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Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 37194

Smart community infrastructures — Disaster risk reduction — Guidance for the process of selecting seismometer systems suitable for specific purposes

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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).

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

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.

Introduction

Earthquakes are one of the most devastating natural hazards. To achieve the goal set by the Sendai Framework for Disaster Risk Reduction 2015–2030^[19], it is necessary for relevant stakeholders in communities to prevent and reduce damage caused by earthquakes and maintain the level of services and quality of life in the community after an earthquake. Effective use of seismometer systems contributes to these objectives by enabling better informed emergency responses and helping organizations develop and implement business continuity plans, and mitigating earthquake risk through improved seismic design regulations for new buildings and for seismic rehabilitation of existing buildings.

ISO 37174 classifies the methods of implementing seismic disaster risk reduction using seismometer systems in smart community infrastructures into several categories according to their purpose. The clarification of categories will enable all stakeholders involved in the implementation of seismometer systems for various types of disaster risk reduction actions to systematically understand their purpose and what each category of seismometer system can achieve.

However, it has not been easy to confirm that a target seismometer system is indeed a product that can fulfil the purposes of the 11 categories and 1 subcategory of ISO 37174. As the functions and performance standards differ for each category of seismometer system, a simple comparison is not sufficient to determine if the system meets the intended needs of the system implementer.

This document helps implementers of seismometer systems to understand the recommended performance parameters and specify the purpose of disaster risk reduction to suppliers based on the classification in ISO 37174 by providing the examples of performance parameters that a seismometer system in accordance with ISO 37174 is recommended to have in order to achieve its purpose. It also provides a process for suppliers of seismometer systems to classify which of the ISO 37174 categories their seismometer systems fall into. It is expected that this document will facilitate communication between system implementers and suppliers of seismometer systems, reduce discrepancies between the systems required by system implementers and those provided by suppliers, help protect the communities from disasters through the effective use of resources based on scientific data and observations, and enable the implementation and supply of appropriate seismometer systems that achieve the purposes of disaster risk reduction.

The system implementers specified in this standard are public agencies and research institutes that select and make decisions on the adoption of seismometer systems to mitigate seismic related disasters, businesses that manage and operate critical infrastructure, and private companies including SMEs. The suppliers are research institutes and private companies, including SMEs, that manufacture or sell seismometer systems.

By implementing in advance appropriate seismometer systems in smart community infrastructures, the communities can address various risks associated with earthquakes by assessing the situation in the event of an earthquake and providing an appropriate response, to reduce or even avoid secondary disasters. The communities can also prepare in advance for the various risks associated with earthquakes and respond when a disaster occurs.

Smart community infrastructures — Disaster risk reduction — Guidance for the process of selecting seismometer systems suitable for specific purposes

1 Scope

This document provides guidance on how to select seismometer systems as a part of smart community infrastructures for disaster risk reduction. It enables planners, developers and community operators to determine if the intended purposes are achieved by seismometer systems through examples of the selection and use of seismometer systems based on the categories defined in ISO 37174.

In this document, a seismometer system refers to a combination of a sensor unit that measures vibrations caused by earthquakes and a processing unit that records the measured data and outputs the results in some form, and does not include a network or management application that communicates the information.

Furthermore, the categories of seismometer systems described in ISO 37174 correspond to their purpose for disaster risk reduction of earthquakes. This will help reduce mismatches between the systems required by implementers and the systems supplied by suppliers so that the suppliers can provide seismometer systems which meet the disaster risk reduction (DRR) objectives that the implementers wish to achieve.

NOTE This document does not provide guidance for organisations conducting seismic observations with well-defined specifications that have been proven in the past. For organisations conducting observations of global environmental parameters such as meteorological changes, volcanic activity and seismic activity, specifications and guidelines can be provided by governments, regulators and observing authorities for observing systems with clearly defined specifications.

2 Normative references

The following documents are referred to in the text in such a way that some or all 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 37174, *Smart community infrastructures — Disaster risk reduction — Guidance for implementing seismometer systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 earthquake focus

point inside the Earth where an earthquake originates, the fault rupture starts and the seismic waves are generated

3.2

seismic intensity

measure of the effects of an earthquake at a specific location

Note 1 to entry: Seismic intensity scales vary from country to country.

Note 2 to entry: Seismic intensity is directly related to the severity of ground shaking and depends on the characteristics of the built environment at that specific location. It can be estimated from direct observations or from seismic ground motion records.

