

FDOT METHOD OF INDEPENDENT SEPARATION OF TIP AND SKIN CAPACITIES OF DRIVEN CONCRETE PILE WITH EMBEDDED SENSORS



Embedded Data Collector (EDC) Technology-Introduction

The EDC technology collects data from internal embedded sensors located at both the tip and top of a pile, a wireless radio transmitter, a receiver, and laptop software. Using this data, FDOT method of analysis, explained below, provides independent tip and skin Capacities.

The basis of this analyses: force and energy conservation using the tip instrumentation to extract static tip capacity and non-linear wave equations solutions using both tip and top instrumentation to extract the static skin friction.

Superposition Principle

- From the FDOT method of analysis results, LRFD ϕ for EOID Tip Capacity and BOR skin Capacity are determined
- This advancement makes it possible to add Tip and Skin Capacities to obtain an optimum total pile capacity.

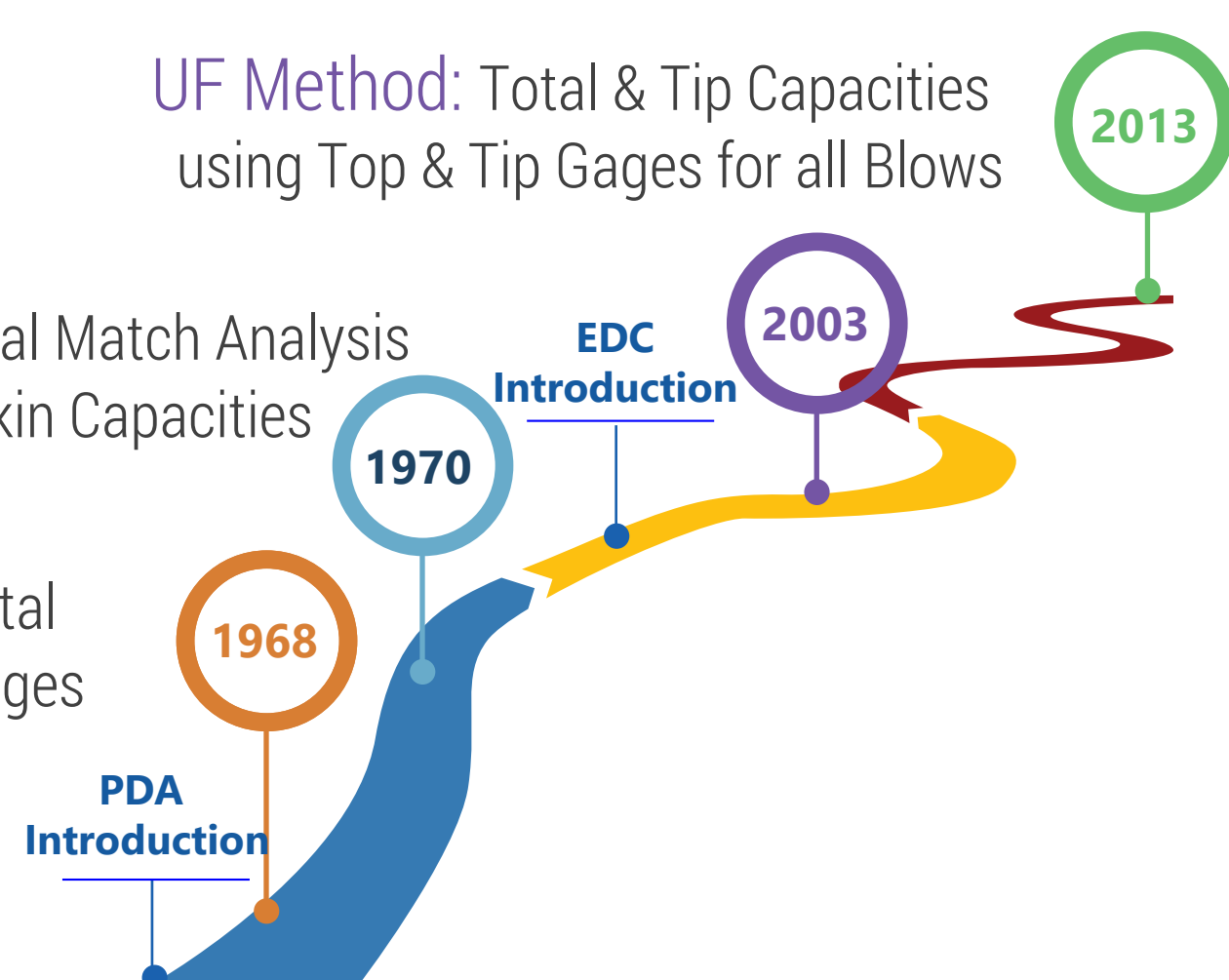
Chronological Advancement of Instrumented Dynamic Testing (Goly, Putcha 2017)

FDOT Method: Independent Tip & Skin Capacities using Top & Tip Gages for all Blows

