

## Geophysical Application

### Site Classification Surveys

The International Building Code (IBC) has established a site classification system for commercial and industrial construction. When soil properties are not known in sufficient detail, the default class is D. Improved site class can mean significantly lower design and construction costs. Site class C can be determined with soil borings or seismic methods. However, the best site classes A or B can only be based on shear wave velocity measurements.

Site Class	Soil Profile Name	Shear Wave Velocity Vs (feet/second)	Standard Penetration Resistance (N)
A	Hard Rock	$V_s > 5,000$	N/A
B	Rock	$2,500 < V_s < 5,000$	N/A
C	Very dense soil	$1,200 < V_s < 2,500$	$N > 50$
D	Stiff soil	$600 < V_s < 1,200$	$15 < N < 50$
E	Soft soil	$V_s < 600$	$N < 15$

Quality Geophysics personnel are experienced designing and implementing seismic surveys to measure the shear velocities ( $V_s$ ) in the upper 30-meters (known as  $V_{s30}$ ) or 100 feet of a site. This can be done cost-effectively, without requiring soil borings using a multichannel analysis of surface wave (MASW) dispersion method of seismic surveying.

Surface wave data can be collected to provide 1-dimensional graph of depth versus shear-wave velocity, two-dimensional cross-sections, or three-dimensional blocks to model subsurface velocity changes.



When site class is known, design engineers can calculate basic spectral response for short and long period accelerations ( $S_s$  and  $S_1$ ), the maximum considered earthquake spectral response  $S_M$ s and  $S_{M1}$  and design spectral response accelerations  $S_D$ s and  $S_{D1}$  values for an effective and stable structure design.



Shear velocities directly relate to shear modulus and can be an important consideration for some site designs. When needed, Quality Geophysics is capable of performing more traditional up-hole, down-hole and cross-hole surveys to develop velocity information related to the presence of a borehole.

For shallow sites where liquefaction may be a concern, Quality Geophysics is capable of shear-wave refraction surveys using horizontal seismic sources and horizontal energy sensors. In addition, Quality Geophysics personnel are among the few nationally who have performed both shear seismic reflection surveys.