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Railway applications — Acoustics — Measurement method for combined roughness, track decay rates and transfer functions

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National foreword

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English Version

Railway applications - Acoustics - Measurement method for combined roughness, track decay rates and transfer functions

Bahnanwendungen - Akustik - Messmethode für kombinierte Rauheit, Gleisabklingraten und Übertragungsfunktionen

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European foreword

This document (CEN/TR 16891:2016) has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN.

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Introduction

This Technical Report provides a basis for a standard on measurement of combined wheel-rail roughness, track decay rates and transfer functions from train pass-bys.

The main items required for a standard are covered but also additional background information and benchmark results are included.

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1 Scope

This method is used to determine combined wheel-rail roughness and track decay rates from rail vibration during the pass-by of a train. By combining sound pressure measurement from the same pass-by, a vibro-acoustic transfer function for rolling noise is determined.

The track decay rate is a vibration quantity that characterizes the attenuation of rail vibration along the track for a given wheel/rail contact excitation, and thereby affects the amount of sound radiation from the track.

Combined roughness is a quantity that determines the level of excitation of wheel-rail rolling noise. It can be determined from vertical rail vibration during a train pass-by and the vertical track decay rate. The transfer function can be used to characterize the vibro-acoustic behaviour of the vehicle-track system for a given roughness excitation and in relation to rolling noise. Combined roughness, track decay rates and transfer functions are determined as one-third octave spectra.

The method can be used for the following purposes:

— to measure track decay rates under operational conditions;

— to characterize the effectiveness of noise control measures in terms of combined roughness, transfer function and track decay rate;

— to compare the combined roughness before and after noise control measures are implemented (thereby quantifying the effect of any change in wheel or rail roughness);

— to monitor wheel roughness during a pass-by, either of whole trains or parts of trains;

— to separate rolling noise from other sources;

— to assess a threshold for the rail roughness by measuring multiple pass-bys.

The method is not for approval of sections of reference track in terms of acoustic rail roughness and track decay rates, which are covered by EN 15610 and EN 15461, respectively.

The method is applicable to trains on conventional tracks, i.e. normal ballasted tracks with wooden or concrete sleepers and on ballastless track systems.

The method has not yet been validated for:

— non-standard wheel types such as small wheels up to 600 mm diameter, resilient tram wheels;

— non-standard track types such as embedded rail or grooved rail;

The method is not applicable to track with rail joints.

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 15461, *Railway applications — Noise emission — Characterisation of the dynamic properties of track sections for pass by noise measurements*

EN 15610, *Railway applications — Noise emission — Rail roughness measurement related to rolling noise generation*

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