



**GROUND
PENETRATING
RADAR
SYSTEMS, INC.**



TEXAS - DFW, AUSTIN, SAN ANTONIO, HOUSTON

"THE NEW WAY TO X-RAY"

To: URS/AECOM

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From: GPRS – Central Texas

Attn: Corey Brecht

Regional Manager

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E: Corey.Brecht@GP-Radar.com

Re: Summary of Void Inspection on 4.8 Mile Trolley Loop.

Mr. Berry,

On March 30th and 31st of 2015, Joseph Granados and myself mobilized to site of the downtown trolley project to perform an inspection of the areas outlined on provided maps to seek for evidence of void spaces in the subgrade. The equipment used consisted of a SIR-3000 operating system along with a 400 MHz antenna. The 400 MHz antenna was able to reach a maximum depth of 4'-5' through your soil type. As the equipment is in active operation, real time data is displayed on the monitor that is interpreted by a trained and experienced technician. The images portrayed by the system will show concrete thickness, underground pipes, voids, etc. While in operation, no radioactive emissions are used.

Process

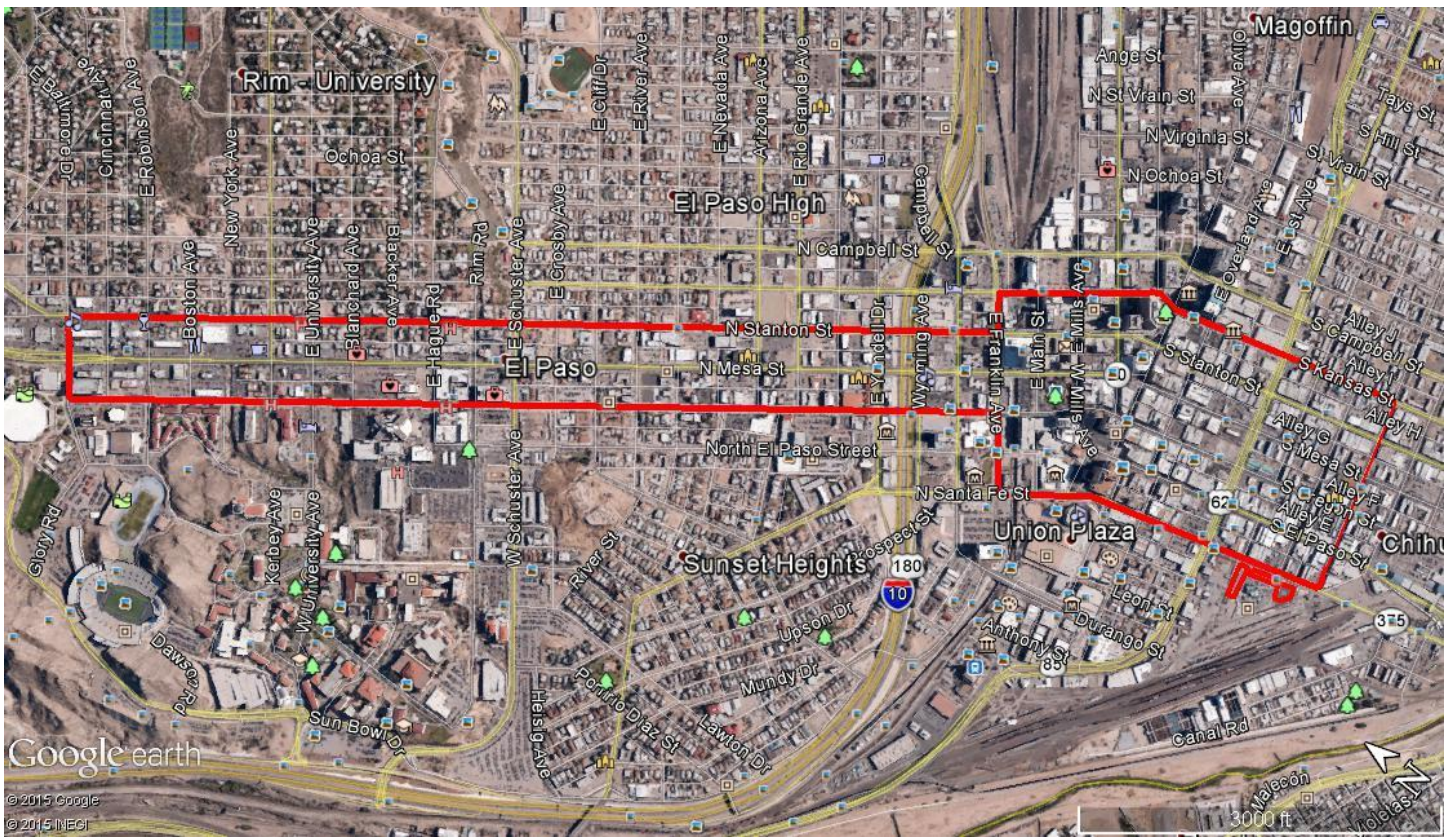
This investigation consisted of performing "scans" in a grid pattern every 4' apart within the scope of work. A "scan" is when the radar system is in operation and the technician moves the radar across the surface in a horizontal or vertical direction. While in operation data scrolls across the screen the control unit in real-time. This data provides information regarding underground utilities/obstructions and potential void/air-space. When the data shows evidence of potential void/air-space the screen shots are collected to be submitted in the report.

The following pages include actual data images from the inspection, as well as accompanying photographs and an aerial map of the target locations. Photographs and corresponding data images are paired together with an explanation of our findings. It is possible that some of the reactions recorded are simply variations in soil content in the subgrade that have a significant difference in dielectric value from the surrounding soil.

