

GROUND PENETRATING RADAR IN CONCRETE

WHAT IS GPR?



GPR technology records the two-way travel time and amplitude of reflection of metallic and non-metallic targets within concrete.

2D OR 3D

Scanned data can be collected in 2D or 3D. Modern technology can even automatically analyze the data with augmented reality to give a clear view of what is inside the concrete. A 2D profile (a.k.a. line scan data) typically appears as a series of perpendicular targets (hyperbolas). A certified and trained expert should review the findings to confirm analysis.

RULES OF THUMB

THE 1:1 RATIO For every foot down, 1 inch in diameter is required to return a strong hyperbolic reflection of a potential target. For example, GPR can detect targets that are **1-in. diameter** (minimum) buried **1-ft. deep** in concrete. A mid-range antenna should provide sufficient resolution to find 4 to 5-in. pipes at 4 to 5-ft deep.

Stepped frequency continuous wave technology can improve depth to target and clarity.

FREQUENCY AFFECTS DEPTH & RESOLUTION

The lower the frequency = The deeper the signal penetration

The lower the frequency = The lower the resolution

The higher the frequency = The less signal penetration

The higher the frequency = The greater the resolution

When imaging in concrete and looking for very small reinforcing and conduits, it's recommended to use a higher frequency GPR antenna. This should offer greater detail too.

Frequency will determine application. A higher frequency is best for concrete inspection.

AVOID HAZARDS

When you need to DRILL, CUT, or BREAK UP concrete, it is essential to avoid hazards that may be contained within.



STRUCTURAL SUPPORTS

UTILITY LINES

VOIDS PIPES

REINFORCING BARS

POST-TENSION CABLES

SLAB THICKNESS

DEPTH TO TARGETS

METALLIC AND NON-METALLIC CONDUITS

TRUE STORY

One jackhammer mistake shut down the power to the kitchen of a 400-bed hospital, causing a \$200,000 bill for electrical repairs and food. A GPR scan of the area would have cost \$600 to \$700.

BTW: ESTIMATE ONLY

GPR isn't the ideal tool to calculate rebar size, the space between reinforcement bars, or differentiating between rebar to conduit. Other more accurate and easier instruments can be used in combination with GPR for a holistic approach to determine rebar diameter.

Having basic knowledge of building principles and knowing how reinforcements are laid out in construction are helpful in using GPR and assist interpreting the data correctly.

CSDA's GPR Methods & Theory Course covers the theory, proper procedures, industry standards, limitations, and case studies.

[CSDA.org/gpr-methods-and-theory](https://csda.org/gpr-methods-and-theory)



The Concrete Sawing & Drilling Association provides certification and resources like specifications, standards and best practices.

RESOURCES



csda.org/specifications

csda.org/gpr-certification

ADDITIONAL SOURCES

Ground Penetrating Radar is the Key to Concrete Cutting Safety - www.forconstructionpros.com/12252430

Rebar Detection Methodology - www.forconstructionpros.com/21903786

Ground Penetrating Radar Can Save Money and Avoid Hazardous Conditions on Jobsites - www.forconstructionpros.com/12207064

What to Know About Ground Penetrating Radar (GPR) - www.forconstructionpros.com/21627989

How to Choose the Right Antenna for Ground Penetrating Radar Jobs - www.forconstructionpros.com/21092148

Best Practices With GPR - www.forconstructionpros.com/22144287

We would like to acknowledge the subject matter experts, Bruno Silla of Geophysical Survey Systems Inc. (GSSI) and Ryan Hammer of Hard Rock Technologies, for reviewing this informational flyer. Both Silla and Hammer sit as chair on the GPR Committee Chair at the CSDA.

Disclaimer: This flyer was meant for informational purposes only. Consult the CSDA Best Practice document for further overview and additional methodology of the technology.

OTHER METHODS

GPR: Ground Penetrating Radar detects metallic AND non-metallic targets.

EC: Eddy Current detects only metallic targets.

DR: Digital Radiography detects the density of materials it passes through, metallic or not. Requires a detector on the opposite side and a safety license.

There is no perfect solution. It is always advisable to apply more than one method for best results.