

INTERNATIONAL ISO  
This is a preview of "ISO 23469:2005". Click here to purchase the full version from the ANSI store.

First edition  
2005-11-15

---

---

## **Bases for design of structures — Seismic actions for designing geotechnical works**

*Bases du calcul des constructions — Actions sismiques pour le calcul des ouvrages géotechniques*



Reference number  
ISO 23469:2005(E)

© ISO 2005

This is a preview of "ISO 23469:2005". [Click here to purchase the full version from the ANSI store.](#)

**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2005

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

This is a preview of "ISO 23469:2005". [Click here to purchase the full version from the ANSI store.](#)

## Contents

Page

Foreword.....	iv
Introduction .....	v
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Symbols and abbreviated terms .....</b>	<b>7</b>
<b>5 Principles and procedure.....</b>	<b>7</b>
<b>5.1 Principles .....</b>	<b>7</b>
<b>5.2 Procedure for determining seismic actions.....</b>	<b>9</b>
<b>6 Evaluation of earthquake ground motions, ground failure, and fault displacements.....</b>	<b>9</b>
<b>6.1 General.....</b>	<b>9</b>
<b>6.2 Seismic hazard analysis .....</b>	<b>10</b>
<b>6.3 Site response analysis and assessment of liquefaction potential .....</b>	<b>11</b>
<b>6.4 Spatial variation .....</b>	<b>12</b>
<b>6.5 Fault displacements, ground failure, and other geotechnical hazards.....</b>	<b>14</b>
<b>6.6 Paraseismic influences .....</b>	<b>14</b>
<b>7 Procedure for specifying seismic actions .....</b>	<b>14</b>
<b>7.1 Types and models of analysis.....</b>	<b>14</b>
<b>7.2 Seismic actions for equivalent static analysis .....</b>	<b>16</b>
<b>7.3 Seismic actions for dynamic analysis.....</b>	<b>17</b>
<b>8 Seismic actions for equivalent static analysis .....</b>	<b>17</b>
<b>8.1 Seismic actions for simplified equivalent static analysis .....</b>	<b>17</b>
<b>8.2 Seismic actions for detailed equivalent static analysis.....</b>	<b>20</b>
<b>9 Seismic actions for dynamic analysis .....</b>	<b>21</b>
<b>9.1 Seismic actions for simplified dynamic analysis.....</b>	<b>21</b>
<b>9.2 Seismic actions for detailed dynamic analysis .....</b>	<b>23</b>
<b>Annex A (informative) Primary issues for specifying seismic actions.....</b>	<b>24</b>
<b>Annex B (informative) Upper crustal rock, firm ground, and local soil deposit.....</b>	<b>27</b>
<b>Annex C (informative) Design situations for combination of actions.....</b>	<b>29</b>
<b>Annex D (informative) Seismic hazard analysis and earthquake ground motions .....</b>	<b>30</b>
<b>Annex E (informative) Site response analysis .....</b>	<b>36</b>
<b>Annex F (informative) Spatial variation of earthquake ground motion .....</b>	<b>46</b>
<b>Annex G (informative) Assessment of liquefaction .....</b>	<b>51</b>
<b>Annex H (informative) Seismic actions defined for various models of geotechnical works.....</b>	<b>57</b>
<b>Annex I (informative) Soil-structure interaction for designing deep foundations: phase for inertial and kinematic interactions .....</b>	<b>73</b>
<b>Annex J (informative) Limitations in the conventional method and emerging trend for evaluating active earth pressure.....</b>	<b>74</b>
<b>Annex K (informative) Effects of liquefaction considered in various models of geotechnical works ....</b>	<b>76</b>
<b>Annex L (informative) Evaluation of other induced effects .....</b>	<b>80</b>
<b>Annex M (informative) Concepts of response control and protection .....</b>	<b>83</b>
<b>Annex N (informative) Interdependence of geotechnical and structure designs .....</b>	<b>84</b>
<b>Bibliography .....</b>	<b>85</b>

## 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 23469 was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*, Subcommittee SC 3, *Loads, forces and other actions* in collaboration with ISSMGE/TC4 and CEN/TC205/SC8.

This is a preview of "ISO 23469:2005". [Click here to purchase the full version from the ANSI store.](#)

## Introduction

This International Standard provides guidelines to be observed by experienced practising engineers and code writers when specifying seismic actions in the design of geotechnical works. Geotechnical works are those comprised of soil or rock, including buried structures (e.g. buried tunnels, box culverts, pipelines and underground storage facilities), foundations (e.g. shallow and deep foundations, and underground diaphragm walls), retaining walls (e.g. soil retaining and quay walls), pile-supported wharves and piers, earth structures (e.g. earth and rockfill dams and embankments), gravity dams, landfill and waste sites. The seismic actions described are compatible with ISO 2394.

The seismic performance of geotechnical works is significantly affected by ground displacement. In particular, soil-structure interaction and effects of liquefaction play major roles and pose difficult problems for engineers. This International Standard addresses these issues in a systematic manner within a consistent framework.

The seismic performance criteria for geotechnical works cover a wide range. If the consequences of failure are minor and the geotechnical works are easily repairable, their failure or collapse may be acceptable and explicit seismic design may not be required. However, geotechnical works that are an essential part of a facility handling hazardous materials or a post-earthquake emergency facility shall maintain full operational capacity during and after an earthquake. This International Standard presents a full range of methods for the analysis of geotechnical works, ranging from simple to sophisticated, from which experienced practising engineers can choose the most appropriate one for evaluating the performance of a geotechnical work.