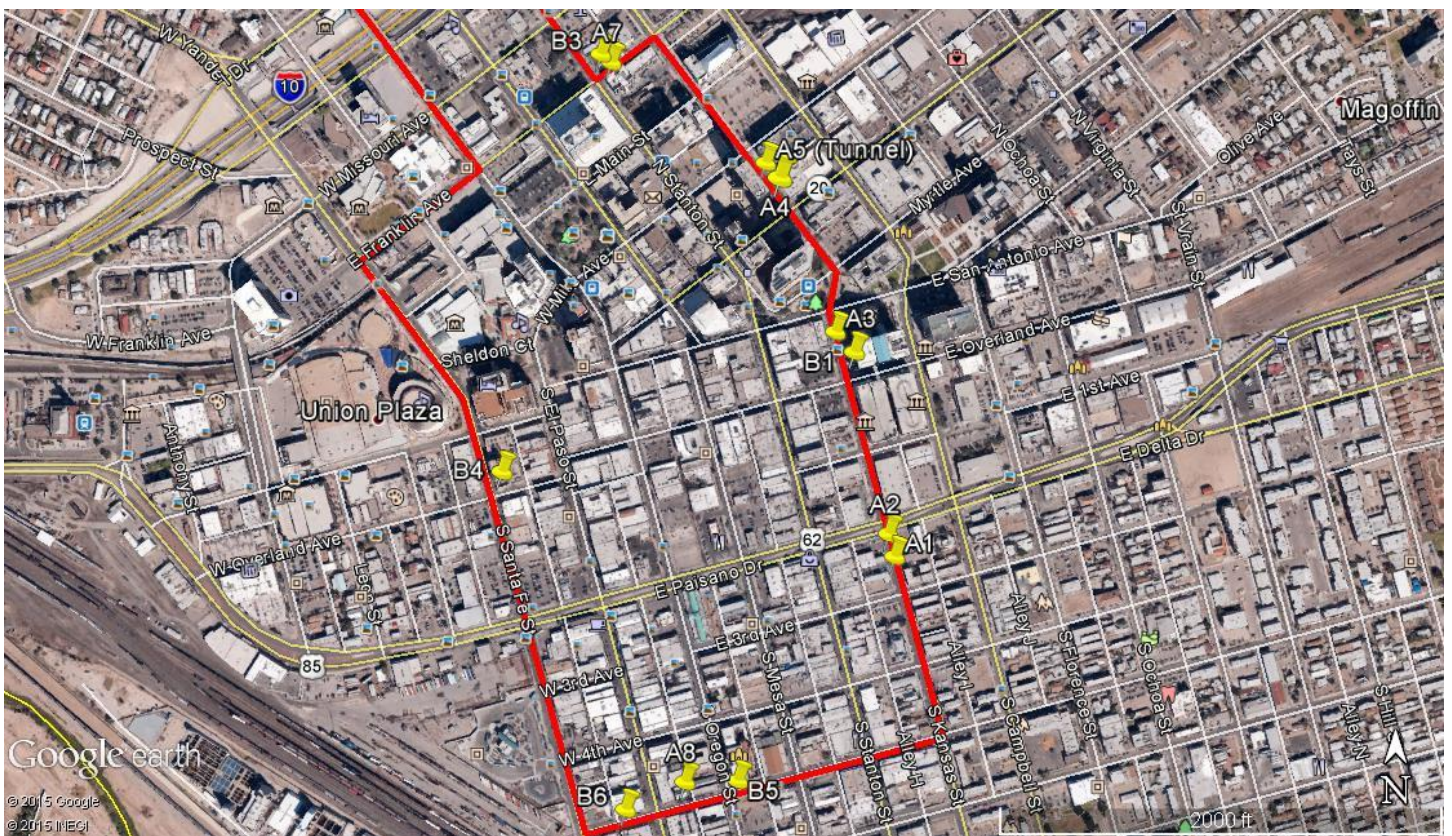
Attached with this report is an interactive .kmz file that can be used with Google Earth software to get a better understanding of our locations.

*Note: Two GPR units were employed simultaneously on this project. In order to avoid confusion during data processing, one data set was labeled A and the other B. You will see A1, A2, etc. as well as B1, B2, etc. in the photos and on the map.

