# Field experience of the piezoball in soft clay

C. Colreavy[1]*; C.D. O'Loughlin[1]; M. Long[2]; N. Boylan[3]; D. Ward[4]


(a)


(b)

Figure 1. (a) CPT mounted truck (In Situ SI Ltd.); (b) Piezoball (∅ = 113 mm) showing equator, mid-face and tip filter positions

## Introduction

The advantages of using full flow penetrometers in assessing undrained shear strength ($s_u$) have been amply demonstrated. Recently, piezoballs (a ball penetrometer with pore pressure sensors) have been introduced which allow for pore pressure measurements.

The aim of this research was to:

- Compare results of piezoball (Figure 1) penetration tests with piezocone (CPTu) data as well as other in situ and laboratory test results for two soft soil sites in Ireland (Figure 2), and
- Assess merits of using piezoball dissipation tests over conventional CPTu to determine consolidation characteristics of soft soil.

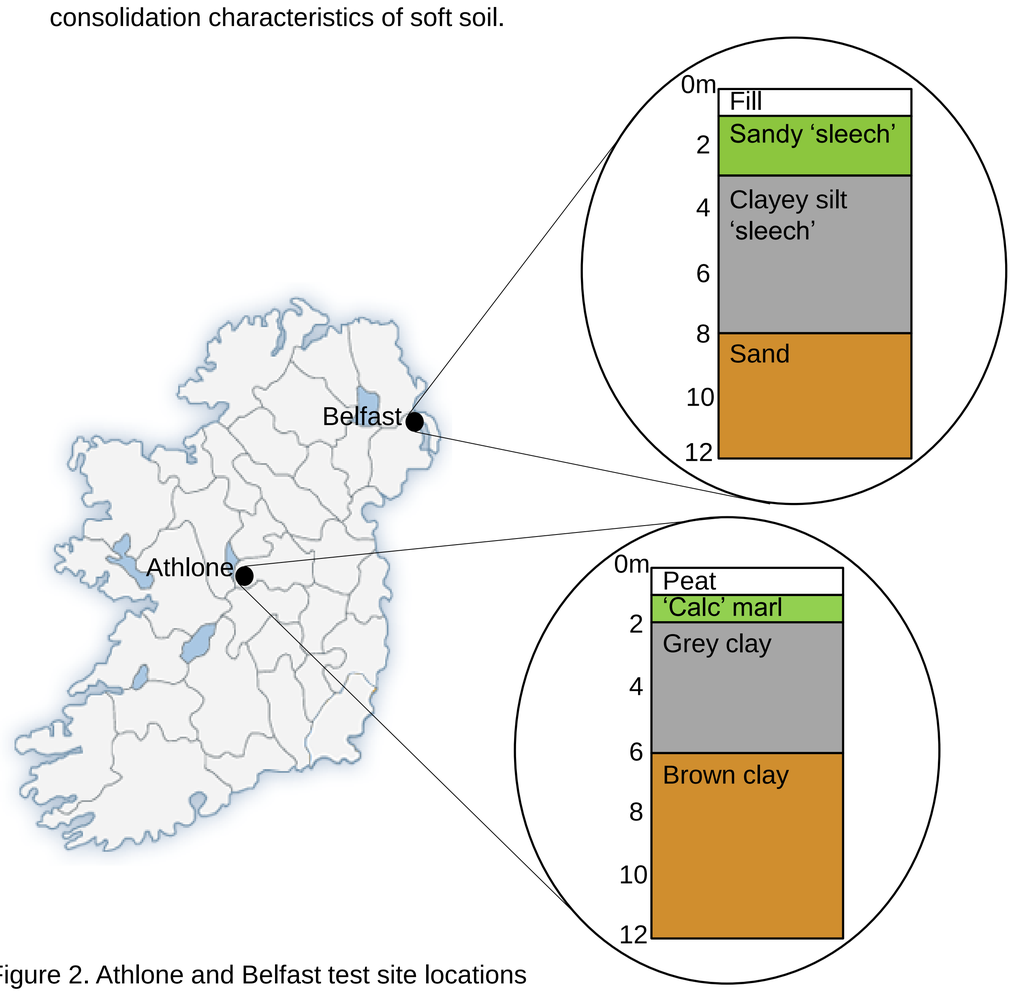


Figure 2. Athlone and Belfast test site locations

## Results

The main findings of the research were:

- In Athlone, piezoball and Tbar resistances are broadly similar, whilst CPTu resistance is higher. At Belfast, piezoball profile plots higher than CPTu profile (Figure 3).
- Piezoball pore pressure profiles consistently plot lower than CPTu profiles at both sites (Figure 3).
- Piezoball and Tbar $s_u$ profiles for Athlone are in good agreement. In Belfast, the piezoball $s_u$ profile is in reasonably good agreement with the CPTu profile and in particularly good agreement with vane results (Figure 4).
- Piezoball and piezocone normalized time factors are similar; the rate of dissipation is faster around the ball than around the cone when different diameters are accounted for (Figure 5).