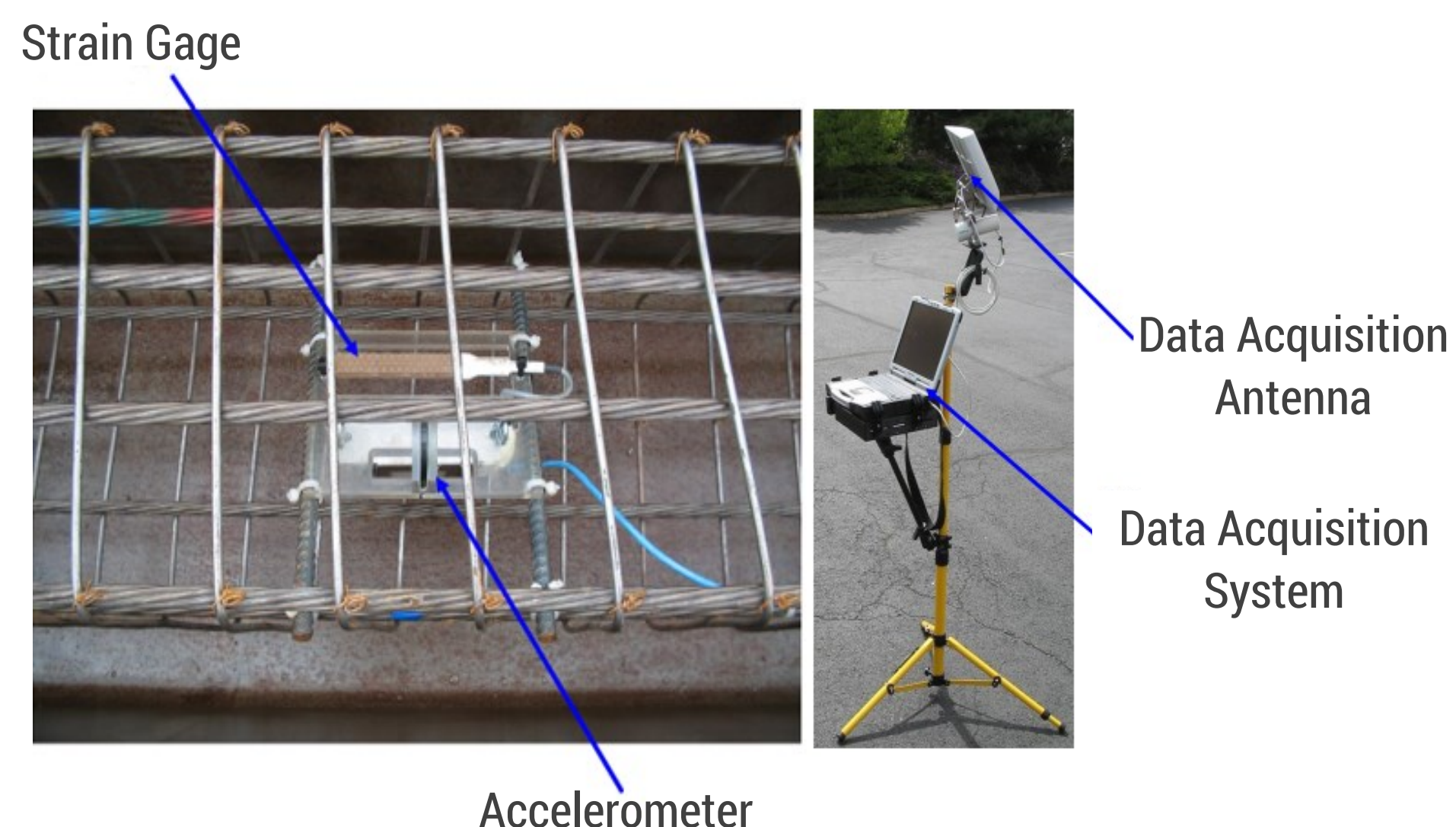
UF Method: Total & Tip Capacities using Top & Tip Gages for all Blows

CAPWAP: Reverse Signal Match Analysis for estimation of Tip & Skin Capacities

Case Method: Only Total Capacities using Top Gages



Wireless EDC Technology



Sensor pack consisting of accelerometer, strain gage and temperature sensor embedded before concrete placement (FDOT-UF 2002)

Estimating Static Tip Capacity of Driven Piles with Pile Tip Instrumentation

(Tran, McVay, Herrera, and Lei, Canadian Geotechnical Journal, Vol. 49, April 2012)

Use of Force Equilibrium and Energy to Assess Static Tip Resistance

$$F_{inertia}(m\ddot{x}) + F_{damping}(c\dot{x}) + F_{static}(kx) = P(t) \quad \text{Force Equilibrium}$$

$$\int (m\ddot{x} + c\dot{x} + kx) dx = \int P(t) dx \quad \text{Energy Equilibrium}$$

obtained from the tip gage

Total Pile Capacity Determination (a Snapshot of the FDOT Method Results)

Tip Capacity vs. Displacement: Blow #311
Skin Capacity vs. Displacement: Blow #321 (Restrike)

