



**International  
Standard**

**ISO 18318**

**Railway applications — Wheel-  
rail contact geometry parameters  
— Definitions and methods for  
evaluation**

*Applications ferroviaires — Paramètres géométriques du contact  
roue-rail — Définitions et méthodes de détermination*

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# Contents

Page

<b>Foreword</b>	<b>v</b>
<b>Introduction</b>	<b>vi</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>1</b>
<b>4 Symbols</b>	<b>2</b>
<b>5 Overview of the process for determining contact parameters</b>	<b>4</b>
<b>6 Description of wheel and rail profiles</b>	<b>4</b>
6.1 General	4
6.2 Uncertainty of the measuring systems	6
<b>7 Plausibility check and processing of measured wheel and rail profiles</b>	<b>6</b>
<b>8 Determining the wheel-rail contact positions and contact functions</b>	<b>7</b>
8.1 General	7
8.2 Determining the rolling radius difference function	8
8.3 Other wheel-rail contact geometry functions	8
<b>9 Determining the equivalent conicity and the related nonlinearity parameter</b>	<b>9</b>
9.1 Background to equivalent conicity	9
9.1.1 Mathematical description of the kinematic lateral wheelset motion	9
9.1.2 Determining the wavelength of a coned wheelset	10
9.2 Determining the equivalent conicity	10
9.3 Determining the nonlinearity parameter	11
<b>10 Determining the rolling radii coefficient</b>	<b>12</b>
10.1 Background and definition	12
10.2 Determining point E for the calculation of the rolling radii coefficient	13
<b>11 Other wheel-rail contact parameters</b>	<b>14</b>
<b>12 Testing of calculation software for contact geometry parameters</b>	<b>14</b>
12.1 Overview	14
12.2 Validation of the calculation algorithms	15
12.3 Assessment of the smoothing process	15
<b>13 Assessment of the complete process for the determination of wheel-rail contact parameters</b>	<b>17</b>
13.1 General	17
13.2 Reproducibility of contact parameter determination based on rail profile measurement	18
13.2.1 Manual rail profile measuring devices	18
13.2.2 Vehicle based rail profile measuring systems	18
13.3 Reproducibility of contact parameter determination based on wheel profile measurement	19
13.3.1 Manual wheel profile measuring devices	19
13.3.2 Ground based wheel profile measuring systems	20
<b>Annex A (informative) Example of presentation of contact geometry functions</b>	<b>21</b>
<b>Annex B (informative) Derivation of the kinematic equation of wheelset motion</b>	<b>22</b>
<b>Annex C (informative) Determination of the lateral peak displacements</b>	<b>24</b>
<b>Annex D (informative) Method for determining the wavelength of the wheelset motion by two-step integration of the nonlinear differential equation</b>	<b>26</b>
<b>Annex E (informative) Method for determining the wavelength of the wheelset motion by direct integration of the nonlinear differential equation</b>	<b>28</b>

## ISO 18318:2026(en)

<b>Annex F (informative) Method for determining the equivalent conicity by linear regression of the <math>\Delta r</math> function</b> .....	<b>29</b>
<b>Annex G (informative) Method for determining linearization parameters by harmonic linearization</b> .....	<b>31</b>
<b>Annex H (informative) Handling of special cases of the <math>\Delta r</math> function</b> .....	<b>33</b>
<b>Annex I (normative) Reference profiles for testing</b> .....	<b>36</b>
<b>Annex J (normative) Calculation results with reference profiles</b> .....	<b>49</b>
<b>Annex K (normative) Tolerances on equivalent conicity for testing calculations</b> .....	<b>83</b>
<b>Annex L (informative) Guidance on wheelset and track geometry parameters</b> .....	<b>104</b>
<b>Bibliography</b> .....	<b>107</b>

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## Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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This document was prepared by the European Committee for Standardization (CEN) (as EN 15302:2021) and was adopted, with corrections and additions by Technical Committee ISO/TC 269, *Railway applications*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

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## Introduction

Wheel-rail contact geometry is fundamental for explaining the dynamic running behaviour of a railway vehicle, as well as the quasi-static behaviour in curves. Among the parameters which influence the dynamic behaviour of a railway vehicle, the equivalent conicity plays an essential role, since it allows a satisfactory characterization of the wheel-rail contact geometry on straight track and in very large radius curves. A wheelset describes a waveform while running on a track. Klingel's theory, valid for massless and rigid wheelsets with conical profiles and pure rolling on rigid rails, states that the waveform is sinusoidal and its wavelength depends on the cone angle of the wheel profile.

Real wheel profiles are not pure cones, but have changing cone angles across the tread, leading to a nonlinear dependency of the rolling radius difference on the lateral movement of the wheelset on the track. The wavelength of the wheelset movement according to the nonlinear kinematic equations of motion can be calculated by solving this formula numerically or by specific methods for linearization of the rolling radius difference function. Equivalent conicity is evaluated by comparison of this wavelength with the equivalent wavelength of a conical wheelset according to Klingel's formula or by calculating the conicity from the linearized rolling radius difference function.

It is important to have a clear specification for the evaluation of wheel-rail contact geometry parameters, which are used in international and national standards and documents (legal and technical).

The objective is to ensure that the results for the determined parameters are consistent. However, it is possible to use different evaluation procedures to those given in this document, provided that the procedure used leads to the determination of wheel-rail contact parameters in accordance with the calculation results using the reference profiles specified in [Annex I](#). A validation process is given in this document to be used in order to determine whether or not an evaluation procedure can achieve the specified reference results.

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# Railway applications — Wheel-rail contact geometry parameters — Definitions and methods for evaluation

## 1 Scope

This document establishes definitions and evaluation methods for the following wheel-rail contact geometry parameters influencing the vehicle running dynamic behaviour:

- the rolling radius difference between the two wheels of a wheelset ( $\Delta r$ -function) which serves as a basis for all further calculations;
- the equivalent conicity function from which are derived:
  - a single equivalent conicity value for a specified amplitude, which is relevant for the assessment of vehicle running stability on straight track and in very large radius curves;
  - the nonlinearity parameter, which characterizes the shape of this function and is related to the vehicle behaviour, particularly in the speed range close to the running stability limit;
- the rolling radii coefficient, which is used to describe the theoretical radial steering capability of a wheelset in a curved track.

Additional information is given about the relationship between the contact angles of the two wheels of a wheelset ( $\Delta \alpha$ -function) and about the roll angle parameter.

NOTE Out of the presented parameters only those related to the contact angle are relevant for independently rotating wheels of wheel pairs.

Descriptions of possible calculation methods are included in this document. Test case calculations are provided to achieve comparable results and to check the proper implementation of the described algorithms.

To validate alternative methods not described in this document, acceptance criteria are given for the equivalent conicity function. This includes reference profiles, profile combinations, tolerances and reference results with tolerance limits.

This document also includes minimum requirements for the measurement of wheel and rail profiles as well as of the parameters needed for the transformation into a common coordinate system of right-hand and left-hand profiles.

This document does not define limits for the wheel-rail contact geometry parameters and gives no tolerances for the rail profile and the wheel profile to achieve acceptable results.

For the application of this document some general recommendations are given.

## 2 Normative references

There are no normative references in this document.

## 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:

- ISO Online browsing platform: available at <http://www.iso.org/obp>