Aerial Overview of Scan Area

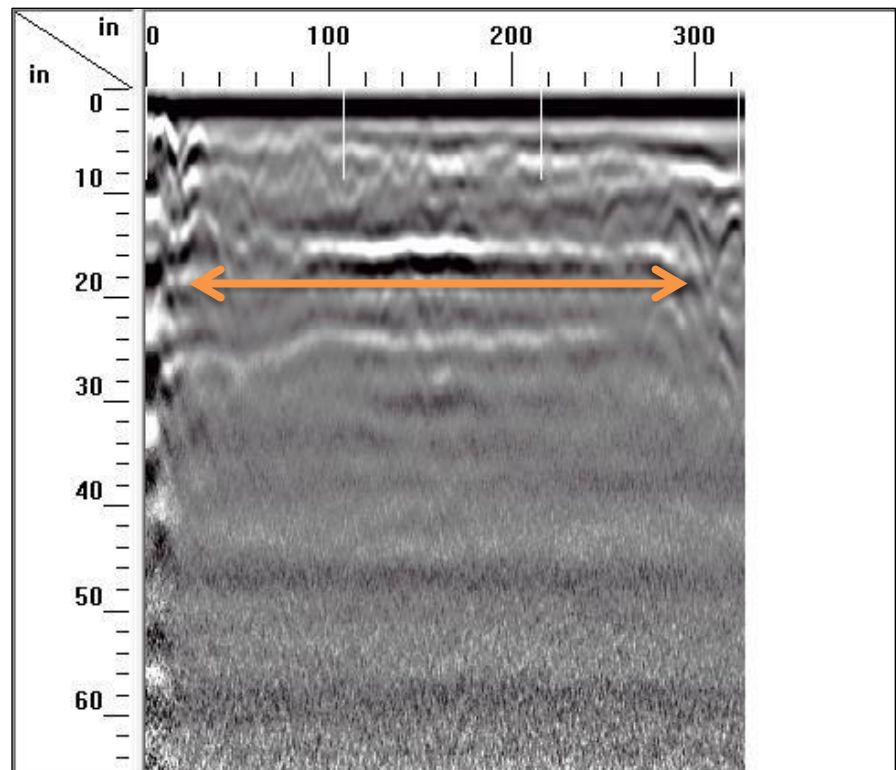
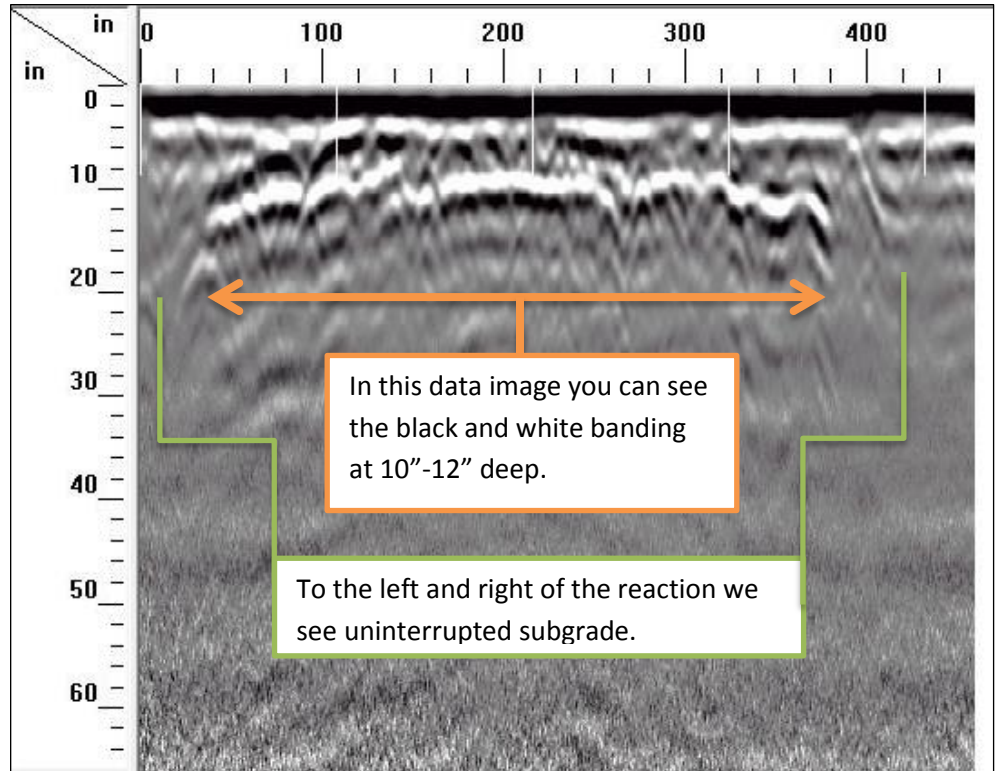
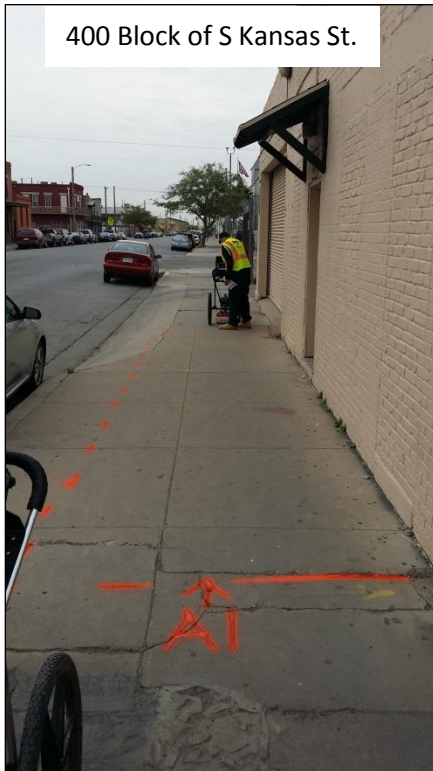


