



**TRINITY COLLEGE DUBLIN**

Department of Civil, Structural & Environmental Engineering

***PEAT IMPROVEMENT UNDER VACUUM  
PRELOADING: A NOVEL APPROACH FOR  
BOG ROADS IN IRELAND***

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# RAMPART ROADS

- Rampart roads are bog roads in which the peat has been harvested for fuel from one or both sides, leaving the road surface, in some cases, many meters above the surrounding ground surface.
- The existing rampart road network has to be improved and widened in accordance with the present traffic demand, economical growth and safety requirements.

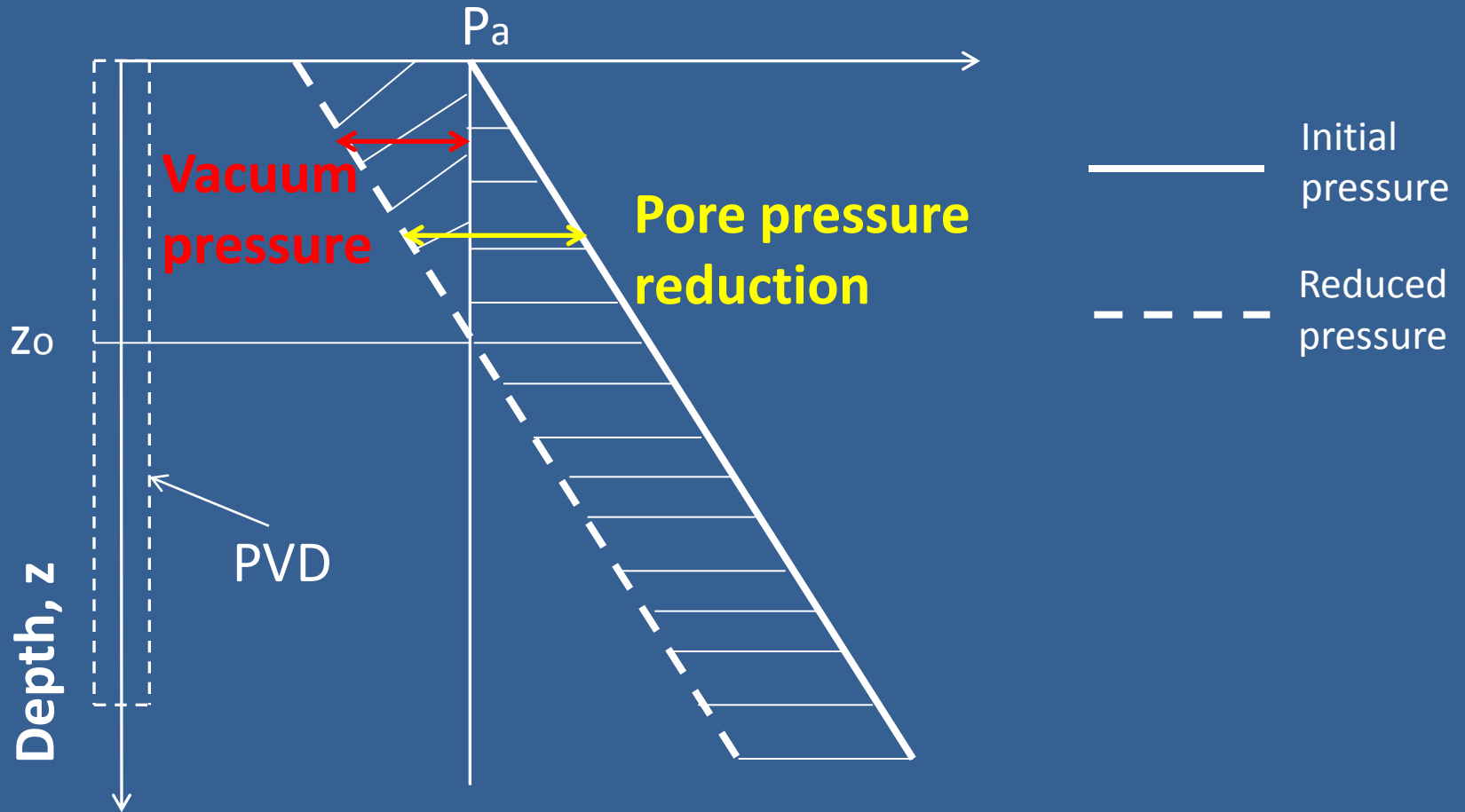


Rampart road on the R400 regional road, between Rhode and the N6, County Offaly, Ireland.

