

Detection of Scouring Area in Chamran Square (Center of Tehran) by GPR Method

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Abstract

After observing two water seepages in the Chamran Tunnel in the two districts of the municipality of Tehran, the GPR Department of Geotechnical and Strength of material study center of Tehran had decided to use ground penetrating radar method to detect possible scouring area on the site. When the target of the investigation is to establish evidence of scouring which cause the voids, the presence of water is less of an issue than might be expected. In this study, Ground Penetrating Radar (GPR) method has been used to identify the source of water seepages in different parts of the Chamran Square on the top of the Chamran Tunnel.

Water damage can occur due to multiple causes which can result in a number of health hazards. Leaks can be classified as two types: one leaking as a gradual drip and/or only as water passes through a pipe or an aqueduct and the second as a constant spray of water. Leaks that occur only when water is flowing can be more challenging to detect because the point of seepage may dry temporarily. In many water distribution systems, a significant percentage of water is lost due to seepage from distribution pipes.

The GPR data acquisition had been performed by the Mala-HDR 80 MHz GPR Shielded antenna. GPR data collected in 14 longitudinal profiles on both parallel and across the street. At the next step, the collected data have been processed by the GPR experts of the Geophysics Department at Geotechnical and Strength of material study center of Tehran. In the processing of the GPR data, different filters such as background removal, migration, band pass filter, and horizontal and vertical smoothing are applied to the data.

The results obtain from this research work indicate that the GPR method, in addition to its speed and simplicity in data acquisition, is very successful in detection of leaking areas in which electromagnetic properties change rapidly. In this study, the seepage of water caused cavities. In order to reveal the cause of this phenomenon, GPR sections analyzed, the location of the water seepages had been determined. It seems two parts of water pipe which passes under Chamran Square and along to the tunnel path have been damaged. Due to the nature of geological formations in the area, the seepage destroyed the wall of Chamran Tunnel by penetration into the layers.