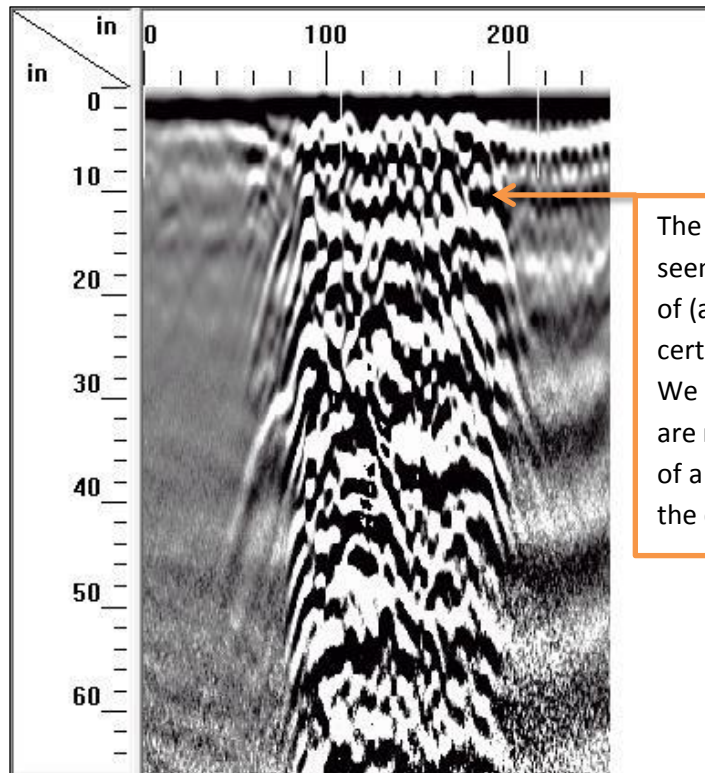
Aerial Overview of Findings



Understanding the Data

The following photographs and GPR data images were collected on site during the inspection. At each location we used orange spray paint to mark the boundaries of the reactions displayed on the GPR control unit. When viewing a data image notice the depth gauge on the left and the distance gauge on top, both set to inches. The first data image will provide the basis for understanding how we interpret the data. Again, it is important to note that it is possible that some of the reactions recorded are simply variations in soil content in the subgrade that have a significant difference in dielectric value from the surrounding soil. Destructive testing is recommended to confirm.



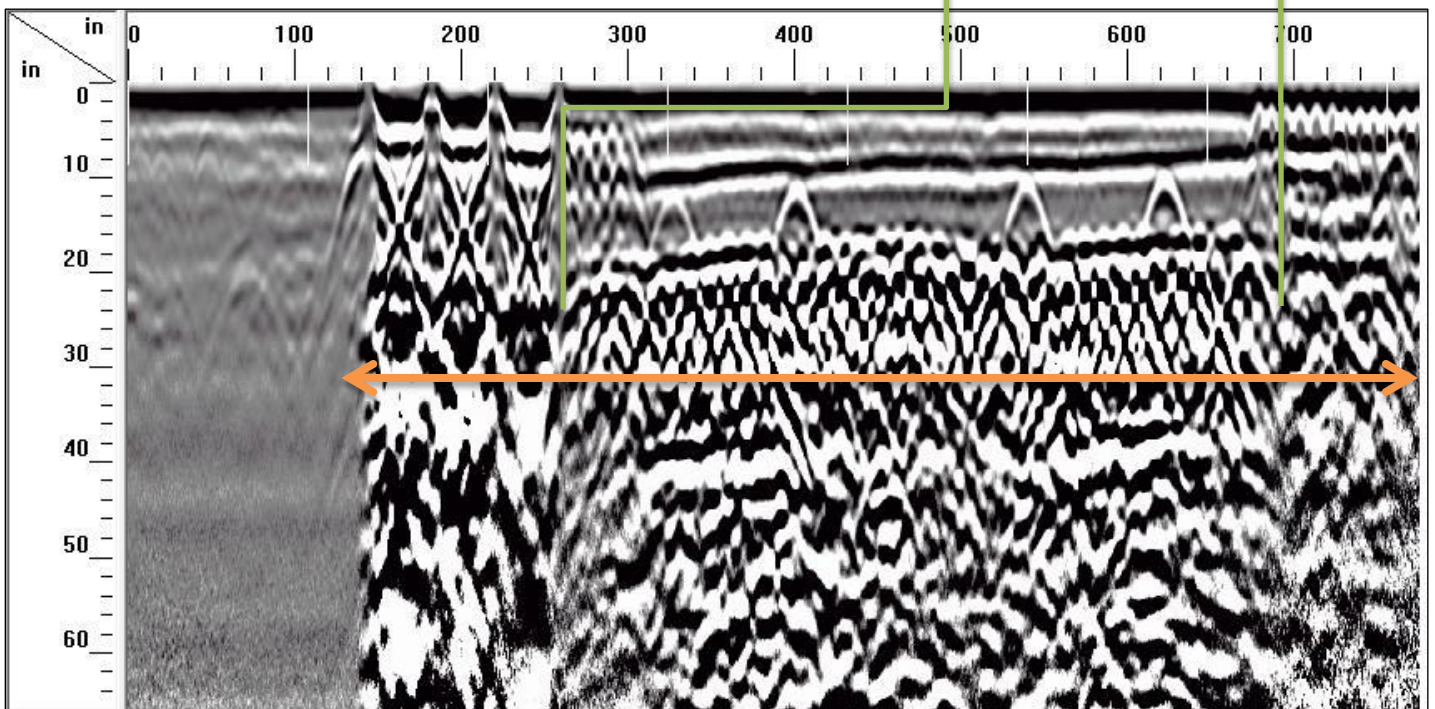


The type of reaction seen here is indicative of (and almost certainly is) air space. We can see that we are near the opening of a utility vault and the data confirms it.

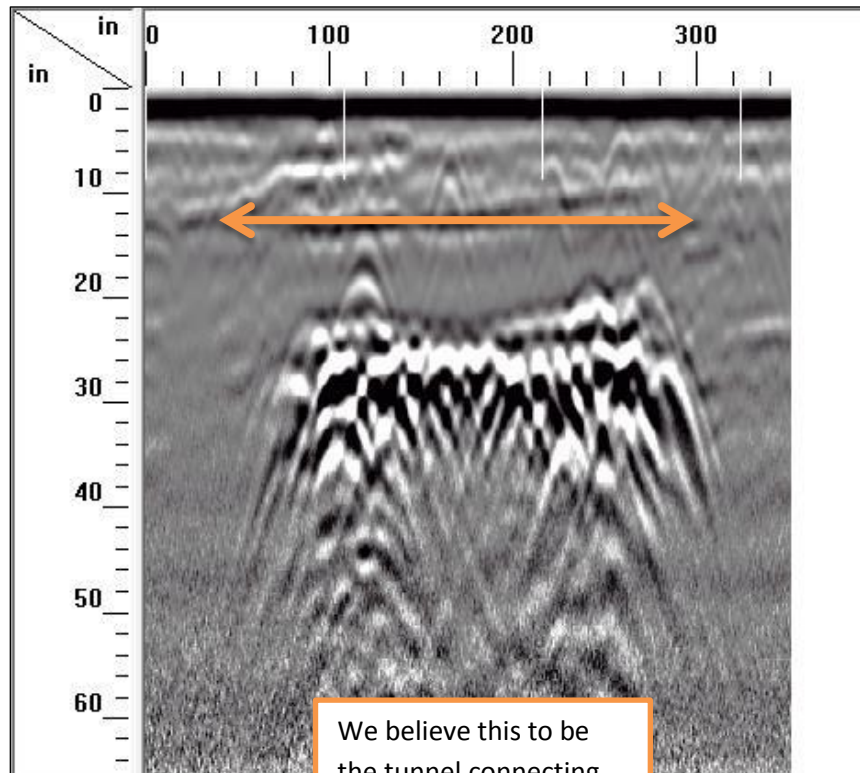


Another type of reaction that is indicative of (and almost certainly is) air space.

