



REMR TECHNICAL NOTE CS-ES-1.9

SYSTEMS FOR DETECTING STEEL EMBEDDED
IN CONCRETE

PURPOSE: To describe instruments capable of providing pertinent information about reinforcing steel embedded in concrete.

APPLICATION: With the exception of mass concrete gravity structures, most concrete requires steel reinforcement for tensile and/or flexural strengths. Therefore, instruments that provide information about steel embedded in concrete are potentially applicable to such structures, including those underwater.

Note: Detection devices discussed can be used to provide information about embedded steel components, such as pipes, prestressed cables, flues, steel linings, cables, etc. This technical note, however, does not cover elaborate nondestructive testing methods such as computerized tomography or ultrasonic and acoustic signaling.

ADVANTAGES: Devices which can be used to detect parameters of reinforcement steel embedded in concrete structures are valuable tools for quality assurance and in situ assessments. Such assessments include determination of the depth (concrete cover), location, spacing, and size of the embedded reinforcing steel.

Because reinforcing steel performs a specific function in concrete structures, placement of the steel is very important. Improper placement may compromise the integrity of the structure and can subsequently result in failure. Steel detection devices can verify specification compliance in terms of location and size of embedded steel.

Evaluation and/or rehabilitation of existing reinforced concrete structures may require coring, grinding, resurfacing or installation of anchors. Prior to conducting such work, it may be necessary to ascertain areas free of embedded steel. If construction drawings detailing the location of steel reinforcement are not available, such detection devices can prove advantageous.

Instruments that detect steel embedded in concrete can also be used to measure concrete cover (important in providing corrosion protection for embedded steel), to locate the exact position of reinforcing steel for a condition evaluation, and to measure the diameter of steel reinforcement (corrosion may cause an increase or decrease in the area of reinforcement; consequently, a change in measurement can indicate onset of corrosive activity).

LIMITATIONS: Most devices used to detect steel embedded in concrete are limited to a depth of about 10 in. The accuracy of some devices may be affected by miscellaneous items, such as steel form ties, wire ties for reinforcement support, aggregates with magnetic characteristics, etc. Reinforcement spacings of less than 5 or 6 in. may also affect the accuracy of measurement.

The size and weight of some devices make conducting evaluations for more than short-term durations difficult, especially overhead applications. The weight of the device places a physical strain on the operator to maintain measuring positions for prolonged periods. Finally, some devices have limited operating durations because the system rapidly drains the power source. Some battery-powered devices may be operated continuously only a few hours before the battery needs to be recharged or replaced.

PERSONNEL REQUIREMENTS: Only one operator is required to conduct evaluations with most devices that detect reinforcing steel embedded in concrete. No special training is required, and usually an operator becomes a competent user after only a few practice sessions.

EQUIPMENT DESCRIPTION: Devices that detect steel in concrete are commercially manufactured by several companies. These devices weigh from 1-1/2 to 40 lb. Generically, they are known as cover meters but are sometimes referred to as pachometers. Most transmit some sort of magnetic pulse through various types of probes. One particular device applies impulse radar. The signals are received, measured, and recorded by a meter or a chart recorder. Some newer versions incorporate microprocessors that perform instantaneous calculations. Other options include digital and audible signaling and additional probes. Newer versions are capable of compensating for temperature variations and magnetic aggregates, distinguishing between horizontal and vertical reinforcement and between steel bars and wire mesh, and resolving parallel bars into single bars.

COSTS: Below is a price list of some available steel detection devices and optional accessories.

