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

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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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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

<b>Contents</b>		<b>Page</b>
<b>European foreword</b> .....		<b>4</b>
<b>Introduction</b> .....		<b>5</b>
<b>1</b>	<b>Scope</b> .....	<b>6</b>
<b>2</b>	<b>Normative references</b> .....	<b>6</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>7</b>
<b>4</b>	<b>Symbols and abbreviations</b> .....	<b>8</b>
<b>5</b>	<b>Instrumentation</b> .....	<b>8</b>
<b>6</b>	<b>Installation aspects</b> .....	<b>9</b>
<b>7</b>	<b>Measurement positions</b> .....	<b>9</b>
<b>8</b>	<b>Measured quantities</b> .....	<b>10</b>
<b>9</b>	<b>Test procedure</b> .....	<b>10</b>
<b>10</b>	<b>Data processing</b> .....	<b>10</b>
<b>11</b>	<b>Method to determine the track decay rate from rail vibration</b> .....	<b>11</b>
<b>11.1</b>	<b>General</b> .....	<b>11</b>
<b>11.2</b>	<b>Energy iteration method</b> .....	<b>11</b>
<b>12</b>	<b>Method to determine the combined roughness from vertical railhead vibration</b> .....	<b>18</b>
<b>13</b>	<b>Method to convert roughness from frequency to wavelength domain</b> .....	<b>20</b>
<b>14</b>	<b>Method to determine the rolling noise transfer function</b> .....	<b>22</b>
<b>14.1</b>	<b>Definition</b> .....	<b>22</b>
<b>14.2</b>	<b>Application examples</b> .....	<b>23</b>
<b>15</b>	<b>Test report</b> .....	<b>23</b>
<b>16</b>	<b>Uncertainty and grade</b> .....	<b>23</b>
<b>Annex A (informative) A<sub>2</sub> factor, difference between the combined roughness and the contact point displacement</b> .....		<b>25</b>
<b>Annex B (informative) Benchmark examples and background information</b> .....		<b>28</b>
<b>B.1</b>	<b>General</b> .....	<b>28</b>
<b>B.2</b>	<b>Examples of vertical decay rates determined for several different tracks</b> .....	<b>28</b>
<b>B.3</b>	<b>Comparison with direct measurements</b> .....	<b>29</b>
<b>B.4</b>	<b>Comparison of TDR methods</b> .....	<b>33</b>
<b>B.5</b>	<b>Repeatability</b> .....	<b>35</b>
<b>B.6</b>	<b>Reproducibility</b> .....	<b>38</b>
<b>B.7</b>	<b>Effect of accelerometer position</b> .....	<b>42</b>
<b>B.8</b>	<b>Effect of speed and averaging</b> .....	<b>48</b>
<b>B.9</b>	<b>Effect of wheel defects</b> .....	<b>52</b>

<b>B.10</b>	<b>Effect of temperature .....</b>	<b>52</b>
<b>B.11</b>	<b>Effect of load .....</b>	<b>52</b>
<b>Annex C (informative)</b>	<b>Slope methods.....</b>	<b>53</b>
<b>C.1</b>	<b>Single accelerometer slope method.....</b>	<b>53</b>
<b>C.2</b>	<b>Two accelerometer method.....</b>	<b>54</b>
<b>Bibliography</b>	<b>.....</b>	<b>55</b>

## **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.

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.

## **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.

## 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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