SLOVENSKI STANDARD
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Železniške naprave - Zgornji ustroj - Kakovost tirne geometrije - 2. del: Merilni sistemi - Merilna vozila

Railway applications - Track - Track geometry quality - Part 2: Measuring systems - Track recording vehicles

Bahnanwendungen - Oberbau - Geometrische Gleislagegüte - Teil 2: Messsysteme - Gleismessfahrzeuge

Applications ferroviaires - Voie - Qualité géométrique de la voie - Partie 2 : Systèmes de mesure - Véhicules d'enregistrement de la voie

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

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European foreword

This document (prEN 13848-2:2018) 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 will supersede EN 13848-2:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This European Standard is one of the series EN 13848 “*Railway applications — Track — Track geometry quality*” as listed below:

— *Part 1: Characterization of track geometry*;

— *Part 2: Measuring systems — Track recording vehicles*;

— *Part 3: Measuring systems — Track construction and maintenance machines*;

— *Part 4: Measuring systems — Manual and lightweight devices*;

— *Part 5: Geometric quality levels — Plain line, switches and crossings*;

— *Part 6: Characterization of track geometry quality*.

1 Scope

This document specifies the minimum requirements for track geometry measuring principles and systems in order to produce comparable results when measuring the same track. It applies to all measuring systems, attended or unattended, fitted on any vehicle, except those systems defined in EN 13848-3 and EN 13848-4. Only systems put into service after the standard comes into force are concerned.

This document doesn't define the requirements for vehicle acceptance.

This document does not apply to measuring systems dedicated to Urban Rail Systems.

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 13848-1, *Railway applications — Track — Track geometry quality — Part 1: Characterisation of track geometry*

EN 13848-6, *Railway applications - Track - Track geometry quality - Part 6: Characterisation of track geometry quality*

JCGM 200:2012 *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

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

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

3.1
track geometry recording vehicle
self-propelled or hauled vehicle with fixed, dedicated, measuring equipment and systems, used for the measurement, assessment and recording of track geometry parameters under loaded conditions, which measures and produces consistent results to the requirements of EN 13848-1

Note 1 to entry: The measuring system can be attended or not. The track geometry recording vehicle belongs to the infrastructure inspection vehicles as defined in TSI Loc&Pas 1302/2014/EU.

3.2
sensor
device which detects, measures and translates characteristics of track geometry into quantities that can be used for further data processing

3.3
repeatability
degree of agreement between the values of successive measurements of the same parameter made under the same conditions (speed, direction of measurement), where the individual measurements are carried out on the same section of track subject to the following controls:

— same measurement method;

— same vehicle orientation;

— same method of interpretation;

— similar environmental conditions;

— short period of time between successive runs

3.4
reproducibility
degree of agreement between the values of successive measurements of the same parameter made under varying conditions, where the individual measurements are carried out on the same section of track using the same measurement and interpretation methods, subject to one or more of the following:

— variation of speed;

— different directions of measurement;

— different vehicle orientations;

— different environmental conditions;

— short period of time between successive runs

3.5
comparability
degree of agreement of different track recording vehicles achieved under the same conditions

3.6
validation
set of tests for determining if a track recording vehicle complies with the requirements of this standard

3.7
calibration
set of procedures for adjusting the measuring devices of track measuring systems in order to meet the requirements of this standard as defined in JCGM 200:2012

3.8
event
record of a track or line-side feature that can be either technical, physical or natural

3.9
localisation
information required to locate events and the measured track geometry

3.10
reference track
track with known characteristics necessary to allow adequate testing of the track geometry recording system

3.11
unattended geometry measuring system (UGMS)
track geometry measuring system fitted on a vehicle, without any human interaction during the measurements

3.12
adjustment of a measuring system
set of operations carried out on a measuring system so that it provides prescribed indications corresponding to given values of a quantity to be measured (VIM- International vocabulary of metrology JCGM 200:2012)

3.13
cross check
method for comparing signals of a single run for linked parameters (e.g. longitudinal level of each rail vs. cross level or alignment of each rail vs. gauge) obtained from different inputs (e.g. devices or signal processing)

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

Table 1 — Symbols and abbreviations

No.	Symbol	Designation	Unit
1	*D1*	Wavelength range 3 m < λ ≤ 25 m	m
2	*D2*	Wavelength range 25 m < λ ≤ 70 m	m
3	*D3*	Wavelength range 70 m < λ ≤ 150 m for longitudinal level Wavelength range 70 m < λ ≤ 200 m for alignment	m
4	λ	Wavelength	m
5	Vmax	Maximum possible measuring speed of a recording system	km/h
6	Vmin	Minimum possible measuring speed of a recording system	km/h

