



## Standard Test Methods for Downhole Seismic Testing<sup>1</sup>

This standard is issued under the fixed designation D 7400; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript symbol (<sup>1</sup>) indicates an editorial change since the last revision or approval.

### 1. Scope<sup>2</sup>

1.1 These test methods are limited to the determination of the interval velocities from arrival times and relative arrival times of compression (P) and vertically (SV) and horizontally (SH) polarized shear (S) seismic waves which are generated near surface and travel down to an array of vertically installed seismic sensors. A preferred method intended to obtain data for use on critical projects where the highest quality data is required is included. Also included is an optional method intended for use on projects which do not require measurements of a high degree of precision.

1.2 Various applications of the data will be addressed and acceptable procedures and equipment, such as seismic sources, receivers, and recording systems will be discussed. Other items addressed include source-to-receiver spacing, drilling, casing, grouting, a procedure for borehole installation, and conducting actual borehole and seismic cone tests. Data reduction and interpretation is limited to the identification of various seismic wave types, apparent velocity relation to true velocity, example computations, use of Snell's law of refraction, and assumptions.

1.3 There are several acceptable devices that can be used to generate a high-quality P or SV source wave or both and SH source waves. Several types of commercially available receivers and recording systems can also be used to conduct an acceptable downhole survey. Special consideration should be given to the types of receivers used and their configuration. Heavily-damped sensors should not be used so that spectral smearing, phase shifting, and latency response between sensors is avoided. These test methods primarily concern the actual test procedures, data interpretation, and specifications for equipment which will yield uniform test results.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.09 on Cyclic and Dynamic Properties of Soils.

Current edition approved June 1, 2008. Published July 2008. Originally approved in 2007. Last previous edition approved in 2007 as D 7400 – 07.

1.4 All recorded and calculated values shall conform to the guide for significant digits and rounding established in Practice D 6026.

1.4.1 The procedures used to specify how data are collected/recorded and calculated in these test methods are regarded as the industry standard. In addition, they are representative of the significant digits that should generally be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of these test methods to consider significant digits used in analysis methods for engineering design.

1.4.2 Measurements made to more significant digits or better sensitivity than specified in these test methods shall not be regarded as nonconformance with this standard.

1.5 This standard is written using SI units. Inch-pound units are provided for convenience. The values stated in inch-pound units may not be exact equivalents; therefore, they shall be used independently of the SI system. Combining values from the two systems may result in nonconformance with this standard.

1.5.1 The gravitational system of inch-pound units is used when dealing with inch-pound units. In this system, the pound (lbf) represents a unit of force (weight), while the unit for mass is slug. The rationalized slug unit is not given, unless dynamic (F = ma) calculations are involved.

1.5.2 It is common practice in the engineering/construction profession to conveniently use pounds to represent both a unit of mass (lbm) and of force (lbf). This implicitly combines two separate systems of units; that is, the absolute system and the gravitational system. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. As stated, this standard includes the gravitational system of inch-pound units and does not represent the slug unit for mass. However, the use of balances or scales recording pounds of mass (lbm) or recording density in lbm/ft<sup>3</sup> shall not be regarded as nonconformance with this standard.

<sup>2</sup>A Summary of Changes section appears at the end of this standard.

# Standard Test Methods For Downhole Seismic Testing1

**Amarnath Chakrabarti, Devdas  
Menon, Amlan Kumar Sengupta**



## **Standard Test Methods For Downhole Seismic Testing1:**

*Standard Test Methods for Downhole Seismic Testing*, *Geotechnical and Geophysical Site Characterization 4* Roberto Quental Coutinho, Paul W. Mayne, 2012-09-06 Site characterization is a fundamental step towards the proper design construction and long term performance of all types of geotechnical projects ranging from foundation excavation earth dams embankments seismic hazards environmental issues tunnels near and offshore structures *Geotechnical and Geophysical Site Characterization 4* provides practical applications of novel and innovative technologies in geotechnical and geophysical engineering and is of interest to academics engineers and professionals involved in Geotechnical Engineering