3.3

disaster

situation where widespread human, material, economic or environmental losses have occurred that exceeded the ability of the affected organization, community or society to respond and recover using its own resources

[SOURCE: ISO 22300:2021, 3.1.73]

4 Performance of seismometer systems

4.1 General

The system implementers in this standard refer to:

- public agencies and research institutes responsible for selecting and making decisions on the adoption of seismometer systems for disaster risk reduction;
- public and private operators engaged in the management and operation of social infrastructure.

The suppliers in this document refer to organizations that supply or manufacture seismometer systems, such as:

- research institutes;
- private companies.

When selecting a seismometer system for specific purposes to reduce disaster risk, both the system implementer and supplier should be aware of the categories of seismometer systems based on the purpose of use. ISO 37174 provides categorization of the purposes for using seismometer systems.

When procuring seismometer systems, it is required to have specialized knowledge (e.g. structural engineering, vibration engineering) to understand whether the proposed seismometer system has adequate performance and function that meet the purpose of use defined in the procurement specifications. During the review of the proposed seismometer system, implementers should ensure if the effectiveness of the seismometer system to reduce disaster risk is sufficient to achieve the purpose of preventing disaster and reducing disaster risk. When system implementers do not have seismometer systems specialists to advise them, there is a possibility that the installed system will not match what was originally planned, and the disaster prevention and mitigation benefits of the seismometer system will not be realized.

By clarifying the minimum performance requirements for each category, it will be possible to select appropriate seismometer systems with higher accuracy even without specialized knowledge at the initial stage of implementation. It will also help to determine which categories the proposed seismometer systems best fit into by describing multiple categories in a comparable form in this document. Additionally, it is anticipated that this approach will empower system implementers to conduct a preliminary check for missing functions when considering the expansion of an already installed seismometer system to another disaster risk reduction category.

The identification of key performance parameters for each category is not intended to limit the performance of seismometer systems in that category, but rather to assist in the development of new products in the future.

4.2 Process for adoption of seismometer systems

When adopting a seismometer system, the system implementer should first decide the purpose of implementation, and then, the system implementer and the supplier should share their understanding of the purpose of implementing seismometer systems to reduce disaster risk.

To share their understanding of the purpose of implementing seismometer systems, the system implementer should specify one or multiple categories of purpose of use defined by ISO 37174, where the applications of seismometer systems are categorized based on the user's purpose and intended contributions to disaster risk reduction. This will enable both the system implementer and the supplier to share the purpose of implementing seismometer systems, thereby reducing and avoiding mismatches at the time of installation.

To ensure that the system implementer adopts a seismometer system for the application that meets the purpose, they should define the required performance characteristics necessary to achieve the purpose in the procurement specifications for the seismometer system. The supplier should:

- provide accurate information to the system implementer on which category defined by ISO 37174 the seismometer system it supplies corresponds to;
- be fully aware of the purposes of disaster risk reduction other than those met by the seismometer system it supplies, and ensure they present a seismometer system in the appropriate category.

Note There is no seismometer system that satisfies all categories.

