

**05-3****AKKUYU-1 NUCLEAR POWER PLANT SITE  
CROSS-HOLE SURVEY**

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Most of the site investigations for Akkuyu I NPPS was performed by EIE based on agreements signed between TEK (Turkish Electricity Authority) and EIE (Electrical Power Resources Survey Administration). These studies comprise of geotechnical investigations such as engineering geophysics geology, drilling, cross-hole tests and other kind of geotechnical investigations.

In addition to the studies conducted earlier at the site, new cross-hole tests have been required at the unit area down to a depth of 100 meters on three lines located at 120 degree angles to each other.

Aim of the tests was to obtain detail information on the design dynamic parameters of the unit area.

As it is known seismic cross-hole method is one of the best methods for evaluation of foundation conditions since direct wave velocities present the in-situ rock conditions. These may not be examined on cores. For instance, some weak zones and weathered zones can be distinguished by borehole seismic methods.

Another objective of the test was to take an advantage by comparing the seismic results and other qualification tests such as water pressure tests, rock quality designation and fracture frequencies.

Seismic wave velocities and dynamic parameters measured between the total ten boreholes which were located on the three lines are presented as diagrams, figures and tables.

The highly sensitive characteristics of big constructions demand extensive insitu and laboratory investigations of the subsoil conditions. Therefore, it is very important to determine and calculate of some physical characteristics of foundation such as Modulus of Elasticity, dynamic Shear Modulus, Bulk Modulus, and Poisson ratio.

In addition to the surface seismic methods, some borehole measuring techniques have also improved in last ten years. The advantage of these methods is to be able to distinguish the weak zones in bedrock.

As it is known, this can not be achieved by surface refraction studies when high velocity layers overlay them.

Further more in borehole methods the seismic waves are directly measured so minimal errors and inefficiencies in calculation of parameters are encountered compared to other surface seismic methods.

One of the best suitable methods is cross-hole survey to direct measurement of seismic waves. In this method at least two boreholes are necessary. One of them is used as source hole and the other is receiving hole. The spacing between the holes and test depths are determined in accordance with the geological bedding and Strike and dip of layers. The basic steps of this technique are developed by Stokoe and Woods in 1972. For Homogeneous soils, spacing-to-depth ratio is recommended to be lower than 1.0 based on experimental results by them.

Since at least two holes are used in cross-hole tests exact spacing must be sensitively calculated by measuring the whole deviations. Measurements were done at every test depth. Finally, it was realized that the surface spacing might be changed up to 20% when correction factor was used.

In receiving holes, three axial geophones were used to receive the vertical and two horizontal components of the real pulse.

In order to overcome the high hydrological pressure at the depth of the hole, oxygen tubes with high pressure were used to clamp the geophone to the whole wall tightly, The clamping device was a inner tube of a ball.