Modern Geophysics In Engineering Geology

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CHAPTER TWO

GEOPHYSICAL METHODS

INTRODUCTION

This chapter begins by defining geophysical methods and techniques, includes results from a literature search, and discusses the geophysical methods and techniques most commonly used for transportation projects.

As related by Telford et al. (*1*), applied geophysics can be divided into the following seven general methods of exploration:

Magnetic,
Electrical,
Electromagnetic,
Seismic,
Gravitational,
Radioactivity, and
Well logging.

Each geophysical method can be used for many different applications (e.g., mining exploration, oil and gas exploration, engineering, and environmental). The division of each method is based on the physics that governs it; therefore, geophysical techniques (e.g., refraction) within each method (i.e., seismic) are designed primarily for applications of the method to a given problem (e.g., rippability). This synthesis will use the terminology of *methods* to refer to those seven major divisions and *techniques* to identify specific applications of the methods.

Material properties can be measured indirectly through the use of engineering geophysical methods such as seismic, electrical resistivity, EM and ground penetrating radar (GPR), to name only a few. The capability of conducting geophysical investigations in difficult or remote terrain and with greater sample density, demonstrates the potential geophysics has to significantly affect design efforts and construction activities. The most important factor geophysics can help address is to reduce the risk associated with unknown subsurface conditions and to avoid related costly claims and repairs. Before publication of this synthesis, it was well known that the success of any geophysical investigation requires that appropriate techniques be applied that address specific engineering objectives. For example, if karstic (e.g., pinnacles or sinks) limestone bedrock is expected to be encountered at shallow depths, applying a magnetic method would not be appropriate.

LITERATURE SEARCH AND TRAINING RESOURCES

A multitude of literature sources exist on geophysics. Existing works either deal purely with the theory and specifics of the physics regarding the variety of methods or they are segregated into the application of geophysics to specific fields. The standard of the geophysical industry for textbooks that contain all the geophysical methods are Telford et al. (*1*) and Dobrin (*3*), both published in 1976. Both books are still used in universities for geophysics coursework.

It was not until the mid-1980s that enough demand for engineering geophysics resulted in the publication of the *Handbook of Engineering Geophysics—Vol. 1: Seismic* (*5*), and *Vol. 2: Electrical Resistivity* (*6*). In the 1990s, a distinct need for specific, application-related books became apparent to present the state of the art for all the geophysical methods and techniques. Consequently, two "best-sellers" related to the use of engineering geophysics became available. The Society of Exploration Geophysicists produced one of the first books dedicated to shallow geophysics, *Geotechnical and Environmental Geophysics—Vols. I–III* (*7*). In 1995, the U.S. Army Corps of Engineers produced a comprehensive document, their engineering manual, *Engineering Design—Geophysical Exploration for Engineering and Environmental Investigations* (*8*). In these last two references, the practical application of geophysics was brought to the forefront through requests to authoritative contributors in specialized fields to develop chapters based on their expertise (Dr. Gregg Hempen, personal communication, 1995). Both books have remained key components of the early application of geophysics to shallow, engineering, and environmental studies. The Corps' engineering manual is available for unlimited public distribution at http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-1-1802/ toc.htm.

With the publication of these two resources, available literature became much more specific as it dealt with particular geophysical methods or engineering applications. One such book, published by The Geological Society of London, *Modern Geophysics in Engineering Geology* (*9*), makes application of the geophysical techniques central to the theme of the book. More recently, FHWA published *Application of Geophysical Methods to Highway Related Problems* (*10*),

Geological Society Engineering Geology Special Publication No. Modern Geophysics in. Engineering Geology. EDITED BY. D. M. McCann.2 Engineering Geology and Geophysics Group, British Geological Survey, Keyworth, Nottingham tured to reflect the application of modern geophysical.Modern Geophysics in. Engineering Geology. Geological Society Engineering Geology Special Publication No. 12 edited by. D. M. McCann, M. Eddleston.Modern Geophysics in Engineering Geology (Geological Society Engineering Geology Special Publication, 12) [D. M. McCann, M. Eddleston, P. J. Fenning.QR code for Modern Geophysics in Engineering Geology Issue 12 of Geological Society engineering geology special publication, ISSN Geologist,. Wimpey. Labora- tories Ltd. ll "The use of geophysical methods in .. modern magnetometers canbe used from floating or airborne craft is important.Environmental and Engineering Geoscience () V (4): kachemile.com //gseegeosci.V Standard View; Views Icon.), aiming towards the exploration of geological structures (b) application of modern geophysical techniques for mapping subsurface.Modern geophysics in engineering geology / edited by D.M. McCann. [Place of publication not identified]: Geological Society, - Geological Society special.engineering geophysics, but deliberately concentrates on identifying those Geophysics plays a vital role intermediate between geological interpretation of the .. It has been noted that modern ground conductivity meters provide data which.Key words: Geotechnical engineering, geophysics, earthquake Reeves GM (eds), Modern Geophysics in Engineering Geology. Geol. Soc.Modern Geophysics in Engineering Geology by M. Eddleston, , available at Book Depository with free delivery worldwide.Modern geophysical baseline data is sampled at a high spatial resolution and can be used in a variety of environmental and land-use Engineering geology.Non-invasive geophysical surveys for engineering and environmental projects. recognition of geological & geotechnical conditions of the area employed high technology instruments and modern hardware and software enables us to offer.Geophysical methods reveal hidden geological structures and bodies at the root of dangerous . important for the solution of many geological, engineering- geological and .. It is advisable to follow the modern experience of the USA. In May.