

**O12-5****APPLICATION OF THE SEISMIC AND GEOELECTRIC TOMOGRAPHY FOR IN-SITU RAW MATERIALS DAMS OF IRRIGATION SYSTEM INVESTIGATION**

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**Abstract**

In this paper there are presented the geophysical technique, the interpretation methodology, the results of seismic and geoelectric tomography in dams of irrigation system in Albania.

**Introduction**

Albania is one of the countries with numerous and biggest dams of irrigation system in Europe. In Albania have been constructed about 600 dams for the reservoirs of the irrigation system in a short period of about 30 years. The height of these clay dams varies among 10 and 40 m, while the crest length of the dams goes up to 3 500 m.

The long period of exploitation of hydrotechnical works, from 15 to 40 years, has influenced in the modification of their physical-mechanical properties and constructive structure. At present conditions, therefore, was a necessity the re-estimation of the stability of the hydrotechnical constructions. In this case the acquisition of technical data on the stability of the constructive raw materials and basement rocks was very important in order to apply the modern dynamic methods of such revaluation. These data were extracted from the in-situ geophysical tests, which had to go through the following task:

1. The study of the structure of constructed raw material, which the dam was built up.
2. The determination of constructive material physical-mechanical properties.
3. The evaluation of variation in time of these properties.

**Geophysical technique and interpretation methodology.**

A complex of geophysical methods was applied for in-situ investigation of the dams. The refracted seismic profiling of high frequencies in surface of the dam's crown were performed, setting the geophones in line with lengths from 0.5-43 meters, according to the object's size and the required depth investigation of the seismic survey. Generation the seismic waves is performed by mechanical shock. A seismic 12-channel station ECHO-2 of Canadian Firm SCINTREX was used for the recording. The proceeding of data records is made by the company's software package. According to surveys' data the velocity of longitudinal waves  $V_p$  and transversal waves  $V_s$  were calculated, as well as the layer thickness. According to all the seismic data, the physical-mechanical properties were calculated for the soil of the dams, such as the Poisson coefficient, the dynamic modulus of elasticity, the Bulk modulus, the rigidity modulus and the modulus of compression volume strength.

Geoelectric tomography to investigate the clay's core of raw materials dams was carried out. Resistivity Real Section of the geoelectric tomography were performed by multiple spacing gradient arrays, with maximal spacing up to  $AB=360$  m, which provided a survey depth of 50-70 m. Profiling were performed for four depths of investigation, according to the required depth investigation for each object. Alongside in the downstream area of soil dams, there were carried out also self-potential surveys in order to study the water filtering process through it.

**Results**

Paskuqani raw material dam is located in northwestern region of Tirana. The dam has a crest length of 430 meters and height of 27 meters. Paskuqani's dam was under observation, because during last years there were built a new district at its downstream area. According to the electrical soundings, located on the axis of the dam's crown, results that dam's body is multilayer. Underlain of stones layer with a thickness of 1.2 m, which cover the dam's surface, there are clay layer. The clay has a resistivity 7.8

Ohm-m and a thickness of 18.5 m. under these layers are lain silstone with gravel lens. This layer has a resistivity of 34.7 Ohm-m. The siltstone are lied under the dam's basement too, up to depth of 40.8 m, from the level of dam's crown. Under these sandstone there are located clay again, with a resistivity of 9.4 Ohm-m. The geoelectrical Real Section shows clearly that dam's material is heterogeneous, horizontally and vertically.

According to the typical data of seismic survey, the physical-mechanical properties of different layers of soil at the dam's body were calculated, at shown in the following table:

Layer's thickness, in meters	Vp, in m/sec.	Vs in m/sec.	Density, in g/cm <sup>3</sup>	Dynamic modulus of elasticity in x10 <sup>5</sup> kg/cm <sup>2</sup>
1.6	520	150	1.53	0.01.
3.2	730	230	1.66	0.02
11.6	850	340	1.77	0.06

According to these data it is obvious that the dam's material is physically and mechanically weak. The dam's body itself is vertically and horizontally heterogeneous.

**Artificial lake's dam in Tirana** is located in the Tirana Park at southern city area. Built in 1957, for ecological needs and industrial water as a homogenous dam, actually it has only an ecological function. It is the most problematic dam, because the dam's slope has slipped several times. Because of Tirana's city extension also at the downstream area of the dam, Albanian ICOLD has decided to change its class from the 3rd to first classes.

According to this point of view, in order to avoid the so far ineffective interference, which didn't fully resolved the issue; the new project was designed for reconstruction in 4 versions. The project was based on the preliminary geological-geophysical and geotechnical surveys results. The reconstruction will surely bring stability to the dam. By the stability point of view, it results that solutions are acceptable, considering the best version among these versions as the best economically, safety and environmentally as well as working facilities. In order to complete the project, at the second stage, more detailed in-situ integrated geophysical and geotechnical investigation is necessary to investigate not only the basement but also the dam's body itself.

## Conclusion

In the rehabilitation projects of irrigation's work carried out in Albania it is necessary to project in situ investigation using integrated engineering geophysics methods, which result are necessary to evaluate the actual physical-mechanical state of the dam's body and select the proper technical measures to be taken for the reconstruction of dams considering the actual urban and rural conditions.