

# SVENSK STANDARD

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### **Järnvägar – Metoder för beräkning av stoppsträcka och nedbromsningssträcka, samt hållbroms och parkeringsbroms – Del 6: Gradvisa beräkningar för tågset eller enkelfordon**

### **Railway applications – Methods for calculation of stopping and slowing distances and immobilization braking – Part 6: Step by step calculations for train sets or single vehicles**

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EUROPEAN STANDARD  
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**EN 14531-6**

May 2009

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English Version

## Railway applications - Methods for calculation of stopping and slowing distances and immobilisation braking - Part 6: Step by step calculations for train sets or single vehicles

Applications ferroviaires - Méthodes de calcul des distances d'arrêt, de ralentissement et d'immobilisation - Partie 6: Calculs pas à pas pour des compositions de trains ou véhicules isolés

Bahnanwendungen - Verfahren zur Berechnung der Anhalte- und Verzögerungsbremswege und der Feststellbremsung - Teil 6: Schrittweise Berechnungen für Zugverbände oder Einzelfahrzeuge

This European Standard was approved by CEN on 23 April 2009.

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<b>Contents</b>	<b>Page</b>
<b>Foreword</b> .....	<b>4</b>
<b>Introduction</b> .....	<b>5</b>
<b>1 Scope</b> .....	<b>6</b>
<b>2 Normative references</b> .....	<b>6</b>
<b>3 Definitions, symbols and abbreviations</b> .....	<b>6</b>
<b>3.1 Terms and definitions</b> .....	<b>6</b>
<b>3.2 Symbols and indices</b> .....	<b>7</b>
<b>4 General algorithms</b> .....	<b>10</b>
<b>4.1 General algorithm to calculate stopping and slowing distances</b> .....	<b>10</b>
<b>4.2 General algorithm to calculate immobilization brake</b> .....	<b>10</b>
<b>5 Stopping and slowing distances calculation</b> .....	<b>10</b>
<b>5.1 Accuracy of input values</b> .....	<b>10</b>
<b>5.2 General characteristics</b> .....	<b>10</b>
<b>5.3 Brake equipment characteristics</b> .....	<b>12</b>
<b>5.4 Initial and operating characteristics</b> .....	<b>23</b>
<b>5.5 Sharing, proportioning of the brake forces - achieved forces</b> .....	<b>25</b>
<b>5.6 Braking force per axle</b> .....	<b>25</b>
<b>5.7 Total force on train level</b> .....	<b>25</b>
<b>5.8 Time step integration loop</b> .....	<b>26</b>
<b>5.9 Other decelerations</b> .....	<b>26</b>
<b>5.10 Time</b> .....	<b>27</b>
<b>5.11 Distance calculations</b> .....	<b>28</b>
<b>5.12 Other calculations</b> .....	<b>29</b>
<b>6 Immobilization brake calculation</b> .....	<b>31</b>
<b>6.1 General</b> .....	<b>31</b>
<b>6.2 General characteristics</b> .....	<b>32</b>
<b>6.3 Characteristics of the immobilization brake equipment</b> .....	<b>32</b>
<b>6.4 Train and operating characteristics</b> .....	<b>32</b>
<b>6.5 Immobilization force provided by each equipment type</b> .....	<b>33</b>
<b>6.6 Immobilization force</b> .....	<b>33</b>
<b>6.7 External forces</b> .....	<b>34</b>
<b>6.8 Final results</b> .....	<b>35</b>
<b>Annex A (normative) Workflow of kinetic and static calculations</b> .....	<b>37</b>
<b>Annex B (informative) Example of time step integration loop</b> .....	<b>40</b>
<b>Annex C (informative) Example of distance and other dynamic calculations</b> .....	<b>41</b>
<b>C.1 Input data</b> .....	<b>41</b>
<b>C.1.1 Mass data</b> .....	<b>41</b>
<b>C.1.2 Wheel data</b> .....	<b>42</b>
<b>C.1.3 Train resistance</b> .....	<b>42</b>
<b>C.1.4 Data for brake equipment types</b> .....	<b>42</b>
<b>C.1.5 Characteristics and settings of the brake equipment</b> .....	<b>44</b>
<b>C.1.6 Initial and final speed</b> .....	<b>44</b>
<b>C.1.7 Gradient</b> .....	<b>44</b>
<b>C.2 Calculation results</b> .....	<b>45</b>
<b>C.2.1 Braking force of single equipments and train resistance</b> .....	<b>45</b>
<b>C.2.2 Total braking force per equipment type and train resistance</b> .....	<b>46</b>
<b>C.2.3 Distances</b> .....	<b>46</b>

