacement and buffer overlap between two coupled vehicles as well as relation to UIC 527-1 and EN 15551 formulae are analysed.

1 Scope

The purpose of this document is to analyse the conducted investigation and evaluation of lateral displacement and buffer overlap between each two specified vehicles of different train sets for defined running cases in curves.

For this purpose, the types of vehicles defining the train sets and different operating conditions are specified. Position of the vehicles on the track at the moment of maximum lateral displacement (minimum buffer overlap) is recorded during the calculation.

The worst cases of lateral displacement and buffer overlap between two coupled vehicles as well as relation to formulae in EN 15551:2009 are analysed.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Symbols and abbreviations

Symbol	Designation	Unit
a	Distance between end wheelsets of vehicles not fitted with bogies or between bogie centres	mm
dg_{a}	Geometric overthrow of the vehicle on the outside of the curve	mm
dg_{i}	Geometric overthrow of the vehicle on the inside of the curve	mm
dy_{i}	Distance from the centre line of the buffer to the contact point at the buffer head, index 1, 2 in accordance to the vehicle number	mm
dy_{p}	Distance between the centre lines of the 2 buffers	mm
F	Geometric overthrow of the vehicle on the outside of the curve for car body pivots on the track centre line	mm
F_{BC}	Compressive force with buffers in contact	kN
F_{LC}	Compressive force simulates the forces which occur on the vehicles during braking or pushing operation	kN
$j1$	Own lateral play (internal lateral displacement) of the vehicle ($j1$) in secondary suspension	mm
$j2$	Lateral play in primary suspension	mm
$j3$	Lateral play of the wheelset in a track	mm