
Železniške naprave – Kategorizacija prog – Dovoljene osne in dolžinske obremenitve železniških vozil in tovornih vagonov

Railway applications – Classification of lines – Corresponding load limits for railway vehicles and payload for freight wagons

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ICS

English Version

Railway applications - Classification of lines - Corresponding load limits for railway vehicles and payload for freight wagons

Applications ferroviaires - Classification des lignes - Limites de charge des véhicules ferroviaires ainsi que des wagons qui en résultent

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Foreword

This document (prEN 15528:2006) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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

- 2001/16/EC of the European Parliament and of the Council of 19 March 2001 on the interoperability of the trans-European conventional rail system¹⁾

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

Most civil engineering railway infrastructure was built before the introduction of the design requirements in the CR-INS-TSI and Eurocodes for the design of structures. Alternative requirements are necessary to ensure compatibility between the static vertical loading characteristics of railway vehicles and the load carrying capacity of railway infrastructure.

This standard contains requirements relevant to:

- Classification of the vertical load carrying capacity of railway infrastructure.
- Design of railway vehicles.
- Determination of payload limits for freight wagons.

This standard specifies criteria to classify lines or sections of lines into categories and defines a methodology to determine the load effects of vehicles and payload limits for freight vehicles, which can be used to determine whether railway vehicles shall be accepted on these lines on the basis of geometrical characteristics of axle spacing, masses per axle, masses per unit length and operating speed.

1) Official Journal of the European Communities No L 110 of 20.04.2001

Introduction

Infrastructure managers and railway operators are required to use the line classification system specified in this standard for managing the interface between load limits for railway vehicles and payload limits for freight wagons and the vertical load carrying capacity of a line. The line classification system is defined in Annex A and takes into account parameters such as the mass per axle (P) and mass per length (p) as well as geometrical aspects relating to the spacing of axles.

NOTE This standard is intended to support requirements in the TSI relating to the interoperability of the European rail network.

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

1 Scope

1.1 General

This standard covers the classification and publication of the classification of existing and new infrastructure lines and the categorisation of new vehicles into line categories for international and national traffic and manages the interface between the existing infrastructure of dedicated freight lines and mixed traffic lines and all railway vehicles under normal operating conditions including passenger train speeds up to 200 km/h (corresponding to traffic category II of prEN 13803-1).

The classification of infrastructure into line categories manages predominantly the interface between the load models (reference wagons) of Annex A and the vertical load carrying capacity of civil engineering structures, track, sub-grade and earthworks.

This standard covers the categorisation of railway vehicles into line categories, the determination of payload limits for existing and new freight wagons according to line category and the marking of vehicles with line categories and for freight wagons the marking of payload limits.

This standard identifies where vehicles may be permitted to run in normal operations without further checks regarding vertical load effects.

The load models (reference-wagons) of Annex A are for the classification of lines and shall not be used to design new structures.

The methodology described in this standard is not valid for high speed rail traffic. Tilting traffic and the working of rail mounted plant and cranes etc. are outside the scope of this standard.

National traffic may be categorised in accordance with national requirements.

In Great Britain all lines and vehicles are classified in accordance with the RA (Route Availability) System. A guide to the equivalent categories in accordance with this standard is given in Annex C.

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

1.2 Implementation

The requirements in this standard shall be implemented within the timescales defined in the following schedule:

Immediately after the publication date of this standard

- Classification of infrastructure and
- Publication of line categories for freight traffic
- Calculation of payload limits and the marking of load limit tables on freight wagons

NOTE This requirement is equivalent to the corresponding requirements in the RIV regulations.

Within one year after the publication date of this standard

- Categorisation of all new railway vehicles which are newly set in service
- Marking of the line category on vehicles for all new railway vehicles which are newly set in service
- Publication of
 - line categories with associated maximum speeds for freight traffic
 - passenger train speeds on all international lines and if relevant associated vehicle restrictions

Within three years after the publication date of this standard

- Categorisation of existing railway vehicles running in international traffic
- Marking of the line category on vehicles for existing railway vehicles running in international traffic and corresponding to a line category > B2
- Publication of line categories with associated maximum line speeds (for all railway traffic) and additional national requirements

2 Normative references

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

COTIF Agreement 1999, *Convention concerning International Carriage by Rail (COTIF) of 9th May 1980 modified by the Protocol of Modification of 3rd June 1999*

prEN 14033-1:2003, *Railway applications — Track — Technical requirements for railbound construction and maintenance machines — Part 1: Running of railbound machines*

prEN 13803-1 final draft:2004, *Railway Applications — Track alignment design parameters — Track gauges 1435 mm and wider — Part 1: Plain line*

EN 13103:2001, *Railway Applications — Wheelsets and bogies — Non-powered axles; Design method*

EN 13104:2001, *Railway Applications — Wheelsets and bogies — Powered axles; Design method*

3 Classification of Infrastructure

3.1 General

Railway Infrastructure Managers shall classify their lines or sections of lines into the line categories defined in Annex A taking into account the load carrying capacity of track, substructures, earthworks, bridges and structures.

