

TIG

Embedded Data Collectors



**Wireless Pile Monitoring to Improve  
the Quality of Driven Foundations**



## What is an Embedded Data Collector?

Embedded Data Collectors are gauges built into prestressed concrete bridge piles that detect and report, to a computer monitor onsite, levels of stress as the pile is driven into the ground. Traditionally, gauges are added to the top exterior of a pile just prior to driving, and reports are reviewed afterward. EDC gauges can detect signs of potential pile tip damage significantly earlier than top-gauge-only systems, which can increase the quality of the driven foundation.

As a pile monitoring system, Embedded Data Collectors give both owner and contractor new options for the design, construction and quality control of prestressed concrete piles.

First recognized by TIG in 2007, recent advances in Embedded Data Collector technology speed the delivery of critical information in the field, promoting a responsive process. The system tracks the change in strain/stress within the pile during the driving process, alerting the operator to control the hammer energy or stop the process to prevent further damage.

Embedding top and tip devices also eliminates the time and risk of manual placement of gauges in the midst of a pile driving operation.

Embedded Data Collectors offer the capacity to test a large number of piles in a labor and time efficient manner and require less expert time in the field. Future testing throughout the life cycle of the pile may also be possible. In short, the potential for improvements in time, cost, installed pile quality and worker safety is substantial.

## What's different about Embedded Data Collectors?

With embedded top and tip gauges—and wireless communication in real time to a laptop onsite—operators can employ Embedded Data Collectors to achieve a more accurate assessment of side friction and tip components while in the process of driving prestressed concrete piles.

## How do I know if Embedded Data Collectors work?

Embedded Data Collectors work because the technology was developed, tested and successfully adopted by your peers. The AASHTO Technology Implementation Group assembled these innovators on a team that is standing by now to help you deliver the benefits of EDC to your colleagues and customers.

## We use PDAs. How do I know that Embedded Data Collectors are a solution that will “fit” in my agency?

Embedded Data Collectors have now been in use for seven years in three State transportation agencies with excellent results. This experience has helped clarify good applications for the technology as well as providing lessons learned in deploying it. Every agency is different. That's why the AASHTO TIG Embedded Data Collector team is available to provide technical assistance with your agency's use of the technology.

## What kind of results can I expect to see from the use of Embedded Data Collectors?

For every blow, the system will provide capacity, stresses, energy transferred, stroke and integrity conditions. For an instrumented pile, no signal match analysis is required to determine capacity since the UF capacity is considered the actual capacity of the pile. In addition, the system can provide the user with actual integrity conditions at the tip of the pile.

## Where do Embedded Data Collectors work best?

Embedded Data Collectors work only in concrete piles, where a reinforcement is available to attach the internal instruments. Economic benefits are generally greater in large projects employing 100% dynamic testing.

## Who else is using Embedded Data Collectors?

Embedded Data Collectors are now in use by transportation agencies in Virginia, Minnesota, Florida and North Carolina.

## What equipment and software is typically required to use Embedded Data Collectors?

An information acquisition system consisting of a heavy duty laptop computer outfitted with a signal receiver is the standard equipment configuration. The computer is loaded with acquisition and review software to collect and display data to the user. This system can generally be rented from the vendor.

## Is there any documentation for Embedded Data Collectors that my agency might adapt for its purposes?

The AASHTO TIG Embedded Data Collector website includes sample documents for your review. These include:

- FDOT standard index 20602.
- FDOT specifications 455, SP 455 for DB, SP for 100% dynamic testing with and without test piles.
- FDOT Structures Manual, Volume I Structures Design Guidelines, section 3.5.6

These documents are also available at the FDOT Structures Design and FDOT Specifications web sites.

## What are the benefits of Embedded Data Collectors overall?

Embedded Data Collectors improve worker safety, provide real time data in the field that allows critical adjustments to be made during the pile driving operation, reduce the time and labor required to test multiple piles, and help create a picture of conditions that can be valuable in driving subsequent piles during the same operation. Clearer data on how the pile is performing as it is driven can help reduce expensive – and sometimes dangerous – damage and repairs over time. By tracking the tip strain gauge and the tip prestressed





load losses, Embedded Data Collectors provide a warning when piles are becoming damaged during the driving operation. Embedded Data Collectors may also provide condition data over the life cycle of the pile.

## What are the benefits of Embedded Data Collectors to Contractors?

Embedded Data Collectors improve worker safety because they eliminate the need to climb leads. Time and labor required to test multiple piles is reduced for the same reason.

Onsite, in-process condition data speeds construction operations. Yet, in terms of complexity, heavy equipment and skill, the Contractor will experience virtually no difference between driving a set of uninstrumented piles and a set of Embedded Data Collector instrumented piles.

In design build projects, Embedded Data Collectors provide an alternate means of dynamic testing, encouraging competition between at least two systems. This is conducive to lower instrumentation costs.

Embedded Data Collectors are also very well suited for projects employing 100% instrumentation. This allows lower required nominal resistance loads, which can translate to shorter piles. Driving problems and impacts to adjacent structures may be minimized by using 100% instrumentation. Conversely, higher factored loads per pile may be used, requiring fewer piles.

## What are the benefits of Embedded Data Collectors to Owners?

Embedded Data collectors provide real time data in the field that allows critical adjustments to be made during the pile driving operation.

The system provides a timely warning when a pile begins to suffer damage at the tip.

Embedded Data Collectors are well suited to 100% instrumentation projects, which allows the use of lower required nominal resistance loads. Driving problems and impacts to adjacent structures may also be minimized through 100% instrumentation.

Agencies currently paying a contractor separately to furnish the labor and equipment required to attach external instruments to a pile for dynamic testing can eliminate this budget item with Embedded Data Collector instrumented piles.

In conventional “design bid build” projects, Embedded Data Collectors provide an alternative method of dynamic testing. This encourages competition between systems, which is conducive to a reduction in instrumentation costs.

Finally, Embedded Data Collectors will reduce the cost of analysis since they eliminate the need for signal matching to determine capacity on an instrumented pile.

## I might be interested in trying Embedded Data Collectors on a project. Where do I start?

The AASHTO Technology Implementation Group assembled the innovators of Embedded Data Collectors on a team that is standing by now to help you deliver the benefits of the technology to your colleagues and customers. The following professionals are ready to provide peer-to-peer assistance as you plan for or initiate an Embedded Data Collector project:

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