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Järnvägar – Linjekategorier för hantering av samverkan mellan lastgränser för fordon och infrastruktur

Railway applications – Line categories for managing the interface between load limits of vehicles and infrastructure

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Denna standard ersätter SS-EN 15528:2008+A1:2012, utgåva 1.

The European Standard EN 15528:2015 has the status of a Swedish Standard. This document contains the official English version of EN 15528:2015.

This standard supersedes the Swedish Standard SS-EN 15528:2008+A1:2012, edition 1.

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Denna standard är framtagen av kommittén för Järnvägar, SIS/TK 254.

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EUROPEAN STANDARD
NORME EUROPÉENNE
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English Version

Railway applications - Line categories for managing the interface between load limits of vehicles and infrastructure

Applications ferroviaires - Catégories de ligne pour la gestion des interfaces entre limites de charges des véhicules et de l'infrastructure

Bahnanwendungen - Streckenklassen zur Behandlung der Schnittstelle zwischen Lastgrenzen der Fahrzeuge und Infrastruktur

This European Standard was approved by CEN on 22 August 2015.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Contents

Page

European foreword

This document (EN 15528:2015) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2016, and conflicting national standards shall be withdrawn at the latest by April 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15528:2008+A1:2012.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

Significant technical changes between this European Standard and the previous edition are:

— Extension of the range of Line Categories

  — new Line Categories a10, a12 and a14 to cover light passenger vehicles (Urban Rail);

  — new Line Categories D5 and E6 to optimize the payload for freight wagons.

— Providing information and guidance for additional dynamic checks, for higher speeds and certain vehicle types.

— Implementation of MU-classes alternative to individual train checks.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The existing European railway infrastructure consists of elements designed for varying historical requirements. Most civil engineering railway infrastructure was built before the introduction of the Technical Specifications for Interoperability (TSIs) and the Eurocodes for the design of structures.

This European Standard defines a line classification system for infrastructure managers and railway undertakings to manage the interface between the load limits for railway vehicles and the payload limits for freight wagons and the vertical load carrying capacity of a line.

The line classification system takes into account parameters such as:

— axle load (P);

— geometrical aspects relating to the spacing of axles;

— mass per unit length (p);

— speed;

and provides a transparent method for determining whether the vertical loading characteristics of vehicles are compatible with the load carrying capacity of lines on the network.

The line classification system utilizes a suite of line categories with each line category defined in this standard by a load model.

1 Scope

This European Standard describes methods of classification of existing and new railway lines and the categorization of vehicles. The standard specifies the technical requirements for ensuring the compatibility of the interface between a vehicle and infrastructure with respect to the vertical load carrying capacity of a line. The standard is suitable for use on freight, passenger and mixed traffic lines with standard track gauge and wider than standard track gauge. It contains requirements relevant to:

— classification of the vertical load carrying capacity of railway infrastructure;

— design of railway vehicles;

— determination of payload limits of freight wagons.

A summary of the classification of infrastructure and the categorization of vehicles is given in Annex B.

The assessment of the vertical load carrying capacity of civil engineering structures, track, sub-grade and earthworks by the use of the load models defined in Annex A permits the classification of infrastructure into line categories.

This European Standard identifies on which lines vehicles are compatible to the infrastructure for regular traffic regarding vertical load effects.

Line categories are provided for:

— all traffic types;

— heavy freight traffic;

— locomotives;

— multiple units;

— lightweight passenger traffic.

Portable trolleys as defined by EN 13977 are outside the scope of this European Standard as well as the working mode of maintenance vehicles (e.g. rail mounted plant, cranes).

This European Standard does not cover the system used in Great Britain, where all lines and vehicles are classified in accordance with the RA (Route Availability) System. A guide to the equivalent categories in accordance with this European Standard is given in Annex Q.

This European Standard does not cover requirements relating to the maximum total mass or maximum length of a train.