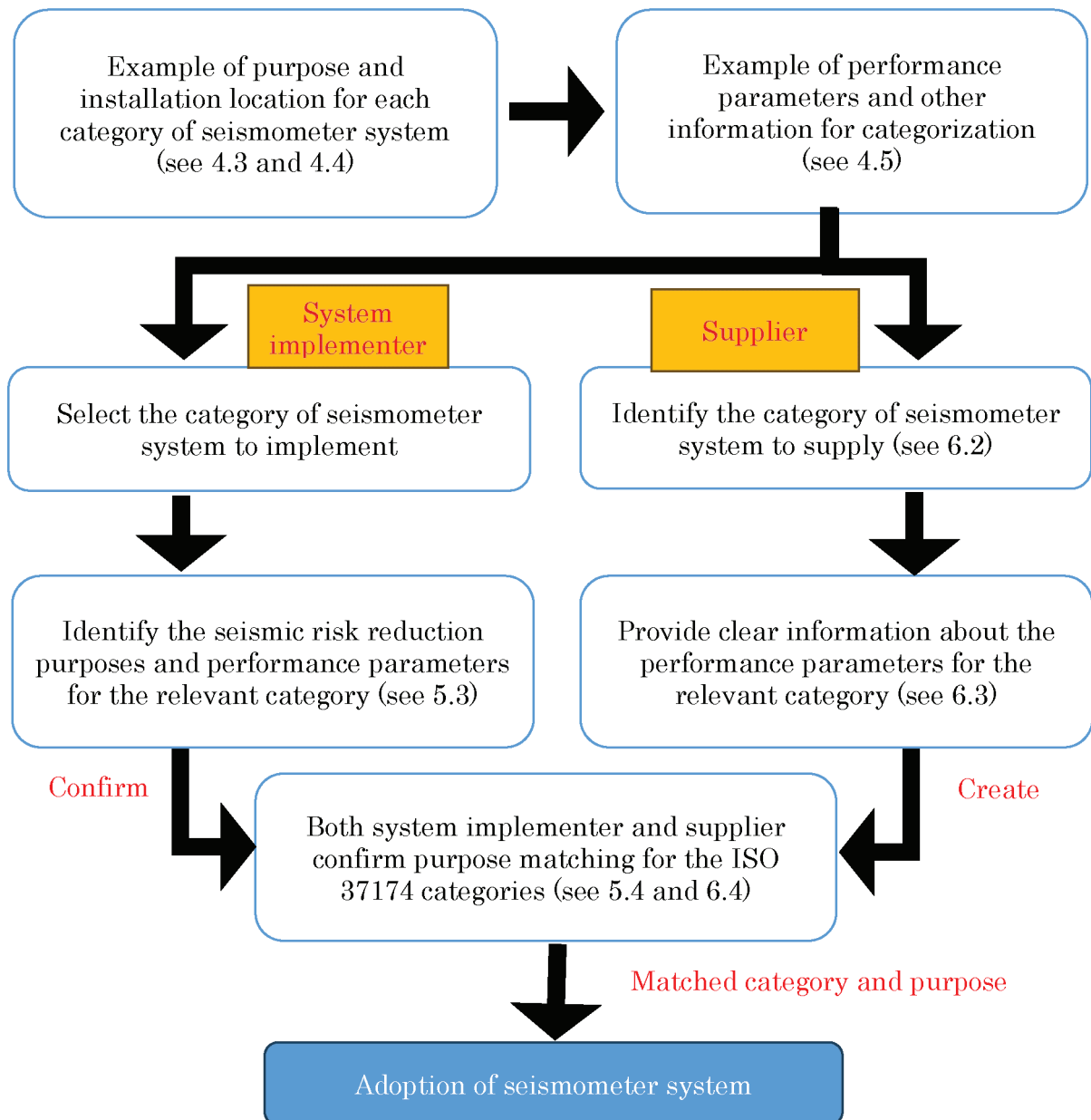


Figure 1 — Example of process for adoption of seismometer system

4.3 Purpose of use, method and location of installation, and additional equipment for seismometer systems

To assist system implementers and suppliers to make better informed choices of seismometer systems based on categorizations of their purpose of use, this document describes examples of purposes for each category. Seismometers should be installed with good coupling in non-seismic noise environments to maintain measurement accuracy.

a) Hazardous area survey (Category A)

Seismometer systems in category A are:

- used to identify hazardous areas that are expected to be damaged in the event of an earthquake, with geological and geomorphological information derived from data collected in advance;

- expected to be adopted by stakeholders such as researchers, academia and engineers to identify hazardous areas based on geological conditions and other factors as a precautionary measure;
- often used to aggregate seismic ground motion information from multiple locations, and both permanent and temporary seismometer systems can be used. When seismometer systems are permanently installed, they are installed on the ground surface or underground.

NOTE 1 For more information on geotechnical monitoring by field instrumentation, see ISO 18674-1.

b) Volcanic tremor survey (Category B)

Seismometer systems in category B:

- monitor and record micro-seismic and seismic ground motions in volcanic regions as signs of future volcanic eruptions;
- are expected to be adopted by research institutes, survey organizations, and academic institutions to observe seismic ground vibrations before volcanic eruptions occur, and to issue local and regional evacuation alarms/warnings/orders to reduce volcanic disaster risk;
- are permanently installed at one or more points on each volcano to monitor ground vibration;
- can observe micro-vibrations with a high degree of accuracy and need to operate under high temperatures if installed underground.

c) Micro-seismic motion monitoring (Category C)

Seismometer systems in category C:

- aggregate information on vibrations in the ground caused by distant earthquakes as well as local small earthquakes and other events occurring on the Earth, and record that information.
- are expected to be adopted by research institutes and survey organizations to provide a variety of information both before and after an earthquake to reduce disaster risk.
- can be used to collect ground vibration data from multiple sites and are connected to a network to calculate the focus, epicentre and magnitude of earthquakes that occur far away.

NOTE 2 For more information on measuring vibrations and evaluating their effects on structures, see ISO 4866.

