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

Part 1:
General guidance

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

Partie 1: Directives générales



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 14837-1 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, 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*

The following parts are under preparation:

— *Part 2: Prediction models*

— *Part 3: Measurement*

— *Part 4: Evaluation criteria*

— *Part 5: Mitigation*

— *Part 6: Asset management*

Introduction

Many if not all ground transportation systems can give rise to ground-borne vibration and/or ground-borne noise. Railways are by far the most common and significant source as a consequence of running steel wheels over steel rail.

Rail systems of all types generate ground-borne vibration and/or ground-borne noise, which (especially in urban settings) can have an undesirable environmental impact. An assessment of the likely ground vibration and response of structures at different distances from the source may be required. This requirement may arise for planning purposes where

- a) a new or extended railway or new or altered buildings are proposed,
- b) changes in dynamic characteristics of track or dynamic characteristics of trains are proposed,
- c) a change in train operations is proposed (e.g. change of total length, speed, service pattern), or
- d) assistance is needed in the evaluation of vibration mitigation measures.

Appropriate prediction of ground-borne vibration and/or ground-borne noise is the first of the two essential blocks required to assess vibration effects of new or modified rail systems on existing buildings, or the effects on new buildings next to or over existing rail systems. Ground-borne vibration and/or ground-borne noise criteria (and/or limit values) in the receiving building are the second block of any assessment. Criteria and limit values, however, are covered by national standards and other International Standards.

Prediction of ground-borne vibration and/or ground-borne noise from rail systems is a complex and developing technical field. This part of ISO 14837 provides guidelines on the essential considerations associated with developing prediction models to ensure that they are "fit for purpose" and that they are consistent in their approach.

Guidance is given on calibrating and validating a model and verifying its implementation, which are vital steps in quantifying and improving the model's accuracy.

Table 1 shows in outline the stages to be observed for new or modified rail systems or building developments alongside rail systems. This part of ISO 14837 provides general introduction and guidance. Detailed matters will be covered in future parts, the titles of which are given in the Foreword.

Table 1 — Outline of stages and the appropriate parts of ISO 14837

<p>1. Approach dependent upon: New build, refurbishment or adjacent development (Part 1) Design stage (concept, preliminary, detail) (Part 1)</p>
<p>2. Evaluation criteria Use national standards and/or Part 4 Define assessment location(s) and metric(s)</p>
<p>3. Parameters affecting situation Identify relevant parameters (check list in Part 1) Gather parameter data</p>
<p>4. Measurements Acquire site-specific information using metric(s) defined by criteria (Part 3 and Part 4) Evaluation of model parameters Develop and or validate prediction model Evaluate mitigation performance</p>
<p>5. Predictions Use metric defined by criteria (Part 4) Use appropriate model in the design stage (Part 1 and Part 2) Ensure validation and define accuracy (Part 1)</p>
<p>6. Assessment Compare predictions against criteria Identify reason(s) for exceeding criteria</p>
<p>7. Mitigation Identify mitigation options (Part 1, Part 5 and Part 6) Assess whether mitigation options are reasonably practicable Carry out cost/benefit analysis</p>
<p>8. Solution Develop detail design Implement solution</p>
<p>9. Asset management Implement a programme of condition monitoring and maintenance to observe criteria (Part 5, Part 6)</p>

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

Part 1: General guidance

1 Scope

This part of ISO 14837 provides general guidance on ground-borne vibration generated by the operation of rail systems, and the resultant ground-borne noise in buildings.

It lists the factors and parameters that need to be taken into consideration and offers guidance on prediction methods appropriate for a range of circumstances (e.g. to support the assessment of effects on human occupants and sensitive equipment or operations inside the buildings in addition to the predictions required to assess the risk of damage to building structures).

Attention is paid in this part of ISO 14837 to

- characteristics of the source: emission (e.g. train, wheel, rail, track, supporting infrastructure),
- propagation path: transmission (e.g. ground condition, distance), and
- receiving structures: immission: (e.g. foundations, form of building construction).

The guidance covers all forms of wheel and rail systems, from light-rail to high-speed trains and freight. This part of ISO 14837 provides guidance for rail systems at-grade, on elevated structures and in tunnels.

This part of ISO 14837 does not deal with vibration arising from the construction and maintenance of the rail system. It does not deal with airborne noise. Structure-radiated noise from elevated structures, which can have a significant environmental impact, is also excluded.

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.

ISO 2041, *Vibration and shock — Vocabulary*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 2041 apply, together with the following.

3.1

ground-borne vibration

vibration generated from the pass-by of vehicle on rail, propagated through the ground or structure into a receiving building