The requirements of this European Standard do not replace any regulations related to running behaviour of vehicles described by the assessment quantities for running safety, track loading and ride characteristics (see EN 14363).

This Standard does not impose any requirements to vehicles or infrastructure, but gives guidance to a simplified management of the interface between vehicles and infrastructure.

Publication of line categories is outside the scope of this European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1991-2:2003, *Eurocode 1: Actions on structures — Part 2: Traffic loads on bridges*

EN 15663:2009[1)], *Railway applications — Definition of vehicle reference masses*

EN 15877-1, *Railway applications — Marking on railway vehicles — Part 1: Freight wagons*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
associated maximum speed
local maximum speed for which the line category is valid

3.1.2
axle load
P
sum of the static vertical wheel forces exerted on the track through a wheelset or a pair of independent wheels divided by *g*

Note 1 to entry: In this standard "load" and "force" are described with units of "mass" (kg or t).

3.1.3
axle load
P_i
axle load *P* of the axle *i*

3.1.4
axle spacing
design values of the distances between the centres of adjacent axles

3.1.5
bending moment
designation of an internal force of a beam as used in structural design

3.1.6
categorization of vehicles
statement of the vertical loading characteristics of a railway vehicle, according to the combination of axle loads and axle spacing, by allocation of a line category

1) This document is currently impacted by the corrigendum EN 15663:2009/AC:2010.

3.1.7
classification of infrastructure
statement of the load carrying capacity of infrastructure on a line by allocation of a line category and related speed information

3.1.8
compatibility
demonstration of the satisfactory interface between the load effects of the vehicles and the load capacity of the infrastructure

3.1.9
design mass under normal payload
mass of vehicle equipped with all the consumables and occupied by all staff, which it requires in order to fulfil its function plus the normal payload defined in EN 15663 as implemented by Annex D

3.1.10
design mass under exceptional payload
mass of vehicle equipped with all the consumables and occupied by all staff, which it requires in order to fulfil its function plus the exceptional payload defined in EN 15663 as implemented by Annex D

3.1.11
length over buffers
L
length over buffers or between coupling planes in case of no buffers

3.1.12
line category
designation of the specific load model based on reference wagons

3.1.13
line speed
general maximum speed of traffic on a route

3.1.14
load limit
maximum allowable payload for a wagon related to each line category

3.1.15
load model
defined by a specific formation of reference wagons

3.1.16
locomotive
traction vehicle that is not intended to carry a payload

Note 1 to entry: In this standard, power heads are considered as locomotives.

3.1.17
locomotive class
reference vehicle with representative locomotive parameters

3.1.18
mass per unit length
p
mass of a vehicle or unit divided by length over buffers

3.1.19
maximum passenger traffic speed/maximum freight traffic speed
additional information provided by the infrastructure manager giving the general limit to the maximum traffic speed on a line according to the type of traffic

3.1.20
reference wagon
virtual vehicle used as a module of loading for a load model defined by axle load, axle spacing and mass per unit length

3.1.21
multiple unit
MU
fixed formation or railcar that can operate as a train not intended to be reconfigured, except within a workshop environment

3.1.22
MU-group
group of MU-trains determined according to the predominant running gear within the unit (conventional bogie, articulated bogie, single axle)

3.1.23
MU-class
defined by the train parameters, axle spacing pattern and axle load within a MU-group

3.1.24
passenger carriages
vehicles without traction: coaches, restaurant cars, sleeping cars, couchettes cars, vans, driving trailers, car carriers and similar vehicles, intended to be integrated in a variable formation as passenger train

3.1.25
series of locomotives
locomotives designed to be equal (the same axle spacing and the same nominal values for mass m_{nom} and, axle loads $P_{i,\mathrm{nom}}$)

3.1.26
shear force
designation of an internal force of a beam as used in structural design

3.1.27
special vehicles
vehicles which are designed for maintenance, inspection or renewal of infrastructure elements or for special transport purposes where the fleet is operated with a low mileage compared to normal railway vehicles including:

a) maintenance vehicles including:

