SLOVENSKI STANDARD
SIST EN 12299:2024

01-december-2024

Železniške naprave - Udobnost vožnje potnikov - Meritve in vrednotenje

Railway applications - Ride comfort for passengers - Measurement and evaluation

Bahnanwendungen - Fahrkomfort für Fahrgäste - Messung und Auswertung

Applications ferroviaires - Confort de marche des voyageurs - Mesurage et évaluation

Ta slovenski standard je istoveten z: **EN 12299:2024**

ICS:

13.160	Vpliv vibracij in udarcev na ljudi	Vibration and shock with respect to human beings
45.060.20	Železniški vagoni	Trailing stock

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EUROPEAN STANDARD
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English Version

Railway applications - Ride comfort for passengers - Measurement and evaluation

Applications ferroviaires - Confort de marche des voyageurs - Mesurage et évaluation

Bahnanwendungen - Fahrkomfort für Fahrgäste - Messung und Auswertung

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 12299:2024) 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of an identical text or by endorsement, at the latest by April 2025, and conflicting national standards shall be withdrawn at the latest by April 2025.

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

This document supersedes EN 12299:2009.

EN 12299:2024 includes the following significant technical changes with respect to EN 12299:2009:

a) the Scope has been revised;

b) Normative references have been updated;

c) Clause 3, Terms and definitions has been updated;

d) Clause 4, Symbols, units and abbreviations has been revised;

e) Clause 5, General description has been revised;

f) Clause 6, Mean comfort and continuous comfort have been revised;

g) Clause 7, Comfort on curve transitions has been updated;

h) Clause 8, Comfort on discrete events has been revised;

i) Clause 9, Guide for the interpretation of the results has been updated;

j) Annex B, Measurement techniques has been updated;

k) Annex C, Weighting curves has been updated;

l) new Annex D has been added;

m) (previous) Annex D has been revised and renamed in Annex F;

n) Annex E has been revised;

o) (previous) Annex F has been revised and renamed in Annex G;

p) Annex H has been renamed Annex I. New Annexes H, J and K added.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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

1 Scope

The purpose of this document is to provide methods for quantifying the ride comfort of a passenger in a rail vehicle in response to the track sections it is operated over.

The methods aim to quantify the effects of vehicle body motions on ride comfort and to make the assessment of passenger comfort predictable, repeatable, objective and meaningful.

The methods and comfort scales are validated for people of good health.

This document applies to passengers in rail vehicles operating on heavy rail networks.

This document applies to measurements of motions. It also applies to simulated motions. Guidance is provided on:

— which method described within the document should be used for different scenarios;

— typical values for different comfort levels;

— the application of simulation.

This document excludes health and safety issues, non-passenger carrying vehicles, vehicle homologation and safety, limit values, motion sickness, discomfort caused by accelerating and braking, design guidelines and measurement technology.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 15663, *Railway applications — Vehicle reference masses*

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1
passenger
person travelling in a rail vehicle, without specific activities related to the transport

3.2
ride comfort
complex sensation experienced by a passenger due to motions (vibrations, roll velocities and inertia forces etc.) transmitted through the rail vehicle body whilst running over track (see also 5.5)

3.3
interfaces
contact parts between the vehicle body or seat and the passenger with the function of sustaining and guiding the passenger and of transmitting the weight of the passenger to the vehicle body itself, e.g. floor-feet

3.4
mean comfort
perceived comfort level, continuously adjusted, as evaluated through measurement on a long-time basis (at least some minutes)

3.5
continuous comfort
level of accelerations, frequency weighted continuously evaluated as a set of RMS (root mean square) values in vertical, lateral and longitudinal direction over a short time period (typical 5 s)

3.6
comfort on curve transitions
comfort evaluation, due to a perceived curve transition, expressed as percentage of passengers feeling uncomfortable

3.7
comfort on discrete events
comfort evaluation, due to a perceived transient acceleration, expressed as percentage of passengers feeling uncomfortable

3.8
whole-body transmission
motion transmitted to the whole body through the interfaces between vehicle body and passenger

3.9
indirect measurement
measurement of motion environment by different motion quantities, such as acceleration or roll velocity

3.10
direct measurement
measurement of actual passenger reactions, for example by asking passengers to fill in a questionnaire

3.11
vehicle assessment with respect to ride comfort
identifying the vehicle's contribution to the ride comfort by relating the measured ride comfort to the condition of the track and operation condition

Note 1 to entry: conditions of track includes geometry, irregularities, turnout, bridges, etc.

Note 2 to entry: operation condition includes speed, cant deficiency, etc.

3.12
test section
part of a rail line used for the passenger comfort test

3.13
test zone
five-minute period, which is used for mean comfort evaluation

3.14
reference system
local reference system for a vehicle body defined by:

Origin: on the floor of the vehicle body, in the central position between the two body-bogie centre pivots (existing or ideally defined)

Axis:

— x-axis: longitudinal

— y-axis: lateral

— z-axis: vertical

Roll motions (φ) are defined as rotation around the x-axis

For human body reference system, a right hand system is used with vertical direction defined upwards

Note 1 to entry: A more detailed definition of the reference system is given in Annex A.

