



**International  
Standard**

**ISO 23373**

**Heavy commercial vehicles  
and buses — Vehicle dynamics  
simulation and validation — Tyre  
model for lateral estimation  
of heavy vehicle combinations  
operated at dry paved road surface**

*Véhicules utilitaires lourds et bus — Simulation et validation de  
la dynamique du véhicule — Modèle de pneu pour l'estimation  
latérale des combinaisons de véhicules lourds exploités sur une  
surface de route pavée sèche*

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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 33, *Vehicle dynamics, chassis components and driving automation systems testing*.

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).

## Introduction

This document describes a generic tyre model intended for lateral stability performance estimations of commercial vehicle combinations operated at dry paved road surface.

Even though the recommended use is limited to moderate excitation levels, non-linear components of truck tyres are included to not underestimate risk levels, especially when it comes to loads with high centres of gravity. Hence the standard model calculates the lateral force from vertical force and slip angle input with a non-linear formula.

The tyre model in this document is inspired by a trigonometric formula for calculating steady-state lateral or longitudinal force under pure slip conditions, often referred to as the Magic Formula. This formula was introduced by HB Pacejka and colleagues in the 1980s.

The standard tyre model is however less complex compared to many tyre models based on the Magic Formula, for example, by neglecting the influence of camber inclination, asymmetry and combined longitudinal slip and sideslip. There are five characterizing parameters in the tyre model that describe the steady state properties of the tyre, and two parameters that describe its transient properties.



# Heavy commercial vehicles and buses — Vehicle dynamics simulation and validation — Tyre model for lateral estimation of heavy vehicle combinations operated at dry paved road surface

## 1 Scope

This document specifies a generic tyre model and model parameters for calculating lateral tyre forces, for use in lateral stability simulations of heavy commercial vehicle combinations with test cases according to ISO 14791. This tyre model is parameterized by easily understandable characteristics which can be estimated from tyre measurement data. If tyre data is not available, the parameters proposed in this document can be used.

One typical application area of this document is the comparing and ranking of various vehicle combination configurations with respect to on-road lateral and roll stability. Such an assessment is usually performed at close to constant speed levels typical for public roads, usually higher than 40 km/h. The tyre model, however, can be useful for both high- and low-speed manoeuvring.

This tyre model is relevant for representing the lateral performance of tyres on a vehicle combination when the longitudinal forces are insignificant, typically less than 10 % of the peak longitudinal friction utilization. The tyre model can be used for normal forces ranging from zero to twice the nominal normal force of the tyre. This tyre model has been developed for moderate lateral slip conditions; it is important that the model is used with care for scenarios where tyre slip angle exceeds 15°.

This tyre model is suitable for vehicle models operating in the yaw and roll plane which naturally include vertical load transfer between the wheels during manoeuvring. The tyre model can also be used in models with less complexity such as pure yaw plane models.

This document applies to heavy vehicles, including commercial vehicles, commercial vehicle combinations, buses and articulated buses as defined in ISO 3833 (trucks and trailers with a maximum weight above 3,5 tonnes and buses and articulated buses with a maximum weight above 5 tonnes, according to ECE and EC vehicle classification, categories M3, N2, N3, O3 and O4).

## 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.

ISO 3833, *Road vehicles — Types — Terms and definitions*

ISO 8855, *Road vehicles — Vehicle dynamics and road-holding ability — Vocabulary*

ISO 15037-2, *Road vehicles — Vehicle dynamics test methods — Part 2: General conditions for heavy vehicles and buses*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3833, ISO 8855, ISO 15037-2 and the following apply.