   1) cranes and matching wagons;

2) on-Track Machines (see EN 14033 (all parts));

3) road rail machines (see EN 15746 (all parts));

4) demountable machines (see EN 15955 (all parts));

5) trailers (see EN 15954 (all parts));

b) monitoring and inspection vehicles, including:

1) track inspection vehicles;

2) catenary inspection vehicles;

c) special transport vehicles, including:

1) transformer transporter;

2) crucible transporters;

3) loaded wagons with more than 8 axles (UIC 502-1)

3.1.28
wheel load
Q
static vertical wheel/rail contact forces divided by g

Note 1 to entry: The terminology in this standard for “load” and “force” is used with the meaning and units of “mass” (kg or t).

3.1.29
wheel load
Q_i
wheel load Q of the axle i

3.2 Symbols and abbreviated terms

$1 + \varphi'$	Dynamic factor	—
$1 + \varphi'_{UIC}$	Limit value of the dynamic factor as defined in UIC 776–1	—
$2a^*$	Bogie spacing between pivot centres within a vehicle	m
$2a^*_{adopted}$	Adopted value of 2a* used in Annex U	m
$2a^*_{table}$	$2a^*$ value in tables of Annex U	m
$2a^*_{unit}$	$2a^*$ value of a MU unit used in Annex U	m
$2a^+$	Axle spacing in a bogie	m
$2a^+_{table}$	$2a^+$ value in tables of Annex U	m
$2a^+_{unit}$	$2a^+$ value of a MU unit used in Annex U	m
AB	Articulated bogie	Unit
a	Distance between axles	m

b	Distance from end axle to the end of the nearest coupling plane	m
c	Distance between two inside axles	m
CB	Conventional bogie	—
ETCS	Electronic Train Control System	—
HSLM	High Speed Load Model	—
d_n	Distance between axle n and axle (n-1)	m
g	acceleration due to gravity	9,81 m/s^2
L	Length over buffers	mm
L_Coa	Coach length	m
m	Mass	t
m_{nom}	Nominal values for mass	t
$m_{\text{nom,excess}}$	Modified nominal value for mass due to excess of tolerances	t
MU	Multiple unit	—
No_Coa	Number of coaches within a unit	—
No_Units	Number of units within a train	—
n	Axle number	—
n_0	Natural frequency	Hz
p	Mass per unit length	t/m
P	Axle load	t
P_i	Axle load of axle i	t
$P_{i,\text{nom}}$	Nominal value for axle load of axle i	t
$P_{\text{LineCategory}}$	Maximum axle load for a Line Category	t
P_{MUclass}	Maximum axle load for a MU-class	t
$P_{\text{nom,excess}}$	Modified nominal value for axle load due to excess of tolerances	t
P_{red}	Reduced value of axle load	t
P_{unit}	Maximum axle load within the unit	t
Q	Wheel load	t
Q_i	Wheel load of axle i	t
$Q_{i\text{r}}/Q_{i\text{l}}$	Wheel load of axle i right or left	t
RA	Route Availability	—
SA	Single axle	—
s_n	Distance between axle n and axle 1	m
$u1+u2$	Bogie spacing between pivot centres of adjacent vehicles	m
$u3$	Overhang of end coaches	m
u_{unit}	Overhang value of a MU unit used in Annex U	m
u_{table}	Overhang value in tables of Annex U	m

UIC	International Union of Railways	—
V	Speed	km/h

4 Classification system

4.1 Definition of line categories

The use of a classification system using line categories permits easy understanding of the load-related compatibility of vehicles and infrastructure.

The line category resulting from the classification process for infrastructure represents the ability of the infrastructure (track, track substructures, earthworks, civil engineering structures) to withstand the vertical loads imposed by vehicles on the line or section of line for regular service.