There appears to be two separate strata below the surface concrete before the void space appears.

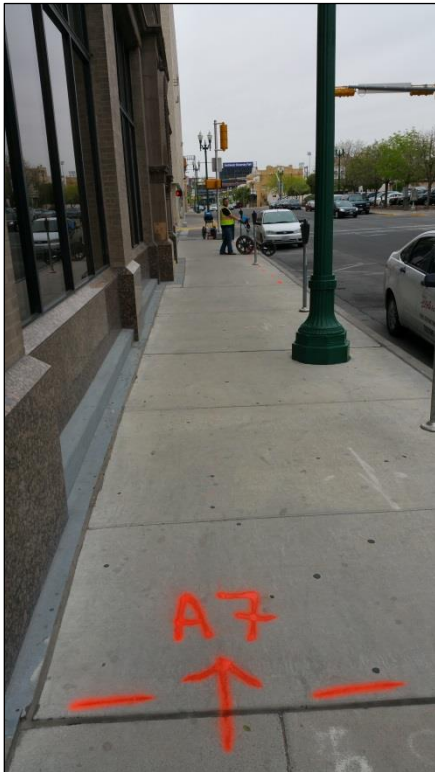


Wells Fargo Building

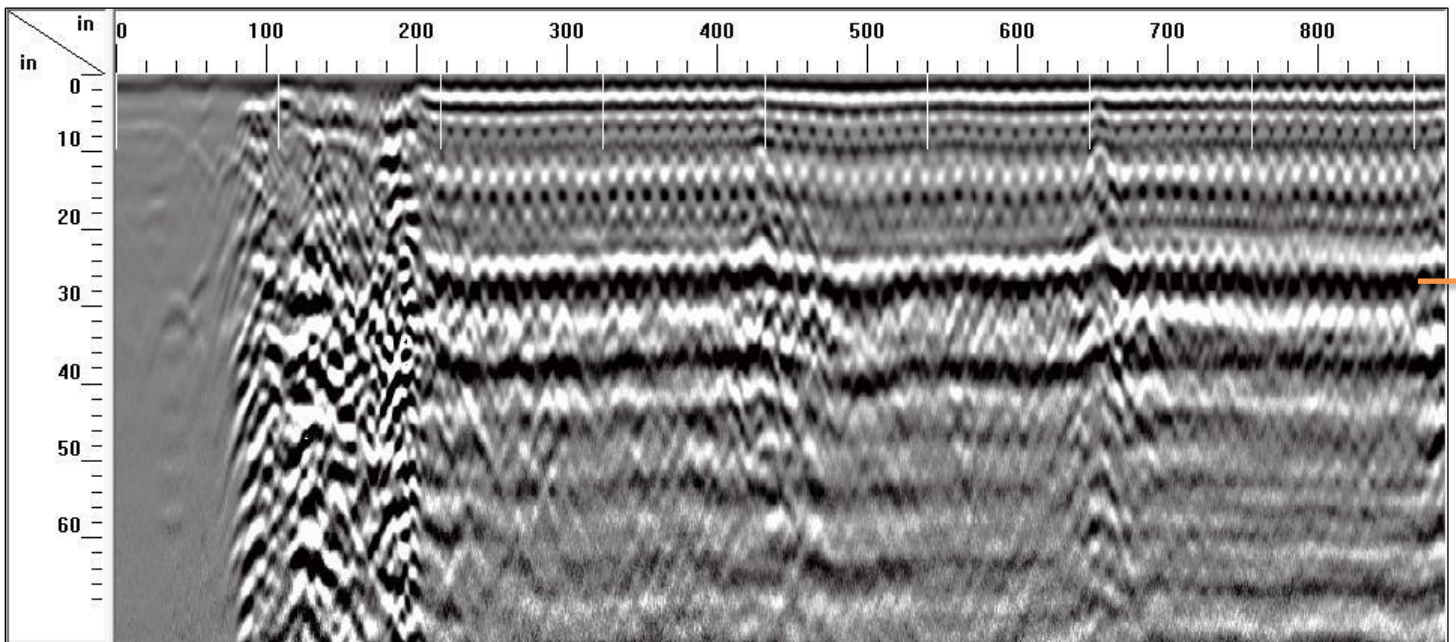


We believe this to be the tunnel connecting the parking garage to the Wells Fargo building.