5 Track geometry recording system

5.1 General description

For the purpose of this standard, the track geometry recording system is divided into several units as represented in Figure 1 below:

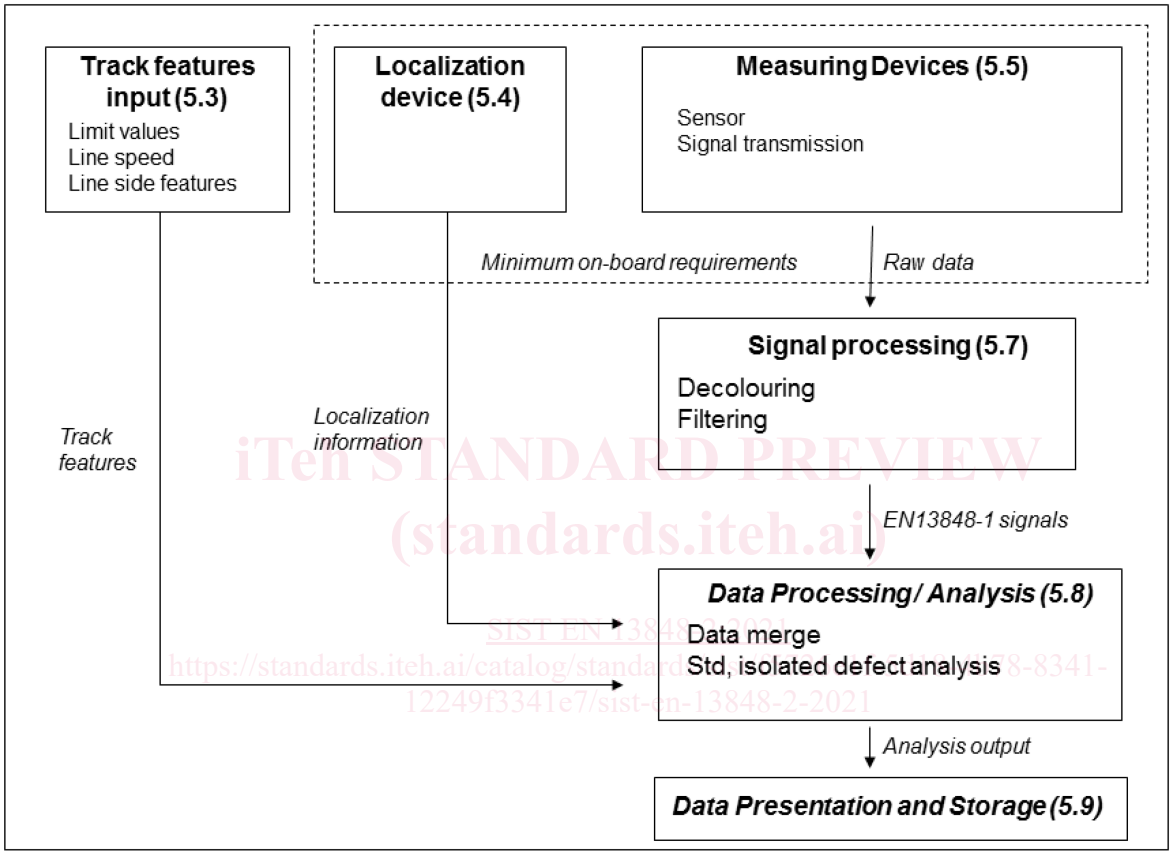

Figure 1 — Track geometry recording system

When measuring the same track, track geometry recording systems shall produce results that are consistent and comparable, irrespective of the measuring speed and direction of travel. These results can be used for track quality monitoring, maintenance planning and safety assurance as related to track geometry.

The track geometry recording system represents the totality of the equipment required to:

— measure track geometry parameters;

— take measurement or information to allow the position to be determined during measuring operations;

— associate these two measurements in order to locate precisely on the track the values exceeding a prescribed threshold or other elements characterizing the track;

- record these parameters on computer readable media;
- calculate, based on the direct measured parameters, other parameters of the track geometry (e.g. twist, curvature);
- process the measured data, in order to analyse the track geometry parameters;
- present and store the results.

The output of the track geometry recording system shall meet the individual parameter requirements of EN 13848-1. All the data necessary to determine the parameters specified in EN 13848-1 shall be taken and stored during the run. The determined parameters should be graphically displayed and analysed in strict relation to the corresponding distance location.