Each line category (a10, a12, a14, A, B1, B2, C2, C3, C4, D2, D3, D4, D5, D4xL and also E4 and E5, E6) is defined by a load model based on reference wagons defined by the characteristics given in Annex A:

— axle load;

— geometrical characteristics of the spacing of axles;

— length of the vehicle.

The value “mass per unit length” of the reference wagon is determined from the above parameters.

4.2 Correlation to types of vehicles

The load effects of different vehicle types are compared to the load models defining the different line categories.

All types of vehicles and freight wagons with their corresponding payload are covered by the line categories A, B1, B2, C2, C3, C4, D2, D3, D4.

Line categories D5, E4, E5 and E6 are defined exclusively for heavy freight wagons.

Locomotives can be covered by:

— line categories B1, B2, C2, C3, C4, D2, D3, D4 and D4xL (plus optional detailed specification for axle spacing ranges);

— locomotive classes L4 and L6.

Passenger carriages and Multiple Units can be covered by:

— line categories a10, a12, a14, B1, C2, D2 (plus optional detailed specification for axle spacing and vehicle lengths). Line categories a10, a12 and a14 have been specially developed for light rail vehicles with up to 14 t axle loads.

— MU-groups and MU-classes, which are provided to assist additional compatibility checks between infrastructure and vehicles where there is a risk of excessive dynamic effects in bridges.

For rail vehicles or wagons with payload limits categorized above D4 or D4xL it is recommended that the infrastructure manager and railway undertaking consider the use of static and dynamic wheel load measuring devices attached to the track and/or fitted to vehicles to assist with ensuring compliance with the requirements of this European Standard.

4.3 Correlation between line category and speed

4.3.1 Introduction

The classification of infrastructure applies to all types of railway vehicles, which can have different maximum speeds (e.g. freight and passenger traffic). Additional information defining the maximum speed corresponding to the line category shall be stated.

As a result of the classification of infrastructure, additional information specifying the line classification can be given to cover two or more combinations (e.g. different maximum speeds and associated line categories for passenger and freight trains).

NOTE Examples illustrating information about line classification and relationship with speed are given in Annex H.

The combinations used for publication should be in accordance with legal, technical and operational requirements (e.g. ETCS [2)] speed levels).

The local line speed shall be taken into account for the classification of engineering structures (see 5.1) and other relevant infrastructure elements (see 5.2).

The line category and associated maximum speed shall be considered as a single combined quantity.

4.3.2 Freight traffic

When classifying infrastructure lines into line categories, the line category at maximum freight traffic speed (maximum 120 km/h) shall be determined.

120 km/h corresponds to the maximum speed for conventional freight traffic and is the limit of validity for freight traffic using line categories. In excess of 120 km/h individual checks shall be carried out.

Optionally, an additional higher line category at an associated lower speed (less than the maximum freight traffic speed) may be determined.

NOTE In some situations it may be desirable to determine the line category at a lower speed to maximize the line category.

In addition, for D5, E4, E5 or E6 lines, an associated maximum speed for such traffic shall be stated together with the associated maximum speed for conventional line traffic of line category D4.

4.3.3 Mixed traffic and passenger traffic

On mixed traffic lines with passenger traffic, the line category at maximum freight traffic speed in 4.3.2 is generally sufficient and appropriate for the optimization of freight traffic.

For vehicles and locomotives, categorized into the same or lesser line category as the line, and which run faster than the maximum freight traffic speed, additional checks starting on the basis of the maximum freight traffic speed shall be taken into account for the classification of engineering structures (see 5.1) and other relevant infrastructure elements (see 5.2).

For speeds over 120 km/h and up to the maximum line speed, the different combinations of line categories-with speed shall be in accordance with general technical and operational requirements or restrictions.

NOTE Line Categories as classification information for speeds over 120 km/h may be related to vehicle types or types of traffic. Additional compatibility checks at different speed levels for different vehicle types may be required to demonstrate compatibility (see 5.1.2 and Annex F).

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2) European Train Control System.