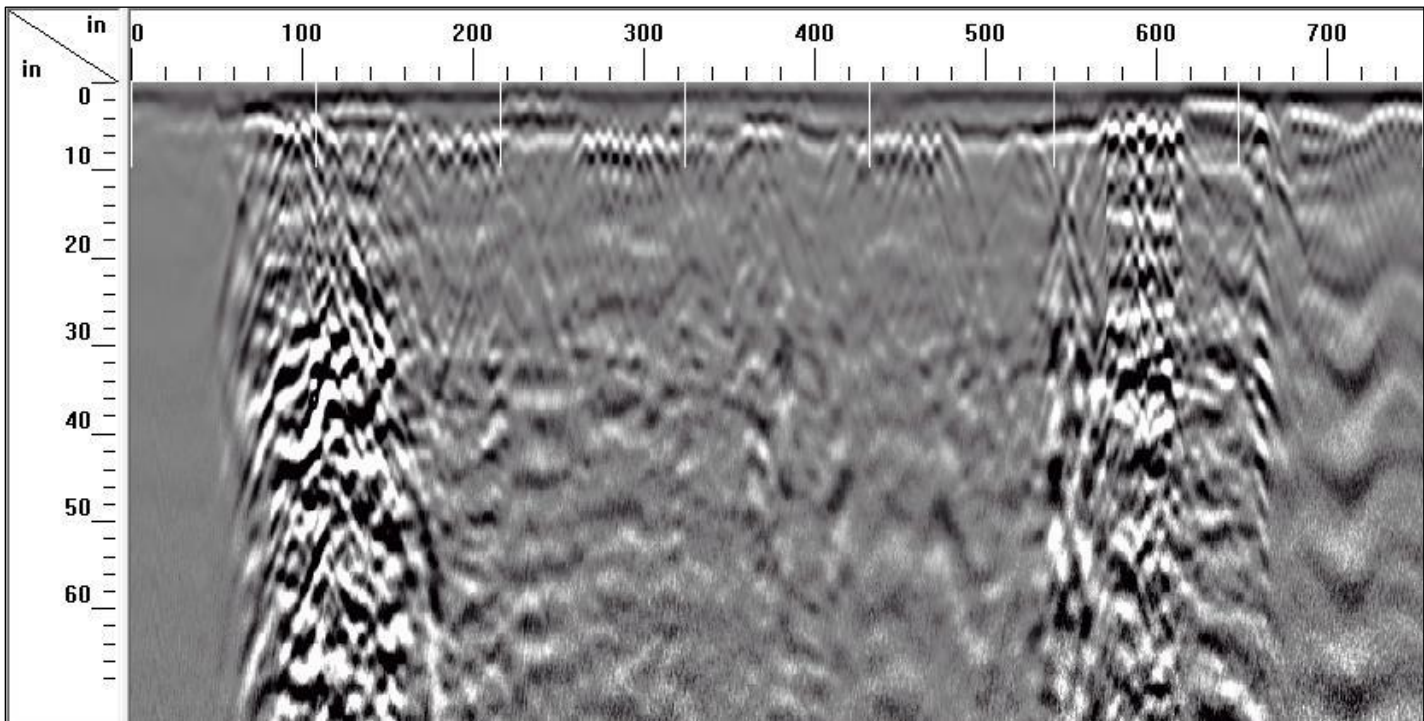
Banamex Building
416 N Stanton St.



This reaction spans the front of the building and extends to the parking meters. Void reaction at 24" depth.



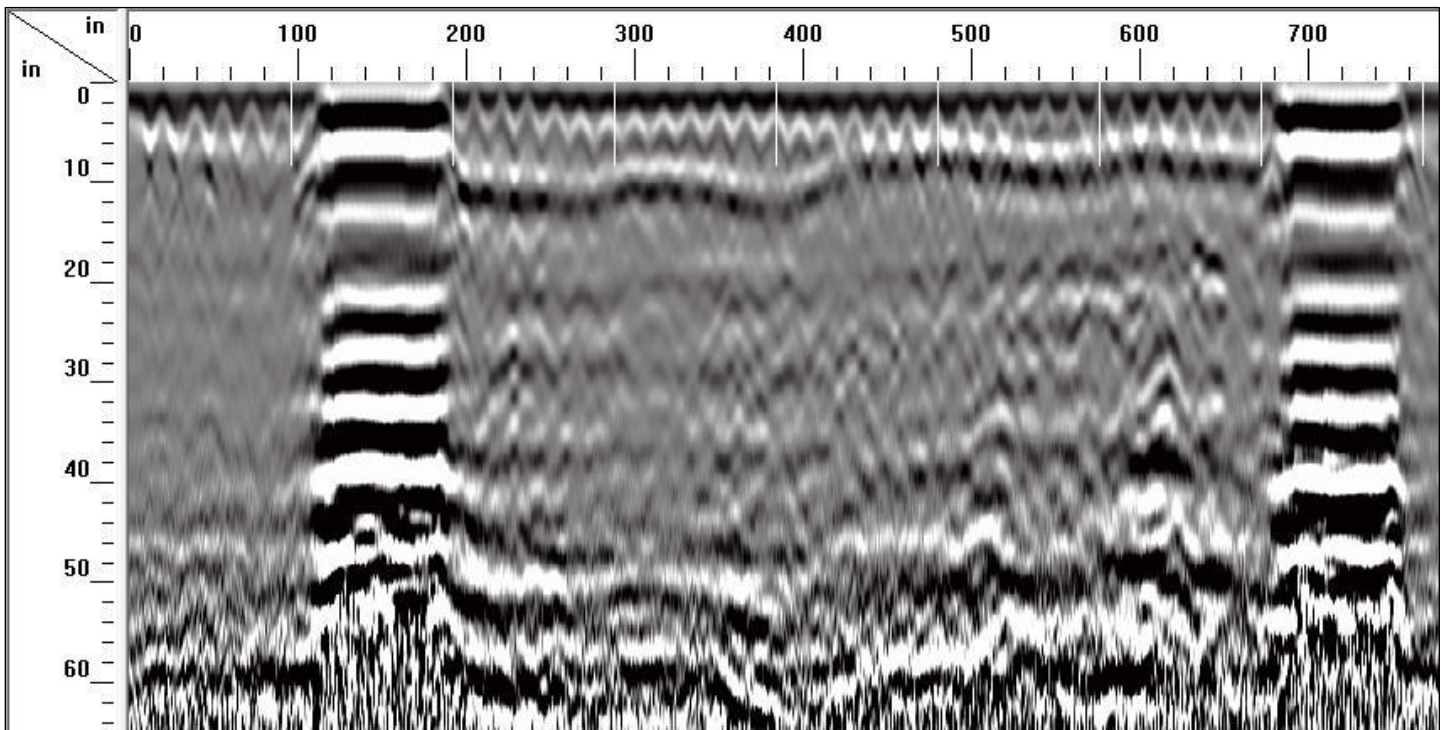
201 E Father Rahm Ave.



