Assessment of permeability with experimental and numerical analyses at the Atasu Dam Site (Trabzon)

Selçuk ALEMDAG[1], Zulfu GUROCAK[2] and Ayberk KAYA[1]

'Gumushane Universitesi, JeolojiMuhendisligi Bolu'mu, 29000 Gumushane, Turkiye, selcukalemdag@gmail.com Firattjniversitesi, Jeoloji Muhendisligi Bolu'mu, 23119 Elazig, Turkiye

The aim of this study is to determinate permeability of basalts and pyroclastics and depth of injection at the the axis of the Atasu dam site. For this purpose, joints in the basalts and their effects on permeability was investigated, and the permeabilities of the basalts and pyroclastics were determined based on the values obtained from Lugeon tests. The permeability of the basalts and pyroclastics at depths of 20 m, 40 m and 50 m and depth of injection were evaluated using 2-dimensional finite element seepage analysis. It is assumed that the rocks are saturated and the flow is steady state in the numerical analyses. The basalts at the dam site have two joint sets and their permeability is controlled by them. The pyroclastics include only bedding surfaces. Based on the Lugeon tests, the basalts have the following distribution: 21 % impermeable, 42 % low permeable, 19 % permeable and 18 % very permeable. The pyroclastics show the following distribution in terms of permeability: 27 % impermeable, 33 % low permeable, 13 % permeable and 27 % very permeable. The permeability of the basalts determined from the numerical analyses for the dam site at depths of 20, 40 and 50 m are 36.4*10~^{7} (very permeable), 4.58*10~^{7} (low permeable), 2.24*10~^{7} (low permeable), while those of the pyroclastics were determined as 6*10~^{7} (permeable), 1.46*10~^{7} (low permeable), 5.33* 10"^{8} (impermeable) for depth of 20m, 40m and 50m, respectively. Based on the results of numerical analyses, depth of injection may be assumed as 50 m to esatblish an impermeable zone at the dam site. *Keywords: Atasu dam, permeability, Lugeon test, finite element method*

Atasu Baraj (Trabzon) yerinde gefirimliligin deneysel ve sayisal analizlerle degerlendirilmesi

Bu calismamn amaci, Atasu Baraji eksen yerindeki bazalt ve piroklastiklerin gecirimlilik ozelliklerinin ve enjeksiyon derinliginin belirlenmesidir. Bu amacla, bazaltlarm icerdigi eklemler ve bu eklemlerin gecirimlilige olan etkisi incelenmis, yerinde yapilan Lugeon deneylerinde belirlenen gecirgenlik katsayisi degerlerine gore bazalt ve piroklastiklerin gecirimliligi belirlenmistir. Bazalt ve piroklastiklerin 20 m, 40 m ve 50 m derinlikler icin gecirimlilik ozellikleri ve enjeksiyon derinligi 2-boyutlu sonlu elemanlar sizmti analizleri ile degerlendirilmistir. Sizmti analizlerinde kayaclarm doygun, akism ise dilzenli oldugu varsayilmistir. Baraj yerindeki bazaltlar iki eklem takimi icermektedir ve bazaltlardaki gecirimlilik bu eklem takimlari tarafmdan kontrol edilmektedir. Piroklastikler ise, sadece tabakalanmaduzlemleri icermektedir. Lugeon deneylerine gore bazaltlarm % 21 'i gecirimsiz, % 42'si az gecirimli, % 19'u gecirimli, % 18'i ise 90k gecirimlidir. Piroklastiklerin ise % 27'si gecirimsiz, % 33'u az gecirimli, % 13'il gecirimli, %27'si ise 90k ge9irimli ozelliktedir. Baraj yeri i9in yapilan sayisal analizlerden, 20 m, 40 ve 50 m derinlikler i9in bazaltlarm ge9irimlilik degerleri 36.4*10~^{7} (90k ge9irimli), 4.58*10~^{7} (az ge9irimli), 2.24*10~^{7} (az ge9irimli), pirkolastiklerin ge9irimlilik degerleri ise 6*10~^{7} (ge9irimli), 1.46* 10"^{7} (az ge9irimli), 5.33*10"^{8} (ge9irimsiz) olarak belirlenmistir. Sayisal analiz sonu9lanna gore baraj yerinde ge9irimsizligi saglamak i9in enjeksiyon derinligi 50 m olarak almabilir. *Anahtar Kelimeler: Atasu baraji, gegirimlilik, Lugeon deneyi, sonlu elemanlaryontemi*