The track geometry recording system shall be monitored and shall allow track geometrical measurements as specified in EN 13848-1 under loaded conditions of the track.

The computer system shall be of a kind and type suitable for railway vehicle bound applications.

To prevent the interruption of the track geometry measurement and the loss of recorded data in case the measuring hardware power supply fails, an adequate uninterruptible power supply should be provided.

5.2 Environmental conditions

5.2.1 Introduction

All the measuring devices and hardware components fitted on a track-recording vehicle shall comply with the environmental conditions specified below.

5.2.2 Climatic conditions

For outside and inside components the following elements shall be respectively considered:

- **Outside components**
  - ambient temperature;
  - condensation, particularly with sudden variation of temperature at the entrance or at the exit of a tunnel;
  - possibility of extreme weather conditions (heavy rain, snow, direct sunlight, …);
  - ambient relative humidity.
- **Inside components**
  - ambient temperature for operating and storage conditions;
  - ambient relative humidity.

5.2.3 Operating conditions

The following elements shall be considered:

- ballast or iron fragments impacts;
- grease on the rail;

— reflection condition of the rail;

— characteristic light conditions;

— dust, water and snow in connection with aerodynamic conditions;

— safety requirements (laser beam, for example);

— vibrations and shocks;

— electromagnetic environment;

— compatibility with signalling and communication systems.

5.3 Track features input

The track features input supports the data analysis (see 5.8) and shall include at least:

— set of limit values of track geometry parameters as defined in EN 13848-5;

— line speed.

Other inputs may be beneficial as, for example:

— geo-spatial positioning;

— line side features such as switches, level crossings, bridges, tunnels;

— track components and track alignment design parameters.

All this data should be able to be entered by manual or automatic means.

5.4 Localization device

The reference point for the data localization system may be the kilometre post or other fixed points.

The localization device gives the track recording vehicle's position along the track and shall fulfil the following functions:

— synchronises the position with the reference point by various methods, using for example the satellite based positioning system, active or passive beacons, track layout or other singular points;

— measures the distance covered by the track recording vehicle, compensated for direction "*reverse*", and is generally based on a synchronisation signal, which could be given by a wheel-mounted encoder or any other equivalent method;

— corrects manually or automatically the inaccuracies caused by:

  — wear, sliding, conicity of the track recording vehicle wheels;

  — difference of kilometre's length;

  — uncertainty of the distance run transducer.

5.5 Measuring devices

5.5.1 General

Track geometry measuring system relies on sensors, signal transmission and signal processing following various measuring principles as described in Annex B.

The speed range shall be from standstill to the maximum permissible measuring speed of the vehicle if a chord-type measuring system is used; if an inertial-type measurement is used, a minimum speed may be necessary to measure some parameters. The minimum speed should be specified according to the characteristics of the used system and the needs defined by the infrastructure manager (e.g. for conventional inertial-type measurement systems usually 10 km/h is necessary for the wavelength range *D1*).

5.5.2 Sensors

The sensors shall measure in real time the track geometry parameters or their components. In order to measure the parameters under track loaded conditions, the sensors placed under the vehicle's frame shall be as close as possible to one of the vehicle's loaded axles to respect measurement conditions indicated in EN 13848-1. The sensors can be either contact type or non-contact type sensors.

The sensors' mechanical and electrical characteristics (frequency response, signal-to-noise ratio, gain, etc.) shall be adequate to enable the generation of track geometry parameters, independently of the environmental conditions on the railway network.

5.5.3 Signal transmission

Signal transmission comprises of all components which are necessary for data interchange between the sensors and the signal processing unit.

It shall at least comply with the following requirements:

— no phase shift;

— no distortion of results data;

— compliance with appropriate industry-accepted data interchange standards.

The transmission characteristics shall be appropriate to the maximum measuring speed of the track recording vehicle and the data volume.

5.6 Resolution

The resolution shall be ≤ 0,1 mm for every measured principal track geometric parameter, as defined in EN 13848-1.

5.7 Signal processing

Signal processing provides the data for some of the track geometry parameters compliant with EN 13848-1 using signals coming from several sensors. The remaining parameters are calculated from the output of the signal processing e.g. twist.

The signal processing shall respect the following points:

— sampling: all measurements shall be sampled at equally spaced intervals of preferably 0,25 m or less but not larger than 0,5 m;

— decolouring: in case of chord measurements the signal shall be decoloured according to EN 13848-1;