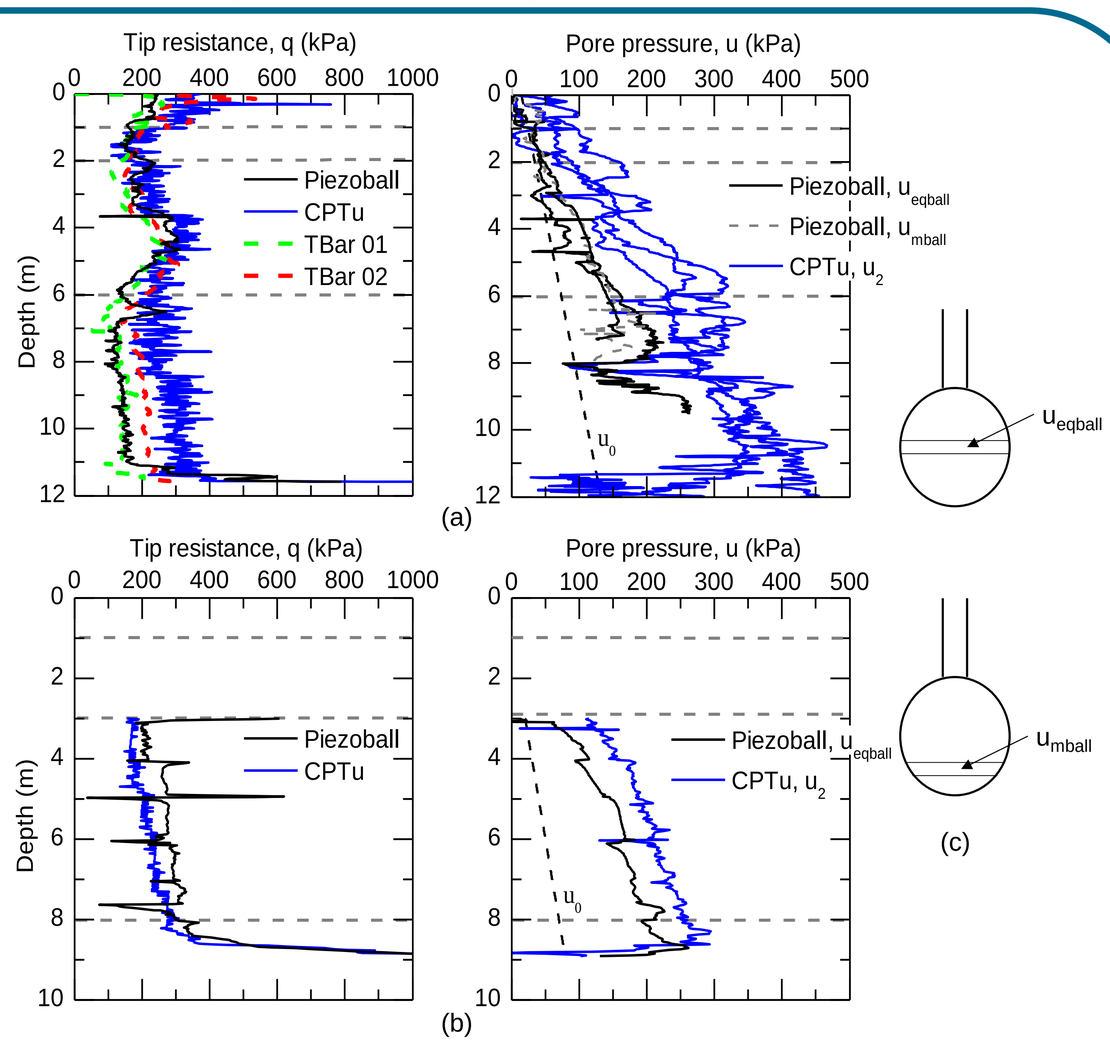


Figure 3. Tip resistance and pore pressure profiles for (a) Athlone (with Tbar resistance profiles from Long & Gudjonsson 2004); and (b) Belfast (with CPTu data from Lehane et al. 2003); (c) piezoball filter positions