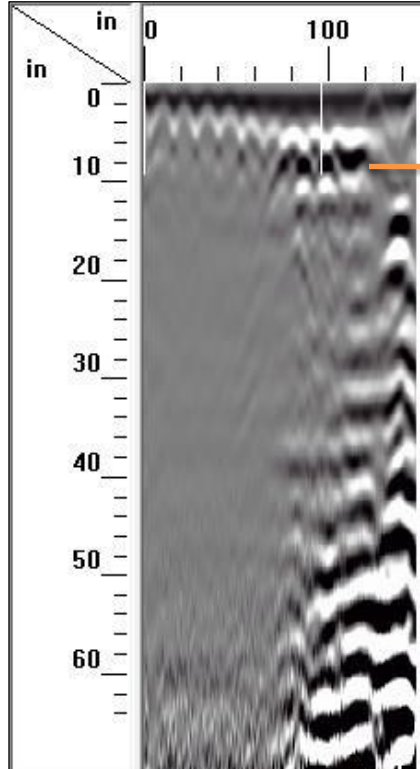
500 E San Antonio Ave.



This reaction spans the front of the building and by looking down through the vault covering you can see that is expansive.



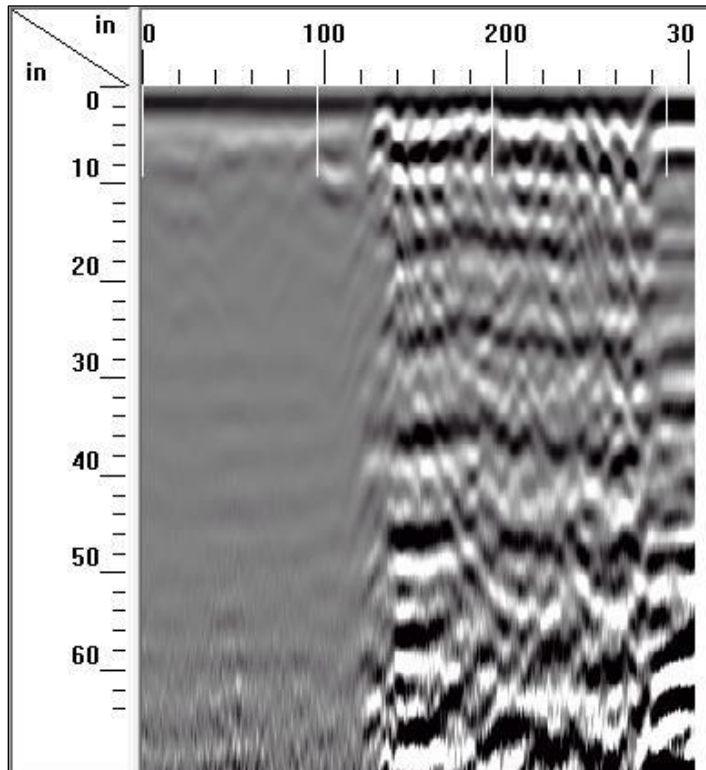
The Pizza Joint Downtown
500 N Stanton St.



Glass block in the concrete. You can see that there is basement space below.

Void space

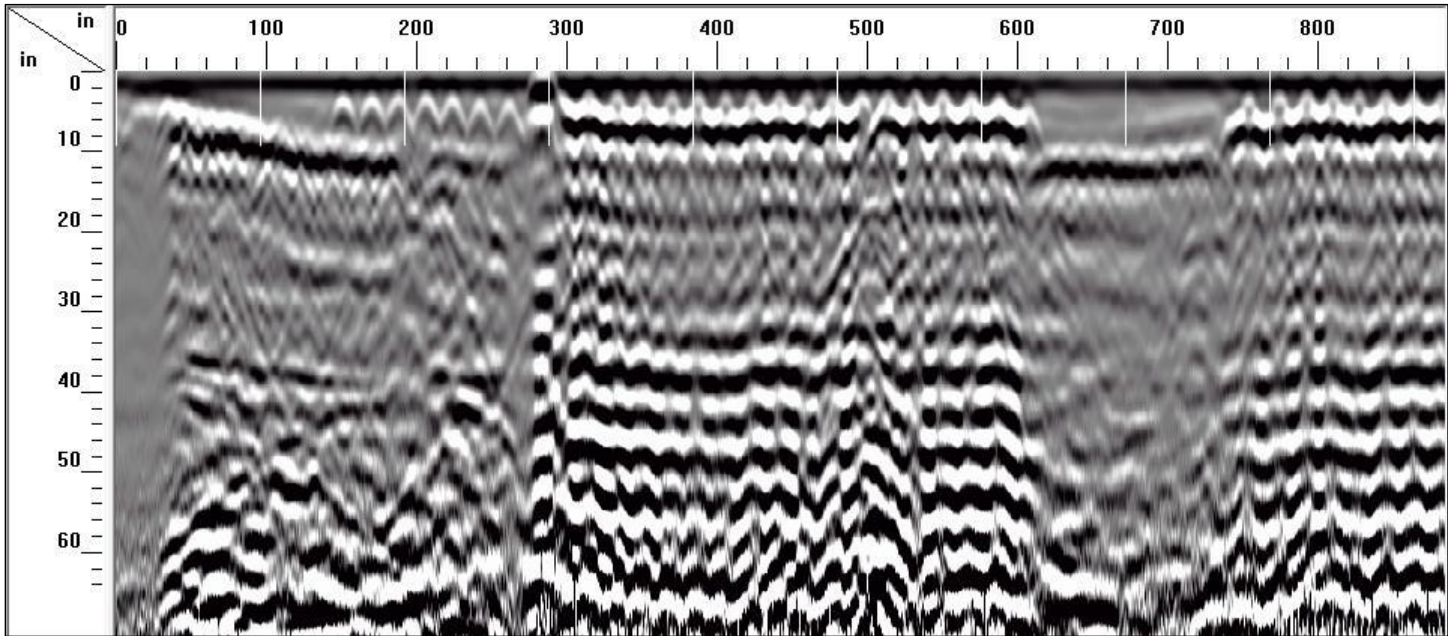
Another perspective of The Pizza Joint Downtown.