NOTE 3 For more information on array measurement of microtremors, see ISO 24057.

d) National disaster management (Category D)

Seismometer systems in category D:

- collect seismic motion information at regional and/or country level after an earthquake and map seismic intensity as data to preliminarily evaluate seismic disaster effects and to allow efficient management of post-earthquake interventions;
- are expected to be adopted by various government agencies and used to grasp the situation when implementing measures for recovery after the occurrence of an earthquake;
- are permanently installed at many observation points and connected to a network to collect ground vibration information;
- can also be used as seismometer systems in Category F by enhancing the network's quick response capability;
- can also be used as seismometer systems in Category A to provide data for seismic hazard studies and seismic hazard zonation.

NOTE 4 For more information on instrumentation for national seismic systems, see Reference [20].

e) Local disaster management (Category E)

Seismometer systems in category E:

- collect vibration information from multiple points in a specific area during an earthquake to determine the seismic situation;
- are expected to be adopted by local government and private operators that provide public infrastructure services, and used to check damage after an earthquake;
- are often used to collect vibration information from multiple locations within an area controlled by the employing organization;
- are permanently installed and used;
- can be used as seismometer systems in Category G for individual facilities.

f) Wide-area earthquake warning (Category F)

Seismometer systems in category F:

- are used to issue evacuation alerts, etc. for a wide area based on information from detected earthquakes;
- are expected to be adopted by various government agencies and private companies with large facilities;
- are used to call for immediate evacuation in the event of an earthquake;
- are used to issue alerts over a wide area using seismic detection information from either a single point or multiple points;
- are, in most cases, permanently installed on the ground, and can be connected to a network or to a speaker that broadcasts alerts and other information.

NOTE 5 For more information on the implementation of a community-based disaster early warning system, see ISO 22328-1.

g) Earthquake evacuation warning (Category G)

Seismometer systems in category G:

- use information from detected earthquakes to issue evacuation alerts, etc. to specific facilities;
- are expected to be adopted by institutions and private companies operating public infrastructure and facilities, and to be used for immediate evacuation in the event of an earthquake;
- use seismic detection information from a single point to issue alerts for evacuation, etc. to target facilities;
- are permanently installed and used;
- should be equipped with an external connection that is linked to a speaker, or with its own speaker function to enable alerts to be issued.

h) Emergency stoppage in the event of an earthquake (Category H)

Seismometer systems in category H:

- are used to issue earthquake alerts and other information to individual devices and infrastructure equipment based on information from detected earthquakes;
- are expected to be adopted for immediate response to earthquakes by institutions and private companies that operate machinery and equipment that need to stop operation in the event of an earthquake;
- use seismic detection information from a single point to issue an earthquake alert to the target facility;
- are permanently installed and used;

- should have an external connection that can be electrically interlocked with the target facility to enable alerts to be issued.

i) Structural damage survey (Category I)

Seismometer systems in category I:

- use information from measured seismic vibrations to determine the overall structural condition of a particular facility;
- monitor mainly the vibration of buildings and other structures in response to earthquakes;
- are expected to be adopted by institutions and private companies that operate public infrastructure and facilities, and to be used to check the condition of the target facilities before and after an earthquake;
- operate using vibration information from multiple locations for a single facility;
- are permanently installed and used;
- should be equipped with some kind of connection between the seismometer systems to provide accurate synchronization for analysis because, in most cases, they use vibration information from multiple installed locations.

NOTE 6 For more information on performance parameters for condition monitoring of structures, see ISO 16587.

j) Structural deterioration survey (Category J)

Seismometer systems in category J:

- use information such as environmental vibrations, including earthquakes, to determine the overall structural condition of a particular facility;
- monitor mainly the normal deterioration of infrastructure by vibration;
- are expected to be adopted by institutions and private companies that operate public infrastructure and facilities, and to be used to check the condition of target facilities regardless of the occurrence of an earthquake;
- operate using vibration information from multiple locations for a single facility;
- are permanently or temporarily installed and used;
- should be equipped with some kind of connection between the seismometer systems to provide accurate synchronization for analysis because, in most cases, they use vibration information from multiple installed locations.

NOTE 7 For more information on dynamic tests and investigations on bridges and viaducts, see ISO 14963.

NOTE 8 For more information on evaluating measurement results from dynamic tests and investigations of bridges, see ISO 18649.

k) Other purposes (Category Z)

When seismometer systems are used for a purpose that does not fall into the categories from a) to j), category Z is applied. If a seismometer system is to be classified in category Z, the supplier should:

- clearly state its use and purpose;
- provide a written specification of its functions and characteristics.