

## Purpose

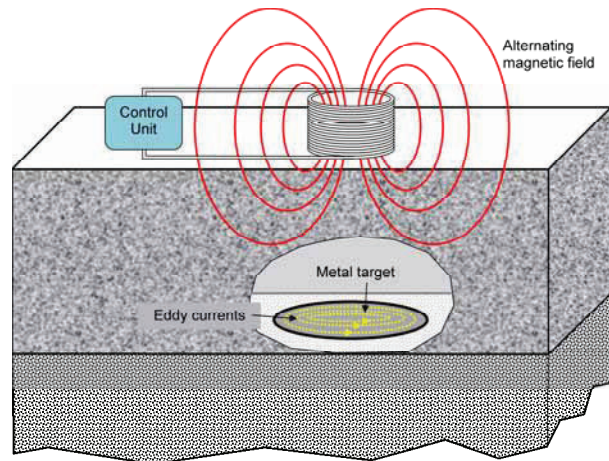
**Eddy-Thick** is a lightweight portable device for measuring the thickness of concrete slabs-on-ground. The device was also developed by MIT Mess- und Prüftechnik GmbH. The system uses metal targets that are placed on the supporting base before concrete is placed. After the concrete has hardened sufficiently to support the weight of a person, the instrument is used to locate the target and then to measure the thickness of the slab. **Eddy-Thick** can be used for the following purposes:

- Measurement of pavement thickness in support of performance-based specifications
- Measurement of slab thickness for the purpose of determining the stress-wave velocity of the concrete for use with stress-wave based methods for measuring thickness at other locations
- On-site quality control of pavement thickness



## Principle

**Eddy-Thick** is based on the pulse-induction technique that is used for measuring cover over reinforcing bars (see page 33). In this case, eddy currents are induced in a metal plate (target) resting on the base instead of reinforcing bars in the concrete. For a given target, the amplitude of the signal induced by the decaying eddy currents in the target is proportional to the distance from the surface to the plate. Targets can be round or rectangular pieces of aluminum foil or plates of aluminum or steel. The target material and target size will affect the amplitude of the response for a given concrete thickness. Before using the instrument, the operator uses the menu system to select the target from a pre-defined list. If a target is used that is not included in the pre-defined targets, a standardization procedure is required to define a correction factor to be applied to the depth calculated using a pre-defined target (see the FHWA reference at the end of this section).



The sensor head of the instrument is housed in a three-wheeled enclosure that is rolled along the concrete surface. The head includes four sensors that make many measurements as the head passes over the target. From the multiple measurements and the known characteristics of the target, the depth of the target is calculated and shown on the LCD on the instrument handle. The depth measurement accuracy is 0.5 % of the measured value plus 1 mm. For example, for a 200 mm nominal depth slab, the measurement accuracy is  $\pm 2$  mm.

Because of the high sensitivity of the instrument, there should not be any other embedded metal objects within 1 m of the target plate. In addition, there should be no parked vehicles within 2 m and no construction equipment within at least 4 m of the test point. Operators should not wear steel-toed shoes because they can affect instrument response. Measurement accuracy is not affected by wet surfaces and measurements can be made on hydraulic cement concrete or asphalt cement concrete.

## Method of operation

The targets are placed on the prepared base before concrete placement. The number and locations of targets depend on the purpose of the thickness measurements and should be stated clearly in the contract documents for the project. The size of the target to be used depends on the nominal

## Eddy-Thick

thickness to be measured. The following circular targets made of 0.65 mm thick sheet metal are available for different slab thickness measurements:



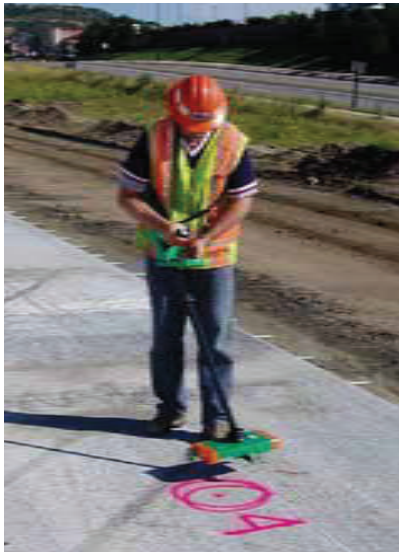
Target ID	Target Diameter, mm	Depth Measurement Range, mm
ST RO 07	70	15 to 120
ST RO 12	120	40 to 180
ST RO 30	300	120 to 350

**Eddy-Thick** can be operated in two modes:

- **SEARCH**—This mode is used to locate the approximate center of the embedded target.
- **MEASUREMENT**—This mode is used to measure the depth of the target.

In the **SEARCH** mode, the sensor head is elevated above the concrete surface and moved across the surface in a sweeping motion as is done with a common "metal detector." The instrument is in a continuous sampling mode and the LCD shows a bar graph of the amplitude of each of the four sensors. When the head is located at the approximate center of the target, each bar will have equal amplitude.

After the target is located, the sensor head is positioned on the surface of the concrete at approximately 300 mm in front of the target edge. **Eddy-Thick** is then placed in the **MEASUREMENT** mode, and the search head is rolled over the target until the sensor head is about 1.8 m from the start position. During the scan, data are automatically recorded. When data recording is completed, the depth is calculated and displayed in the LCD. The following summarizes the measurement process:



*SEARCH mode to locate target*



*MEASUREMENT mode to measure thickness*



*Display of measured thickness*

**Evaluations**

**Eddy-Thick** (also called MIT Scan T-2) was evaluated by the FHWA Concrete Pavement Technology Program and by Caltrans. In both cases, it was concluded that the device was easy to use and resulted in accurate thickness measurements (see References).

**Eddy-Thick Specifications**

- Measurement range: 15 to 350 mm depending on target size
- Accuracy:  $\pm(0.5\%$  of measured thickness plus 1 mm)
- Operating temperature range: -5 to 50 °C
- Memory capacity: up to 16,000 test results
- NiMH rechargeable batteries with approximately 8 h of operation
- Interface for data transfer to PC

**Eddy-Thick Ordering Numbers**

Item	Order #
Basic measurement system including: <ul style="list-style-type: none"> <li>• Sensor head and control unit</li> <li>• Battery recharger</li> <li>• Microcontroller firmware</li> <li>• Carrying case and strap</li> <li>• User manual</li> </ul>	ET-001
Cable for data transfer to PC	ET-002
Software for data transfer to PC	ET-003
Charging system for use with 12 V auto battery	ET-004
Printer with charging unit and thermal paper	ET-005
Targets: diameter <ul style="list-style-type: none"> <li>• 70 mm</li> <li>• 120 mm</li> <li>• 300 mm</li> </ul>	ET-ST R0-07 ET-ST R0-12 ET-ST R0-30



**References**

FHWA Concrete Pavement Technology Program, 2009, "TechBrief: Determination of Concrete Pavement Thickness Nondestructively Using the Magnetic Imaging Tomography Technique," [www.fhwa.dot.gov/pavement/concrete/pubs/hif09023/index.cfm](http://www.fhwa.dot.gov/pavement/concrete/pubs/hif09023/index.cfm)

Rao, S. and Kumar, T., 2007, "Final Report—Method to Determine Pavement Thickness Using Recommended Technology," Division of Engineering Services, Caltrans, Sacramento, CA.

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