<b>C.2.4</b>	<b>Stopping time .....</b>	<b>47</b>
<b>C.2.5</b>	<b>Equivalent response time .....</b>	<b>47</b>
<b>C.2.6</b>	<b>Equivalent deceleration.....</b>	<b>47</b>
<b>C.2.7</b>	<b>Decelerations.....</b>	<b>47</b>
<b>C.2.8</b>	<b>Required adhesion.....</b>	<b>48</b>
<b>Annex D</b>	<b>(informative) Example of immobilisation calculations.....</b>	<b>50</b>
<b>D.1</b>	<b>Input data .....</b>	<b>50</b>
<b>D.1.1</b>	<b>Mass data .....</b>	<b>50</b>
<b>D.1.2</b>	<b>Wheel data .....</b>	<b>51</b>
<b>D.1.3</b>	<b>Train resistance.....</b>	<b>51</b>
<b>D.1.4</b>	<b>Wind force on the train.....</b>	<b>51</b>
<b>D.1.5</b>	<b>Data for axle related disc brake equipment .....</b>	<b>51</b>
<b>D.1.6</b>	<b>Gradient .....</b>	<b>52</b>
<b>D.1.7</b>	<b>Available adhesion.....</b>	<b>52</b>
<b>D.1.8</b>	<b>Brake equipment in use.....</b>	<b>52</b>
<b>D.2</b>	<b>Calculation results of the immobilisation calculation.....</b>	<b>52</b>
<b>D.2.1</b>	<b>Immobilisation force .....</b>	<b>52</b>
<b>D.2.2</b>	<b>Immobilisation safety factor .....</b>	<b>53</b>
<b>D.2.3</b>	<b>Required adhesion per axle .....</b>	<b>53</b>
<b>D.2.4</b>	<b>Maximum achievable gradient.....</b>	<b>53</b>
<b>Annex ZA</b>	<b>(informative) Relationship between this European Standard and the Essential Requirements of EC Directive 2008/27/EC .....</b>	<b>54</b>
<b>Bibliography</b>	<b>.....</b>	<b>57</b>

## Foreword

This document (EN 14531-6:2009) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2009, and conflicting national standards shall be withdrawn at the latest by November 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This Standard<sup>1</sup> is one in a series of six, under the generic title EN 14531, Railway applications — Methods for calculation of stopping distances, slowing distances and immobilization braking. The other five are:

*Part 1: General algorithms;*

*Part 2: Application to Single Freight Wagon (in preparation);*

*Part 3: Application to mass transit (in preparation);*

*Part 4: Single passenger coaches (in preparation);*

*Part 5: Locomotives (in preparation).*

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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<sup>1</sup> Although it was originally intended to prepare a series of six parts for this Standard, the intention is now to rationalize and restructure the Standard so that it comprises fewer parts.



## **Introduction**

The objective of this European Standard is to enable the railway industries and operators to work with a common calculation method.

It describes the adapted algorithms and step-by-step calculations for the design of brake equipment for all types of train sets, electrical multiple units, diesel multiple units and single vehicles.

## 1 Scope

This European Standard describes a general algorithm that may be used in all types of high speed and conventional vehicle applications, including self-propelling thermal or electric trains, thermal or electric traction units; passenger carriages, mobile railway infrastructure construction and maintenance equipment and freight wagons. This standard does not specify the performance requirements. It enables the calculation of the various aspects of the performance: stopping or slowing distances, dissipated energy, force calculations and immobilization braking.

This standard enables the verification by calculation of the stopping, slowing and immobilization performance requirements for high speed and conventional trains operating on high speed and conventional infrastructure.

Other calculation methods may be used providing that the order of accuracy achieved is in accordance with this European Standard.

This standard presents:

- a) example of distance and other dynamic calculations, see Annex C;
- b) example of immobilisation calculations, see Annex D.

## 2 Normative references

The following referenced documents are indispensable for the application 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 14478:2005, *Railway applications — Braking — Generic vocabulary*

EN 14531-1:2005, *Railway applications — Methods for calculation of stopping distances, slowing distances and immobilization braking — Part 1: General algorithms*

prEN 15328, *Railway applications - Braking - Brake pads*<sup>2</sup>

ISO 80000-3:2006, *Quantities and units — Part 3: Space and time*

ISO 80000-4:2006, *Quantities and units — Part 4: Mechanics*

## 3 Definitions, symbols and abbreviations

### 3.1 Terms and definitions

For the purposes of this document, the definitions given in EN 14478:2005, EN 14531-1:2005, ISO 80000-3:2006, ISO 80000-4:2006, and the following apply.

#### 3.1.1

##### **static mass per axle**

(1) mass, measured by weighing at the wheel-rail interface, or estimated from design evaluation of each axle in a stationary condition

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<sup>2</sup> At the time of publication, this Standard was in the process of being prepared.

(2) mass of the train divided by the quantity of axles in case where the static mass per axle is not known

### **3.1.2**

#### **static mass of the train**

summation of all the static mass per axle values, including all operating loads

### **3.1.3**

#### **brake equipment type**

group of equipment the purpose of which is to provide braking force

### **3.1.4**

#### **isolated brake equipment**

status of inoperable brakes on e.g. bogie (see EN 14478)

### **3.1.5**

#### **active brake equipment**

equipment considered during the calculation of a specific type of braking (in opposition with isolation) (see EN 14478)

### **3.1.6**

#### **step by step calculation**

numerical method with finite time steps

NOTE    Synonym for a numerical type of solving an integral.

## **3.2 Symbols and indices**

For the purposes of this document, the general symbols given in Table 1 and indices given in Table 2 apply.

NOTE    Specific symbols and indices are defined in the relevant clauses.