The line categories represent the traffic load capacity of the line or section of line for regular service.

Each line category (A, B1, B2, C2, C3, C4, D2, D3, D4 and also E4 and E5) is defined by the capacity of a line to withstand the loads represented by a load model (reference-wagon) defined by 3 characteristics shown in Annex A:

- mass per axle,
- mass per length and
- geometrical characteristics of the spacing of axles.

Letters characterize the limits for mass per axle and numbers the limits for mass per length of the corresponding load model. The line categories are ranked by letter $A < B < C < D < E$ and number $1 < 2 < 3 < 4 < 5$.

NOTE For example, D3, D2, C4, C3, C2 all less than or equal to D4 (both letter and number must be less than or equal) but also note $C3 \neq D2$, $D3 \neq C4$.

Line categories E4 and E5 are defined exclusively for heavy freight wagons. For E4 or E5 traffic a maximum operating speed of 100 km/h is recommended. On lines or section of lines classified as E4 or E5, for all other vehicles or trains the maximum permitted conventional line category is D4.

For rail vehicles or payload limits categorized above D4 it is recommended that railway infrastructure managers and railway operators consider the use of axle weight measuring devices attached to the track and/or fitted to vehicles to assist with ensuring compliance with the requirements of this standard.

3.2 Correlation between Line Category and Line Speed

Classification shall apply to all types of railway vehicles taking their maximum speeds (e.g. passenger and freight train speeds have to be covered) and line speed into account.

In order to clarify the line classification requirements relating to all train types and vehicles, additional information relating to the maximum speed corresponding to the line classification(s) shall be stated. To cover two or more categories of maximum speed or traffic type (e.g. different maximum speeds and associated line classification(s) for passenger and freight trains) within the same line classification system, additional information specifying the line classification may be given.

NOTE 1 Typical speed categories:

— Loco hauled passenger train	≤ 120 km/h	≤ 140 km/h	≤ 160 km/h	≤ 200 km/h*
— Multiple unit	≤ 120 km/h	≤ 140 km/h	≤ 160 km/h	≤ 200 km/h*
— Freight train	≤ 80 km/h	≤ 100 km/h	≤ 120 km/h	≤ 160 km/h**

*) depending on the characteristics of bridges, the method of classification defined in this standard is not always valid for speeds over 160 km/h to 200 km/h due to the potential for excessive dynamic effects and resonance in existing bridges and traffic should be permitted by special permission (the railway infrastructure manager may specify when special permission is required).

***) only for light weight freight trains (e.g. mail transport) that are similar to passenger trains

NOTE 2 The load model (reference wagons) of line categories of Annex A are related to all railway vehicles as defined in clause 4. Different train types and vehicle types, e.g. locomotives, may have different operating speeds. A locomotive hauling a passenger train may have larger load effects than hauling a freight train.

National requirements relating to speed and operating restrictions shall be taken into account.

When classifying infrastructure lines into the line categories, the following options may be used by the railway infrastructure manager to optimize freight traffic:

Option 1: determination of the line category at maximum local freight speed (maximum 120 km/h).

Option 2: determination of the maximum line category related at an associated speed less than 120 km/h.

The line category and associated maximum speed are to be considered as a unit. The railway infrastructure manager may determine how many units (and the combination of line category and associated maximum speed forming a unit) to determine and publish. The unit according to option 1 shall be determined and published obligatory in any case.

Generally for lines dedicated to freight traffic or mixed traffic lines of traffic category I (prEN 13803-1 – passenger train speeds from 80 km/h to 120 km/h maximum) the local line speed shall be taken into account for the classification of the engineering structures (see 3.3) and other relevant infrastructure elements (see 3.4).

NOTE 3 Additional the classification of the maximum line category related to a lesser speed than 120 km/h may be useful to maximise the line category in accordance with Option 2.

NOTE 4 All types of rail vehicles are covered by the above requirement.

NOTE 5 See examples 1 and 2 of NOTE 3 in 3.5.