- a. Profometer 3 (Fig 1)
Proceq SA Zurich
Description (includes standard spot probe):
 - 1. Dimensions (LxWxH) - 11.8 x 13 x 4.3 in.
 - 2. Weight - 4.4 lb
 - 3. Depth range - 9 in.
 - 4. Power source - 4 AA batteries (150 hr continuous operation)

Total cost: \$2,285.00

Optional equipment:

 - 5. Depth probe: \$345.00
 - 6. Diameter probe: \$900.00
 - 7. Calibration block: \$180.00
 - 8. Marker: \$125.00

- b. James HR Rebar Locator (Fig. 2)
James Instrument Inc.
Descriptions:
 - 1. Dimensions (LxWxH) - 10 x 6 x 4 in.
 - 2. Weight - 3.5 lb
 - 3. Depth range - 10 in.
 - 4. Power source - rechargeable storage battery (8 hr continuous operation)

5. Battery charger

Total cost: \$1,635.00

c. Magnetic Locator, Model GA-52B (Fig 3)
Schonstedt Instrument Company

Description:

1. Dimension (length) - 42-5/16 in.
2. Weight - 3 lb
3. Depth range - approximately 7 ft
4. Power source - 4 C batteries (50 hr continuous operation)

Total cost: \$785.00

d. Rebar Locator C-550
Brainard-Kilman

Description:

1. Dimensions (LxWxD) - 23 x 5-1.4 x 4-3/4 (including handle)
2. Weight - approximately 5 lb
3. Depth range - 8 in.
4. Power source - 6 AA batteries (10 hr continuous operation)

Total cost: \$295.00

Optional equipment:

5. Vinyl carrying bag - \$29.50
6. Carrying case - \$75.00
7. 3-1/2-in. coil cover - \$4.00
8. 8-in. coil cover - \$5.00
9. Body mount kit - \$20.00
10. Headphones (stereo) - \$25.00

e. SIR System - 3R, Radar Rebar Locator (Fig 4)
Geophysical Survey Systems, Inc.

Description:

1. Model PR-8315, Profile Recorder
Dimensions (LxWxD) - 17.5 x 17.5 x 10.5 in.
Weight - 50 lb
2. Model 3100, Transducers
Dimensions (LxWxD) - 6.5 x 4 x 1.5 in.
Weight - 4 lb
3. Model CC-15/11, Control cable
4. Depth range 1,000 mHz transducer, 18 in.
900 mHz transducer, 48 in.
5. Power source 110/220 Volts

Total cost: \$17,850.00

MANUFACTURERS: Listed below are some companies that market rebar locating devices.

- a. Metrotech Corp
670 National Avenue
Mountain View, CA 94043
Telephone: 415-940-4900
Fax: 415-962-9527

- b. Brainard-Kilman
P. O. Box 1959
Stone Mountain, GA 30086
Telephone: 800-241-9468 404-469-2720
Fax: 404-498-2841

- c. Geophysical Survey Systems
15 Flagstone Dr.
Hudson, NH 03051
Telephone: 800-524-3011 603-889-4841
Fax: 603-889-3984

- d. Soiltest Inc.
P. O. Box 8004
Lake Bluff, IL 60044
Telephone: 800-323-1242 708-295-9400
Fax: 708-295-9414

- e. Schonstedt Instrument Company
1775 Wiehle Avenue
Reston, VA 22090
Telephone: 703-471-1050
Fax: 703-471-1795

- f. SDS - Nondestructive Testing (Distributor)
P. O. Box 844
Paso Robles, CA 93447
Telephone: 805-238-3229
Fax: 805-238-3496

- g. James Instruments Inc.
3727 North Kedzie Avenue
Chicago, IL 60618
Telephone: 800-426-6500 312-463-6565
Fax: 312-463-0009



Figure 1. Profometer 3
(PROSEQ SA Photo courtesy
of SDS Company)



Figure 2. James HR Rebar Locator
(Evanston Photographic Studios, Inc.
Photo courtesy of James Instruments, Inc.)



Figure 3. Magnetic Locator
(Photo courtesy of Schonstedt Instruments Co.)



Figure 4. SIR System-3R, Radar Rebar Locator
(Photo courtesy of Geophysical Survey Systems, Inc.)