*Geomechanics in Soil, Rock, and Environmental Engineering* John Small, 2018-09-03 Utilizes both Computer and Hand Based Calculations Modern practice in geomechanics is becoming increasingly reliant on computer based software much of which can be obtained through the Internet In *Geomechanics in Soil Rock and Environmental Engineering* the application of these numerical techniques is examined not only for soil mechanics but also for rock mechanics and environmental applications For Use in Complex Analysis It deals with the modern analysis of shallow foundations deep foundations retaining structures and excavation and tunneling In recent years the environment has become more and more important and so it also deals with municipal and mining waste and solutions for the disposal and containment of the waste Many fresh solutions to problems are presented to enable more accurate and advanced designs to be carried out A Practical Reference for Industry Professionals This Illuminating Book Offers a broad range of coverage in soil mechanics rock mechanics and environmental engineering Incorporates the author s more than 40 years of academic and practical design experience Describes the latest applications that have emerged in the last ten years Supplies references readily available online for further research *Geomechanics in Soil Rock and Environmental Engineering* should appeal to students in their final undergraduate course in geomechanics or master s students and should also serve as a useful reference to practitioners in the field of geomechanics reflecting the author s background in both industry and academia

**Latest Developments in Geotechnical Earthquake Engineering and Soil Dynamics** T.G. Sitharam, Ravi Jakka, Sreevalsa Kolathayar, 2021-07-01 This volume brings together contributions from world renowned researchers and practitioners in the field of geotechnical engineering The chapters of this book are based on the keynote and invited lectures delivered at the 7th International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics The book presents advances in the field of soil dynamics and geotechnical earthquake engineering A strong emphasis is placed on proving connections between academic research and field practice with many examples case studies best practices and discussions on performance based design This volume will be of interest to research scholars academicians and industry professionals alike

**Practical Soil Dynamics** Milutin Srbulov, 2011-06-17 The objective of this book is to fill some of the gaps in the existing engineering codes and standards related to soil dynamics concerning issues in earthquake engineering and ground vibrations by using formulas and hand

calculators The usefulness and accuracy of the simple analyses are demonstrated by their implementation to the case histories available in the literature Ideally the users of the volume will be able to comment on the analyses as well as provide more case histories of simple considerations by publishing their results in a number of international journals and conferences The ultimate aim is to extend the existing codes and standards by adding new widely accepted analyses in engineering practice The following topics have been considered in this volume main ground motion sources and properties typical ground motions recording ground investigations and testing soil properties used in simple analyses fast sliding in non liquefied soil flow of liquefied sandy soil massive retaining walls slender retaining walls shallow foundations piled foundations tunnels vertical shafts and pipelines ground vibration caused by industry Audience This book is of interest to geotechnical engineers engineering geologists earthquake engineers and students

### **Electrical Measuring Instruments and Measurements**

S.C. Bhargava,2012-12-27 This book written for the benefit of engineering students and practicing engineers alike is the culmination of the author s four decades of experience related to the subject of electrical measurements comprising nearly 30 years of experimental research and more than 15 years of teaching at several engineering institutions The unique feature of this book apart from covering the syllabi of various universities is the style of presentation of all important aspects and features of electrical measurements with neatly and clearly drawn figures diagrams and colour and b w photos that illustrate details of instruments among other things making the text easy to follow and comprehend Enhancing the chapters are interspersed explanatory comments and where necessary footnotes to help better understanding of the chapter contents Also each chapter begins with a recall to link the subject matter with the related science or phenomenon and fundamental background The first few chapters of the book comprise Units Dimensions and Standards Electricity Magnetism and Electromagnetism and Network Analysis These topics form the basics of electrical measurements and provide a better understanding of the main topics discussed in later chapters The last two chapters represent valuable assets of the book and relate to a Magnetic Measurements describing many unique features not easily available elsewhere a good study of which is essential for the design and development of most electric equipment from motors to transformers and alternators and b Measurement of Non electrical Quantities dealing extensively with the measuring techniques of a number of variables that constitute an important requirement of engineering measurement practices The book is supplemented by ten appendices covering various aspects dealing with the art and science of electrical measurement and of relevance to some of the topics in main chapters Other useful features of the book include an elaborate chapter by chapter list of symbols worked examples exercises and quiz questions at the end of each chapter and extensive authors and subject index This book will be of interest to all students taking courses in electrical measurements as a part of a B Tech in electrical engineering Professionals in the field of electrical engineering will also find the book of use

*Soil Improvement and Ground Modification Methods* Peter G. Nicholson,2014-08-29 Written by an author with more than 25 years of field and academic experience Soil Improvement and

Ground Modification Methods explains ground improvement technologies for converting marginal soil into soil that will support all types of structures. Soil improvement is the alteration of any property of a soil to improve its engineering performance. Some sort of soil improvement must happen on every construction site. This combined with rapid urbanization and the industrial growth presents a huge dilemma to providing a solid structure at a competitive price. The perfect guide for new or practicing engineers, this reference covers projects involving soil stabilization and soil admixtures including utilization of industrial waste and by products commercially available soil admixtures, conventional soil improvement techniques and state of the art testing methods. Conventional soil improvement techniques and state of the art testing methods. Methods for mitigating or removing the risk of liquefaction in the event of major vibrations. Structural elements for stabilization of new or existing construction. Industrial waste by products commercially available soil. Innovative techniques for drainage filtration, dewatering, stabilization of waste and contaminant control and removal.