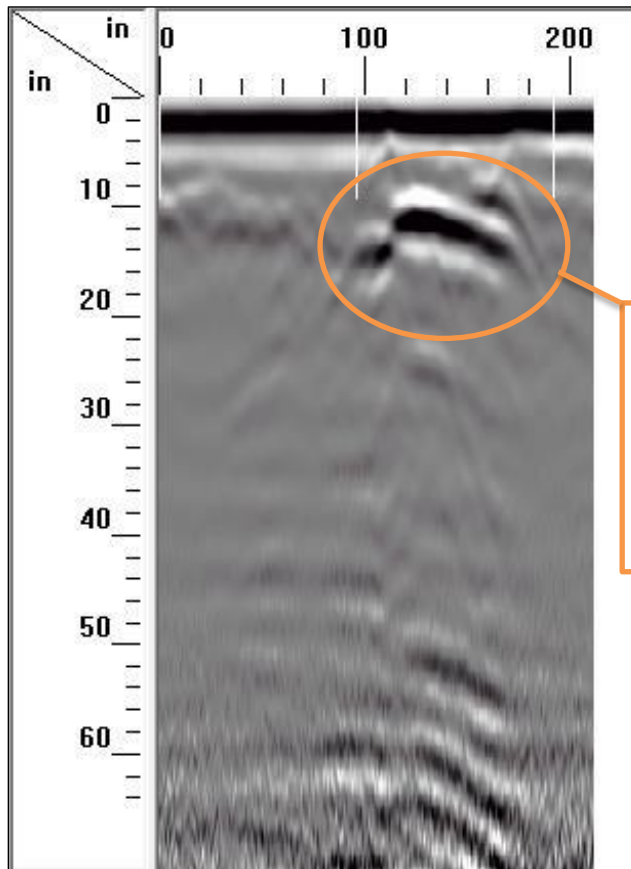
200 S Santa Fe St.



This reaction spans the entire building and extends to approx.. 2' off the curb.

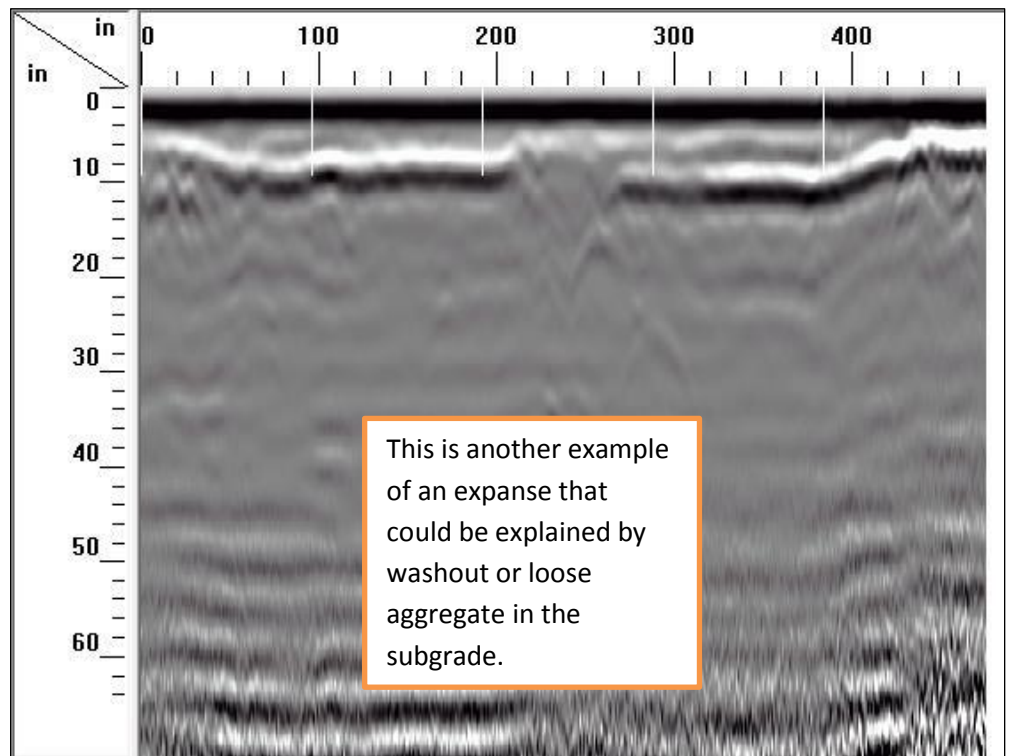


SE intersection of S Oregon St and Father Rahm Ave.



This reaction could simply be an area of washout below the asphalt, but it could also be a buried utility vault.

100 Block of Father Rahm Ave.



This is another example of an expanse that could be explained by washout or loose aggregate in the subgrade.