

1999 NOVA AWARD WINNER**The Humboldt Soil Stiffness And Modulus Gauge**

The Humboldt Stiffness Gauge (HSG) is a field instrument that has been developed to nondestructively measure soil stiffness and soil modulus. The HSG vibrates, imparting small forces to the soil through a ring-shaped foot, and causes small soil deflections. The instrument determines the soil stiffness as the ratio of these small forces to small deflections. It assumes a value of Poisson's ratio and derives Young's soil modulus from the stiffness. HSG measures soil stiffness in just over a minute. Soil stress and strain are determined by HSG at levels commonly found in soil applications (3 to 5 psi). Because it vibrates from 100 Hz to 200 Hz, HSG filters out soil deflections caused by nearby equipment. By using soil stiffnesses measured with HSG along with statistical quality control, the current overspecification and overcompaction of soil can be greatly reduced, thereby reducing compactive effort by approximately 30%. When soil is compacted for pavements, pipe bedding, backfills, and foundations, soil density is used almost exclusively by the construction industry to specify, estimate, measure and control soil compaction. However, soil density may not be the desired engineering property, instead, the desired engineering property is the soil modulus or soil stiffness. Development of the HSG began four years ago with an FHWA contract to BBN Technologies of Cambridge, MA, in cooperation with CNA Consulting Engineers of Minneapolis, MN. The purpose of this contract was to adapt the U.S. Army's proven technology for the detection of non-metallic land mines to soil evaluation applications for the construction industry. Successful proof-of-principle demonstrations were performed and Humboldt Mfg. Co. Of Norridge, IL, was recruited to commercialize HSG.

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