On lines of traffic category II (prEN 13803-1) dedicated to mixed traffic with passenger train speeds up to maximum 200 km/h additional checks for vehicles and locomotives running faster than freight train speed and categorized into the same or lesser line category as the line the maximum speed of freight train speed shall be taken into account for the classification of engineering structures (see 3.3) and other relevant infrastructure elements (see 3.4).

NOTE 6 Generally on lines of traffic category II the consideration of Option 1 is sufficient and relevant to optimize freight traffic. In some situations it may be desirable to determine the line category at a lower speed to maximise the line category in accordance with Option 2.

NOTE 7 See example 3 of NOTE 3 in 3.5.

Freight traffic is covered if all wagons and locomotives do not exceed the line category of the line taking into account the associated maximum speed.

The units of variation of line category with speed for speeds over 120 km/h and up to the maximum line speed shall be in accordance with national requirements.

In addition, for E4 or E5 lines a corresponding maximum permitted line speed for E4 and E5 traffic shall be stated together with the maximum permitted speed for conventional line traffic of line category D4. For E4 or E5 traffic a maximum operating speed of 100 km/h is recommended.

3.3 Civil Engineering Structures

To determine the line category in which a line is to be classified the railway infrastructure manager shall take into account:

- a train made up of an unlimited number of the load wagons (reference wagons) in accordance with the data given in Annex A;

- the load wagons shall be applied to produce the most onerous load effects;
- the dynamic load effects corresponding to the associated speed (see 3.2);
- published and operating and other restrictions relating to types of traffic etc.

The method used to determine the load carrying capacity of structures (bridges and other structures supporting the track) shall take account of the condition of the structures and be in accordance with national requirements.

NOTE 1 Methods typically used to determine the load carrying capacity of structures include:

- recalculation of structures taking into account structural configuration and details, material properties and the condition of the structure etc. and taking into account strength and other safety related criteria etc.;
- comparison of the original design loading specification with the load effects generated by the load models (reference wagons) in Annex A taking into account dynamic effects together with allowances as necessary for the condition of structures and advances in predicting the structural capacity of structures in accordance with national requirements;
- in the absence of data from bridge recalculations or information on the original design loading specification engineering judgement may be used to assign the structure a line category on the basis of its current condition, behaviour and the line category of vehicles regularly using the structure for a significant period at up to the same speed in accordance with national requirements.

The load models (reference-wagons) defined in Annex A are for the classification of lines and shall not be used to design new structures. For the design of new structures the loading to be used is given in the EN 1991-2.

The result of classification shall the maximum line category related to an associated maximum speed for speeds in accordance with 3.2.

NOTE 2 In some cases it may be necessary to determine further permissible combinations of line category and associated maximum speed in accordance with 3.2 and 3.5.

NOTE 3 This associated speed may not be the same as the maximum speed values published by the railway infrastructure manager (see also 3.5).

When determining the line classification (or locomotive class – see 4.3) and associated maximum operating speed for locomotives and other non passenger carrying power cars account may be taken of the reduced likelihood of overloading and cargo displacement with locomotives.

NOTE 4 For example, this may be taken into account when determining the line category or loco class for speeds of operation of locomotives higher than line categories available for freight operation. Depending on the difference in speeds of operation and relative static loadings between the proposed locomotive and load models the increased dynamic load effects from the higher speed of locomotive operation may be compensated by an appropriate reduction in the partial load factor for rail vehicle loading. Any reduction in partial load factors is to be in accordance with national requirements.

Annex G and Annex H covering 4-axles and 6-axles locomotives classes give additional information to differentiate and optimise the speed of different locomotive classes within the same line category. In Annexes G.1 and H.1 examples of permitted speed increases on straight track are given using partial load factors of $\gamma_{Qlinecategory} = 1.45$ and $\gamma_{Qred loco} = 1.3$.

NOTE 5 When determining the allowable line category or locomotive class for locomotives it may be necessary to specify additional operating restrictions relating to the number or position of locomotives in a train to limit associated traction forces, vertical load effects etc.

The result of classifying all structures on a line or section of a line is the maximum line category and, if no other regulations exist (or providing there is no conflict with other regulations), the associated maximum speed.

It is recommended that special studies should be undertaken for proposed speeds in excess of:

- 100 km/h to establish an appropriate maximum speed of wagons with axle masses greater than 22,5 t
- 120 km/h to establish an appropriate maximum speed of wagons with axle masses of up to 22,5 t
- 200 km/h (or other value specified in accordance with 3.1) to establish an appropriate maximum speed of locomotives or passenger vehicles

to check the adequacy of the allowances for the dynamic increment of loading (in EN 1991-2 Annex C) and to address the potential risk of adverse bridge dynamic effects resulting from resonance etc. between vehicles and infrastructure.