*Seismic Stability Evaluation of Ririe Dam and Reservoir Project*, 1991

Handbook on Seismic Retrofit of Buildings Amarnath Chakrabarti, Devdas Menon, Amlan Kumar Sengupta, 2008. The Handbook on Seismic Retrofit of Buildings is a compiled source of technical information for engineers and professionals in the buildings industry, decision making officials and students. The Handbook is divided into 17 chapters covering basic concepts of earthquakes, seismic design and retrofit of buildings, seismic vulnerability assessment, retrofit strategies for different types of buildings, geotechnical and foundation aspects, advanced applications, quality assurance and case studies.

**Geological and Geotechnical Investigation Procedures for Evaluation of the Causes of Subsidence Damage in Florida**, 2005

**Proceedings of the ... Annual Symposium on Engineering Geology & Geotechnical Engineering**, 2003

**Creation of a Data Base of Seismic Shear Wave Velocities for Correlation Analysis** D. W. Sykora, 1987

Subsurface Characterization and Monitoring Techniques: Solids and ground water, appendices A and B, 1993

**Use of Geophysical Methods in Construction** Soheil Nazarian, John G. Diehl, 2000. GSP 108 contains 16 papers presented at sessions of Geo Denver 2000 held in Denver Colorado August 5-8, 2000.

**Canadian Geotechnical Journal**, 2011

**Dynamical Methods in Soil and Rock Mechanics: Rock dynamics and geophysical aspects** Bernd Prange, G. Gudehus, G. W. Borm, 1978

Geotechnical Abstracts, 1992

Penetration Testing in the UK. Institution of Civil Engineers (Great Britain), 1989. The geotechnical engineer needs to be aware of the advantages and problems of different tests for sites with different geological conditions. Interpreting the results of penetration tests is an essentially empirical activity and as such the engineer is required to understand standard equipment and procedures. This book provides crucial information about all these considerations and is a valuable textbook of current theory and practice.

**Second ASCE Conference on Civil Engineering and Nuclear Power, Knoxville, Tennessee, September 15-17, 1980: Geotechnical topics**, 1980

**Standard Handbook for Solid and Hazardous Waste Facility Assessments** Martin N. Sara, 1994. This landmark new book sets the standard for planning, performing and interpreting investigations for solid and hazardous waste sites and

selecting appropriate locations for ground water monitoring It covers the technical components of assessment monitoring programs that define both the rate and extent of contamination and provide design criteria for aquifer remediation Technical tools are discussed in detail to provide background techniques such as flow net constructions cross section instructions and documentation standards More than 500 figures and tables illustrate the author s structured holistic program for examining the physical chemical and environmental factors of a site for waste disposal The technical aspects of site assessments regarding contaminated ground water evaluation and remediation are also covered in detail Learn the fundamentals of site assessments This classic guide explains the fundamentals of a technical approach to site assessments It is the principle text used for training EPA regional project managers for Superfund sites The book uses a practical step by step format to walk you through the following tasks

The book delves into Standard Test Methods For Downhole Seismic Testing1. Standard Test Methods For Downhole Seismic Testing1 is an essential topic that needs to be grasped by everyone, ranging from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Standard Test Methods For Downhole Seismic Testing1, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:
    - Chapter 1: Introduction to Standard Test Methods For Downhole Seismic Testing1
    - Chapter 2: Essential Elements of Standard Test Methods For Downhole Seismic Testing1
    - Chapter 3: Standard Test Methods For Downhole Seismic Testing1 in Everyday Life
    - Chapter 4: Standard Test Methods For Downhole Seismic Testing1 in Specific Contexts
    - Chapter 5: Conclusion
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  4. In chapter 3, this book will examine the practical applications of Standard Test Methods For Downhole Seismic Testing1 in daily life. The third chapter will showcase real-world examples of how Standard Test Methods For Downhole Seismic Testing1 can be effectively utilized in everyday scenarios.
  5. In chapter 4, this book will scrutinize the relevance of Standard Test Methods For Downhole Seismic Testing1 in specific contexts. This chapter will explore how Standard Test Methods For Downhole Seismic Testing1 is applied in specialized fields, such as education, business, and technology.
  6. In chapter 5, this book will draw a conclusion about Standard Test Methods For Downhole Seismic Testing1. This chapter will summarize the key points that have been discussed throughout the book.
- The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Standard Test Methods For Downhole Seismic Testing1.

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