
**Mechanical vibration — Ground-
borne noise and vibration arising
from rail systems —**

Part 32:
**Measurement of dynamic properties
of the ground**

*Vibrations mécaniques — Vibrations et bruits initiés au sol dus à des
lignes ferroviaires —*

Partie 32: Mesurage des propriétés dynamiques du sol



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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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 2, *Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures*.

ISO 14837 consists of the following parts, under the general title *Mechanical vibration — Ground-borne noise and vibration arising from rail systems*:

- *Part 1: General guidance*
- *Part 32: Measurement of dynamic properties of the ground*

The following parts are under preparation:

- *Part 31: Measurement for the evaluation of complaints at residential buildings*

Introduction

In order to resolve received vibration and noise from rail systems where there is soil or rock in part of the transmission path between the source at the track and the receiver location in the building, it is necessary to know the noise and vibration transmission function of the ground. To know this necessitates knowledge of the properties of the materials in the ground and their stratification which influence the transmission. In general there is a need to measure or in other ways to estimate these properties. To this aim, this part of ISO 14837 defines methods for measurement and estimation of the relevant dynamic ground parameters.

After a brief survey about ground-borne noise and vibration in [Clause 4](#), the key content of this part of ISO 14837 is outlined in two clauses. [Clause 5](#) defines the relevant dynamic ground parameters, describes how they are interrelated and how they are related to basic physics of wave propagation. [Clause 6](#) deals with methods to determine these parameters: [6.3](#) presents simple estimation methods based on empirical correlations with conventional geotechnical and engineering geological index parameters; [6.4](#) presents methods for indirect determination from geotechnical in-situ penetration test data, while [6.5](#) and [6.6](#) present more precise methods for direct measurement of the parameters in-situ and in the laboratory.

Mechanical vibration — Ground-borne noise and vibration arising from rail systems —

Part 32: Measurement of dynamic properties of the ground

1 Scope

This part of ISO 14837 provides guidance and defines methods for the measurement of dynamic properties of the ground through which ground-borne noise and vibration is transmitted, from the operation of rail systems and into foundations of neighbouring buildings. The purpose is to determine the parameters of the ground system which are necessary to reliably predict the noise and vibration transmission, to design railroads and foundations to meet noise and vibration requirements, to design countermeasures and to validate design methods.

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.

ISO 14837-1:2005, *Mechanical vibration — Ground-borne noise and vibration arising from rail systems — Part 1: General guidance*

3 Symbols

The following symbols are used in this part of ISO 14837.

NOTE Abbreviations are summarized in [Annex A](#).

B	dimensionless constant in equation for $G_{\max}$
D	loss-related distance attenuation factor
d	distance travelled by wave
$E_{\max}$	Young's modulus, low-strain dynamic value
e	void ratio, $e = \varphi / (1 - \varphi)$
f	frequency
G^*	complex shear modulus
$G_{\max}$	shear modulus, low-strain dynamic value
G_{sec}	secant shear modulus, dynamic value
I_p	plasticity index
$K_{\max}$	bulk modulus, low-strain dynamic value
k^*	complex wave number