ABSTRACT

Subsidence measurements are an operational necessity for most areas overlying excavations in salt and potash. Physical benchmarks and conventional optical surveying methods are normally employed to track excavation-induced vertical movement of the ground surface. Repeated horizontal position surveys can also be performed but are normally reserved for areas where such data are critical. Since subsidence surveys are repeated over the same benchmarks, the design of these monuments is critical to the success of a subsidence-monitoring program. Electronic instruments can be used to supplement subsidence data by measuring strain, tilt, and differential elevation changes. Electronic instruments can provide greater sensitivity and measurements can be automated and alarmed, if desired.

INTRODUCTION

Surface subsidence results as ground mass moves to fill void space. Void space is created through mining, production of water and hydrocarbons, and surface and subsurface mass wasting. Measurement of subsidence above underground excavations can be a valuable tool in understanding the structural response of the ground mass to the excavation. Subsidence measurements provide not only a direct measurement of surfacial disturbance, but also an important measure of the closure of underground openings. Engineers experienced with subsidence data and analyses can use acquired data to look for anomalies symptomatic of nonclosure-related subsidence (namely, sinkholes). Conventional optical survey methods are by far the most common method of performing subsidence measurements. In critical areas, it is often desirable to complement conventional surveys with other monitoring methods. This paper outlines the requirements for performing conventional subsidence surveys and also discusses the application of various types of electronic instruments to better define the surface effects of underground activities.

Typically, it is the purview of the conventional surveyor to measure surface subsidence. While traditional survey practices can be time-consuming affairs, they are not likely to be replaced for some time to come. When attempting to measure the surface disturbance over a mined excavation, conventional optical surveying methods can usually provide adequate accuracy over relatively large areas. To supplement the data obtained from conventional surveys, electronic instruments can be employed. The use of electronic instruments is best confined to areas where structures or specific surface disturbances are being monitored. The advantage of electronic instruments regards the potential for higher sensitivity and accuracy, and options for continuous monitoring, data acquisition, and alarms.

ESTABLISHING A SUBSIDENCE NETWORK

Performance of a subsidence survey using conventional methods requires that discrete monitoring points (benchmarks) above the excavated region be established. The monitoring