3.15
heavy rail network
conventional rail network intended for intra- and interregional and/or international transportation

3.16
unit
generic term used to name the rolling stock. It may be composed of either one vehicle or several vehicles in a fixed formation

4 Symbols, units and abbreviations

Table 1 and Table 2 define the symbols, units and abbreviations used in this document.

Table 1 — Symbols and units – Part 1

Parameter	Symbol	Unit
General parameters		
Time	t	[s]
Time period	T	[s]
Integration variable	τ	[s]
Vehicle speed	V	[km/h]
Frequency	f	[Hz]
Frequency weighting curve for vertical direction	W_b	[-]
Frequency weighting curve for longitudinal direction (backrest)	W_c	[-]
Frequency weighting curve for lateral/longitudinal direction	W_d	[-]
Low-pass filter	W_p	[-]
n-tile	k	[-]

Parameter	Symbol	Unit
Percentile	n	[%]
Number of samples	N	[-]
Imaginary unit	i	[-]
Root mean square	RMS	[-]
Constants for passenger comfort on curve transitions and discrete events		
Constant in acceleration component in curve transitions	A	[s^2/m]
Constant in acceleration component in curve transitions	B	[s^3/m]
Constant in acceleration component in curve transitions	C	[-]
Constant in roll velocity component in curve transitions	D	[s/rad]
Constant in roll velocity component in curve transitions	E	[-]
Constant in acceleration component in discrete events	a	[s^2/m]
Constant in acceleration component in discrete events	b	[s^2/m]
Constant in acceleration component in discrete events	c	[-]
Transfer functions		
Cut-off frequencies, n = 1,2,3,4,5,6	f_n	[Hz]
Resonant quality factors, n = 1,2,3,4	Q_n	[-]
Gain	K	[-]
High pass transfer function	$H_h(f)$	[-]
Low pass transfer function	$H_l(f)$	[-]
Acceleration to velocity transfer function	$H_t(f)$	[-]
Upward gradient transfer function	$H_s(f)$	[-]

Table 2 — Symbols and units – Part 2

Parameter	Longitudinal axis	Lateral axis	Vertical axis
Translational accelerations in vehicle body [m/s^2]			
Leading end of passenger compartment	–	$\ddot{y}^*_{\mathrm{EI}}$	$\ddot{z}^*_{\mathrm{EI}}$
Over leading bogie	–	$\ddot{y}^*_{\mathrm{I}}$	$\ddot{z}^*_{\mathrm{I}}$
Body centre	$\ddot{x}^*_{\mathrm{M}}$	$\ddot{y}^*_{\mathrm{M}}$	$\ddot{z}^*_{\mathrm{M}}$
Over trailing bogie	–	$\ddot{y}^*_{\mathrm{II}}$	$\ddot{z}^*_{\mathrm{II}}$
Trailing end of passenger compartment	–	$\ddot{y}^*_{\mathrm{EII}}$	$\ddot{z}^*_{\mathrm{EII}}$
Translational weighted accelerations [m/s^2]			
Seat, weighted W_c, W_b	$\ddot{x}^*_{\mathrm{D,Wc}}$	–	$\ddot{z}^*_{\mathrm{A,Wb}}$
Vehicle body, weighted W_d, W_b	$\ddot{x}^*_{\mathrm{P,Wd}}$	$\ddot{y}^*_{\mathrm{P,Wd}}$	$\ddot{z}^*_{\mathrm{P,Wb}}$
Vehicle body, weighted W_p	–	$\ddot{y}^*_{\mathrm{P,Wp}}$	–
Seat (Dossier, seat back in French, and Assise, seat pan in French), weighted W_c, W_d, W_b, RMS	$a^{w_c}_{\mathrm{XD}}$	$a^{w_d}_{\mathrm{YA}}$	$a^{w_b}_{\mathrm{ZA}}$
Floor (Plancher in French), weighted W_d, W_b, RMS	$a^{w_d}_{\mathrm{XP}}$	$a^{w_d}_{\mathrm{YP}}$	$a^{w_b}_{\mathrm{ZP}}$
Floor, weighted W_d, W_b, RMS, 50$^{\mathrm{th}}$ percentile	$a^{w_d}_{\mathrm{XP50}}$	$a^{w_d}_{\mathrm{YP50}}$	$a^{w_b}_{\mathrm{ZP50}}$
Seat, weighted W_c, W_d, W_b, RMS, 95$^{\mathrm{th}}$ percentile	$a^{w_c}_{\mathrm{XD95}}$	$a^{w_d}_{\mathrm{YA95}}$	$a^{w_b}_{\mathrm{ZA95}}$
Floor, weighted W_d, W_b, RMS, 95$^{\mathrm{th}}$ percentile	$a^{w_d}_{\mathrm{XP95}}$	$a^{w_d}_{\mathrm{YP95}}$	$a^{w_b}_{\mathrm{ZP95}}$
One-second average	–	$\ddot{y}_{\mathrm{ls}}(t)$	–
Two-second average	–	$\ddot{y}_{\mathrm{2s}}(t)$	–
Peak to peak	–	$\ddot{y}_{\mathrm{pp}}(t)$	–
One-second average, maximum absolute value	–	$\lvert\ddot{y}_{\mathrm{ls}}\rvert_{\mathrm{max}}$	–
Two-second average, absolute value	–	$\lvert\ddot{y}_{\mathrm{2s}}\rvert(t)$	–