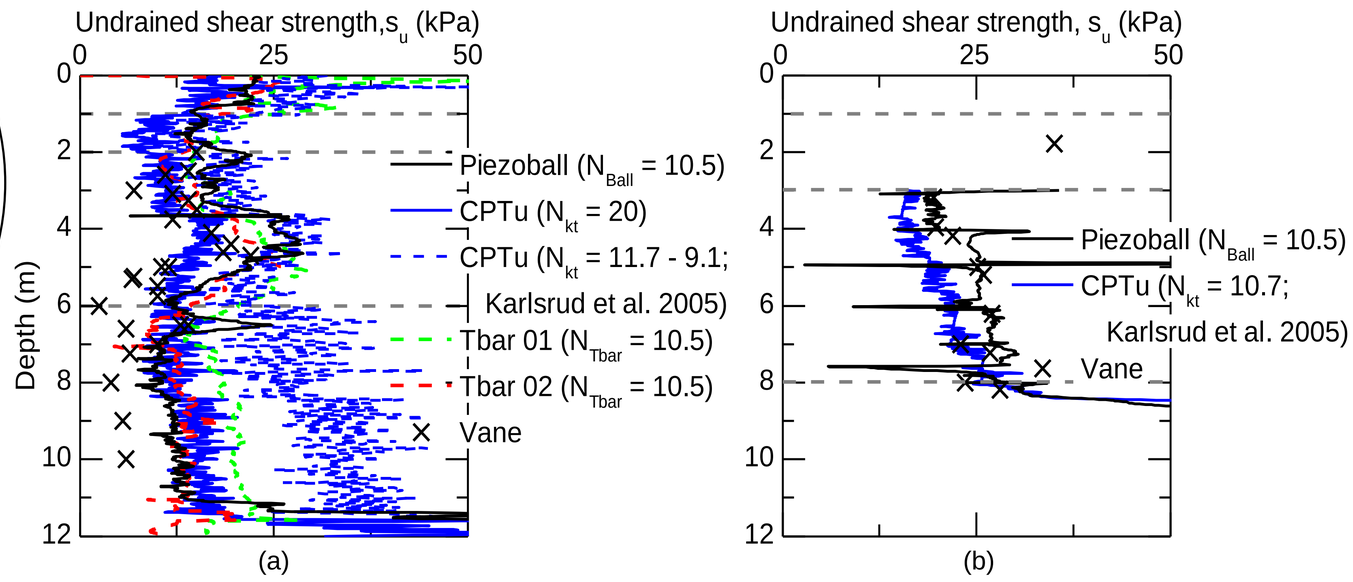


Figure 4. $s_u$ profiles for (a) Athlone (with FVT results and Tbar profiles from Long & Gudjonsson 2004); and (b) Belfast (with FVT and piezocone profiles from Lehane et al. 2003)

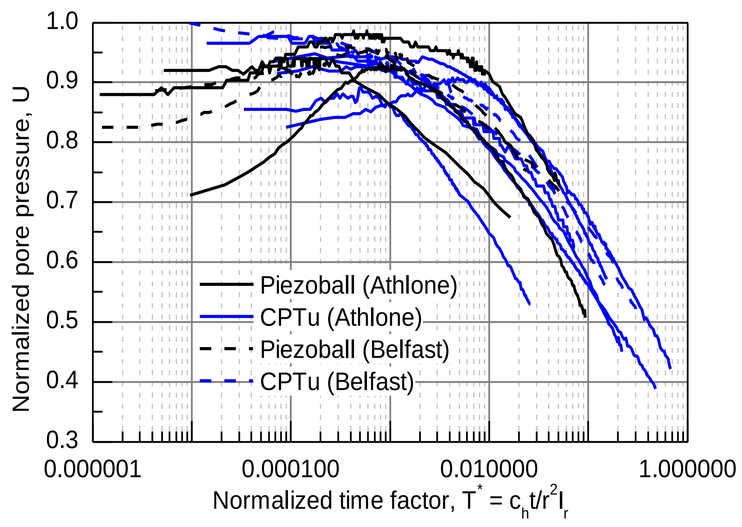


Figure 5. Normalized piezocone and piezoball dissipation curves for Athlone and Belfast

## Conclusions

- Piezoball and Tbar $s_u$ profiles using N = 10.5 are in good agreement with previously established $s_u$ profiles.
- The difficulty in choosing an appropriate $N_{kt}$ factor for the cone is highlighted.
- Dissipation tests using the piezoball have been shown to have significant potential for assessing the consolidation characteristics of soft soil, particularly if a smaller standardized piezoball diameter is adopted (e.g. 60 mm).

[1]Institute of Technology Sligo, Ireland
[2]University College Dublin, Ireland
[3]University of Western Australia, Australia
[4]In Situ SI Ltd., UK
*Corresponding author: colreavy.cathal@itsligo.ie