3.4 Track Constructions, Sub Structures and Earthworks

The load carrying capacity of the track, substructures and earthworks shall be determined in accordance with national requirements.

NOTE 1 Typically such methods take account of the type of rail and track components, sleeper spacing, track geometry, track quality, annual tonnage of traffic, inspection and maintenance regimes and other national requirements etc.

NOTE 2 For E4 and E5 traffic the requirements in UIC 518-2 "Supplement to UIC 518: application to wagons with axle loads between 22,5 t and 25 t" is recommended.

NOTE 3 It is recommended that special studies should be undertaken to check the dynamic effects on track for wagons with axle masses greater than 22,5 t proposed speeds in excess of 100 km/h to establish an appropriate maximum speed.

Railway infrastructure managers shall determine the correspondence between their own national classification systems and the line classification system defined in this standard. Annex I shows an example of the correspondence between a track classification system and the line category classification system.

For E4 and E5 traffic the recommended maximum permitted cant deficiency is 100 mm.

The results of the above shall be used to determine the line classification in accordance with this standard with respect to the load carrying capacity of the track, substructures and earthworks.

3.5 Results and Publication

The line classification shall be taken as the lesser of:

- the line classification of civil engineering structures determined in accordance with 3.3
- the line classification of track, substructures and earthworks determined in accordance with 3.4
- other national requirements relating to speed and operating restrictions etc.

taking into account qualifications relating to associated maximum speed in accordance with 3.2.

NOTE 1 Depending on the option used for taking speed into account the results may not be sufficient for the intended operations. Where the line classification is insufficient, consideration may be given to determining a higher line category at a reduced speed to reduce the need for special permissions. Alternatively, where the maximum speed of operation is not sufficient, consideration may be given to determining a reduced line category at higher speeds to reduce the need for special permissions.

Line classifications relating to locomotives may be expressed in accordance with the load models (reference wagons) defined in Annex A or the locomotive classes defined in Annexes G and H.

NOTE 2 For locomotives running at speeds exceeding normal freight traffic speeds (e.g. in passenger trains) the permissible speeds should be checked. The locomotive classes defined in Annex G and Annex H may be used as an

alternative to the load models in Annex A to optimize this speed check within the line category by taking detailed axle loads and typical locomotive axle spacing into account (see 3.3 and 4.3).

The classification of lines in accordance with this standard and in accordance with any national classification system shall be published.

The information to be published shall include:

- the results of line classification,
- associated requirements relating to speed in accordance with 3.2,
- general requirements relating to maximum permitted speeds for different types of traffic,
- if speed regulations and operating requirements relating to locomotives due to this standard are given and conflict with the requirements arising from other regulations clarification of the applicable requirements shall be stated,
- additional qualifications relating to the validity of the published line classification etc.

NOTE 3 Example 1

Required traffic type:	Traffic Category I
Local line speed:	90 km/h
Determined Line Category:	D4 at maximum of 90 km/h
Publish:	D4 at maximum of 90 km/h

Example 2

Required traffic type:	Traffic Category I
Local line speed:	120 km/h
Determined Line Category:	C4 at maximum of 120 km/h and D4 at maximum of 90 km/h
Publish:	C4 at maximum of 120 km/h and D4 at maximum of 90 km/h
Additional required information for	
—	Operating restrictions or national regulations for locomotives corresponding to line category D4 but running faster than 90 km/h

Example 3

Required traffic type:	Traffic Category II
Local line speed:	160 km/h
Determined Line Category:	D4 at maximum of 140km/h (freight 90 km/h) and C2 at maximum of 160 km/h (freight 120 km/h)
Publish:	D4 at maximum of 140 km/h (freight 90 km/h) and C2 at maximum of 160 km/h (freight 120 km/h) and loco classes L4a21.5, L4b21.5 at maximum of 160 km/h
Additional required information for	
—	Operating restrictions or national regulations for locomotives corresponding to line category D4 faster than 140 km/h.

NOTE 4 It is permissible for different types of vehicles with the same static loading characteristics to have different permitted maximum speeds etc. resulting from consideration of the likelihood of overloading, operating matters, the number of vehicles in a train etc. (see 3.3).

Information defining the classification of lines shall be updated regularly by the railway infrastructure manager.