

# Non-Destructive Lead Pipe Identification Utilizing Acoustic Machine Learning

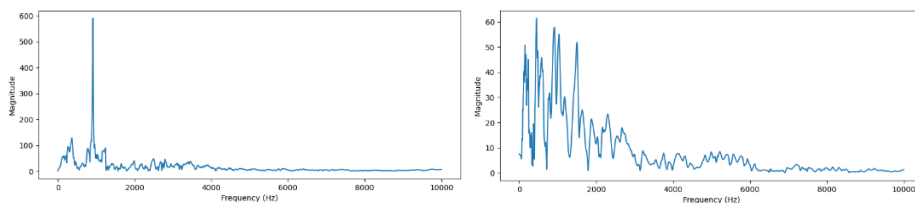
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Across the United States, and the world, there are millions of lead service lines sending water to people's homes [1]. These pipes are dangerous to human health and may soon be mandated, by the Environmental Protection Agency (EPA), to be replaced [1]. To replace these lead service lines, local utilities and communities are undertaking surveys of their existing water infrastructure to identify the materials of their service lines [1]. Unfortunately, current methodology is expensive and invasive, which is why a more efficient and scalable option could assist in the initial surveying of service line materials. This project explored the option of utilizing machine learning models applied to acoustic files as a method for improving the inventorying of service lines without the need for invasive visual inspections.

To identify, develop, and validate such a model, data was gathered from locations with known service line materials, utilizing several audio recording methodologies. Additionally, experts in the field from the EPA and water utilities were consulted for guidance on industry best practices and standards. The model was then deployed to an Application Programming Interface (API) that allows web and mobile applications to be built upon it for larger scale use and distribution. A web application and mobile application were developed and made available publicly at <https://find82.com>, these applications have been developed strictly for research purposes and should not be used as a reliable way to identify materials. The model showed a strong ability to identify the correct material, including lead, in exposed portions of service lines, but becomes less accurate in its ability to determine the materials running underground. To develop a better model, additional data and enhanced recording devices will be required.



*Fast Fourier Transformation of audio from lead pipe (left) and pvc pipe (right)*

[1] U.S. Environmental Protection Agency, "Lead Service Lines," Environmental Protection Agency. [Online]. Available: <https://www.epa.gov/ground-water-and-drinking-water/lead-service-lines>. Accessed 5-5-2024].