TransTech
TRANSTECH SYSTEMS, INC.

SDG

Soil Density Gauge

- Eliminates unit licensing and certification associated with nuclear materials usage
- No special operator training/certification or radiation monitoring requirements
- No special storage or transport problems
- User friendly, in-process, cost effective tool for each crew
- Fast, reliable, rugged, accurate and repeatable readings in real time
- Link to GPS and wireless transmission for database management
- Insure solid foundations for structures such as buildings, bridges, roads and dams

SDG

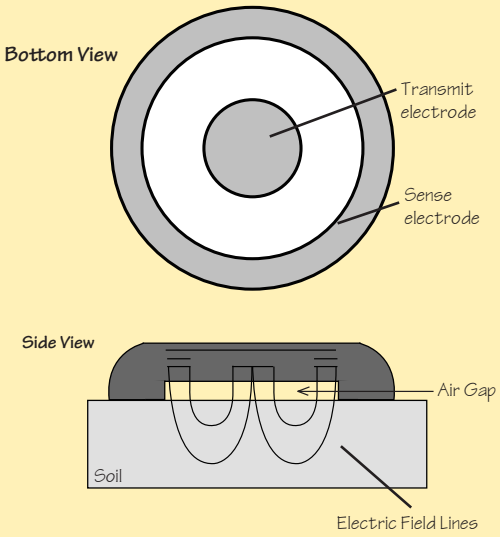
Soil Density Gauge

Problems Solved

- Replace nuclear with non-radioactive energy source
- Reduce or eliminate asphalt pavement failures (potholes, subsidence)
- Safety hazards, traffic congestion, pollution and energy usage associated with pavement repairs
- Compaction irregularities in preparation of foundations and other civil infrastructure

Competition/Alternatives

- Nuclear-based densitometers require penetrating probe
- Soil cone penetrometers require physical penetration (inaccurate and relies on operator interpretation; no data logging)
- Sand cone time consuming; accuracy impacted by operator skill
- Soil stiffness gauges look at resilient modulus of soil; current devices' results are highly operator dependant; do not provide the moisture content measurement necessary for knowledge of true strength characteristics of the soil



The configuration of the non-contacting sensor is shown. A central transmit ring injects an electric field into the soil and the response is received on the outer sensing ring.

Density of compacted soil is the most important construction variable in the durability of soil sub-base for pavement, fills, and other construction applications. All current methods of measuring soil density have major limitations. The Sand Cone Test (ASTM D1556) and Rubber Balloon Test (ASTM D2167) are the accepted tests for field density measurement. The tests are time consuming, the results can be influenced by the skill level of the operator and they are destructive to the soil surface. Measurement time is a critical issue for utility cut/repair operations on congested city streets. The alternative, nuclear densitometers, are cumbersome to use, require strict licensing and usage procedures, take several minutes to get data and have limitations in their accuracy, such as the known edge effects when used in small spaces (e.g. utility cut/repair). Many states have initiated, or are in the process of initiating, programs to replace nuclear soil density gauges to eliminate the regulatory and logistical difficulties.

To meet the need for a fast, accurate, non-nuclear soil density/compaction and moisture gauge, TransTech Systems has developed an innovative alternative, the electrical impedance-based Soil Quality Indicator (SDG) for use as a QC tool during the soil compaction process. The SDG builds upon the patented, and NOVA Award winning, Pavement Quality Indicator (PQI). Using advanced electrical impedance spectroscopy (EIS), the SDG is able to make fast, non-contact measurements of soil density and moisture content. This novel approach permits separation of the effects of density and moisture content on the response of the soil to electromagnetic probing. The density, or compaction level, is measured by the response of the SDG's electrical sensing field to changes in electrical impedance of the material matrix. Since the dielectric constant of air is much lower than that of the other soil constituents, as density/compaction increases, the combined dielectric constant increases because the percentage of air in the soil matrix decreases. The SDG performs a calculation on the measurement data that enables the device to report the soil's density and moisture content. Currently, the SDG is still under development and in the early stages of beta testing.

The importance of this innovation is that soil density measurements can now be taken quickly and non-destructively, allowing necessary changes to the compaction process to be made immediately. It also makes it possible to take many more readings per hour on the job site, which helps ensure that the best possible level of compaction is attained. Initially, the SDG was developed to address utility cut/repair operations. Several studies have shown that improper compaction of the fill prior to repaving is the major cause for failures in the street cuts made by utilities during installation, repair, or upgrading of buried equipment. The SDG can also be used in any construction activity where proper soil compaction is critical to ultimate performance of engineered structures, such as pavements, foundations, dams, and embankments.

TransTech Systems' extended family of electrical impedance based systems, such as the Pavement Quality Indicator (PQI), that measures asphalt pavement density, and the Soil Density Gauge (SDG), are not only light-weight, but are also easy to use. Other electromagnetic sensors, including Time Domain Reflectometry (TDR) and Ground Penetrating Radar (GPR), have also been applied in various contexts to determine the moisture content and/or density of engineering materials, such as asphalt or soil. Both TDR and GPR are used to determine soil moisture and density by measurement of the electromagnetic propagation velocity in the medium. These alternatives are typically complex and cumbersome to operate/transport and generally require skilled operators.

One of the most appealing aspects of our innovative device is that any member of the construction crew can accurately and effectively operate TransTech's SDG without the need for extensive training or licensure, as opposed to the alternative devices mentioned above. The SDG is a unique tool that gives you a cost effective method for rapidly determining critical soil parameters of both density and moisture with the same convenient instrument

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