

## **The use of Ground Penetrating Radar to detect tree roots in an urban setting**

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Here, we discuss the application of Ground Penetrating Radar (GPR) in the detection of tree roots using a broad range of frequencies (from 250 MHz to 4GHz) and several processing flows, assessing the applicability of the method, with its advantages and limitations, using GPR models as well as practical surveys.

For many years, geophysical techniques have been successfully applied in a range of environmental, engineering and geotechnical sectors. Especially in urban areas, the rise of near-surface geophysics has been challenging, as not only are the investigation targets often much more subtle and difficult to study remotely, but man-made materials typically make investigations much more difficult.

Tree roots account for between 10 and 65 % of the total biomass, depending on factors such as age, species, soil type, water availability and competition. However, tree roots have rarely been studied with GPR in real, urban environments, despite the fact that they can cause significant damage to buildings, bridges, roads, and sidewalks. We carried out hundreds of profiles over several surfaces and structures commonly found in urban environments and around various species of trees, of different ages and heights and we report on the success and shortcomings we encounter. Several relevant models were developed to aid the study, focusing especially on the minimal detectable geophysical contrast.

To our knowledge, GPR (or any other geophysical method) research was not used by any municipality or policy maker to study tree root hazard. We propose it as a means to better understand said hazard as well as to assess the development of trees in urban areas.