# VACUUM PRELOADING

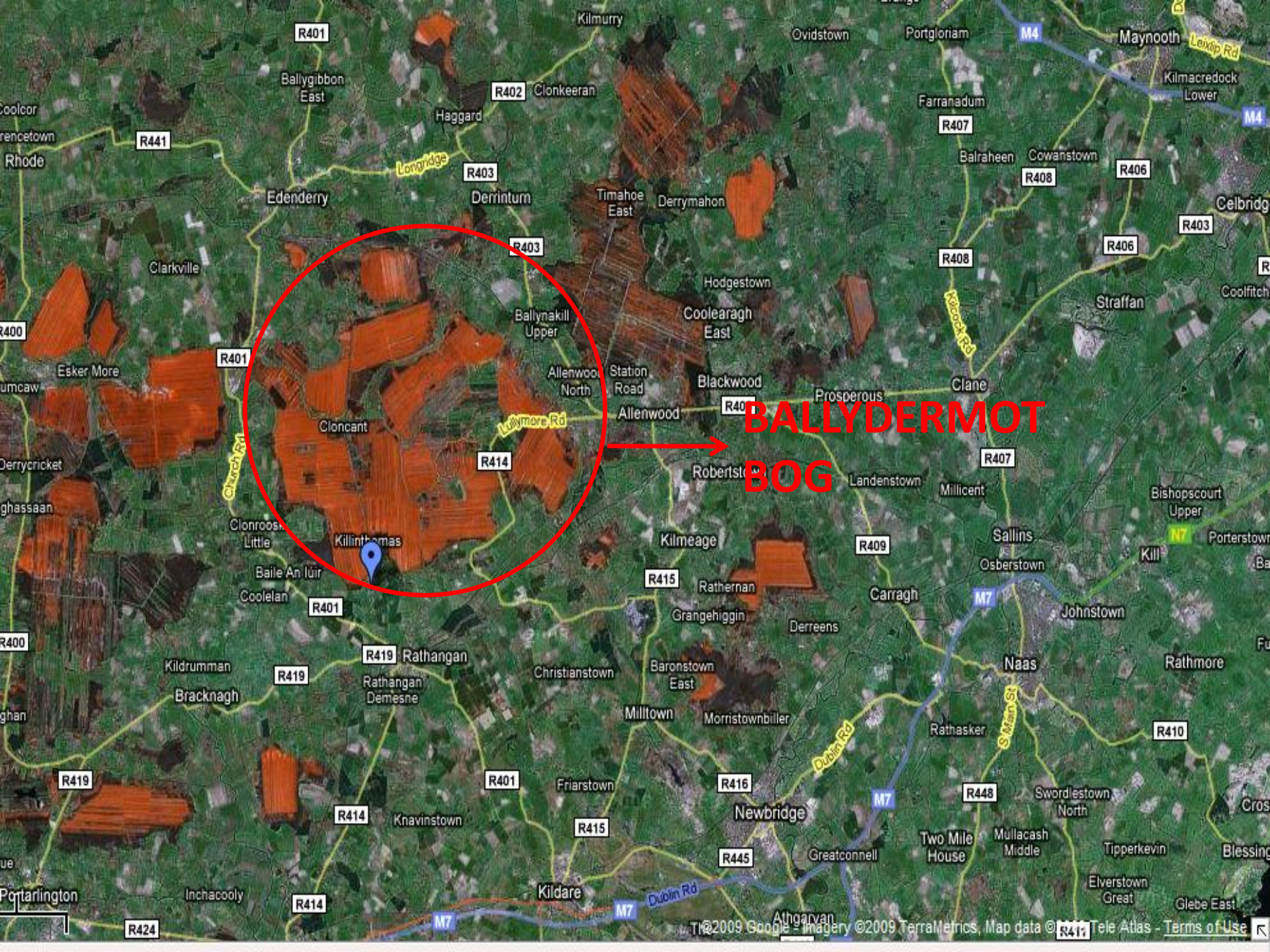
- Vacuum preloading is a construction method used to accelerate ground settlement by reducing the air pressure at the ground surface, thereby accelerating the consolidation process.
- Vacuum preloading was originally proposed in the 1950s.

# VACUUM PRELOADING



# TCD/NRA VACUUM PRELOADING FIELD TRIAL

- The TCD/NRA vacuum preloading field trial is currently being undertaken at Ballydermot bog, county Offaly.
- The main objective is to evaluate vacuum preloading as a technique for improving peat ground and its feasibility for improving the conditions and reducing the maintenance costs for bog roads and rampart roads.



**BALLYDERMOT  
BOG**

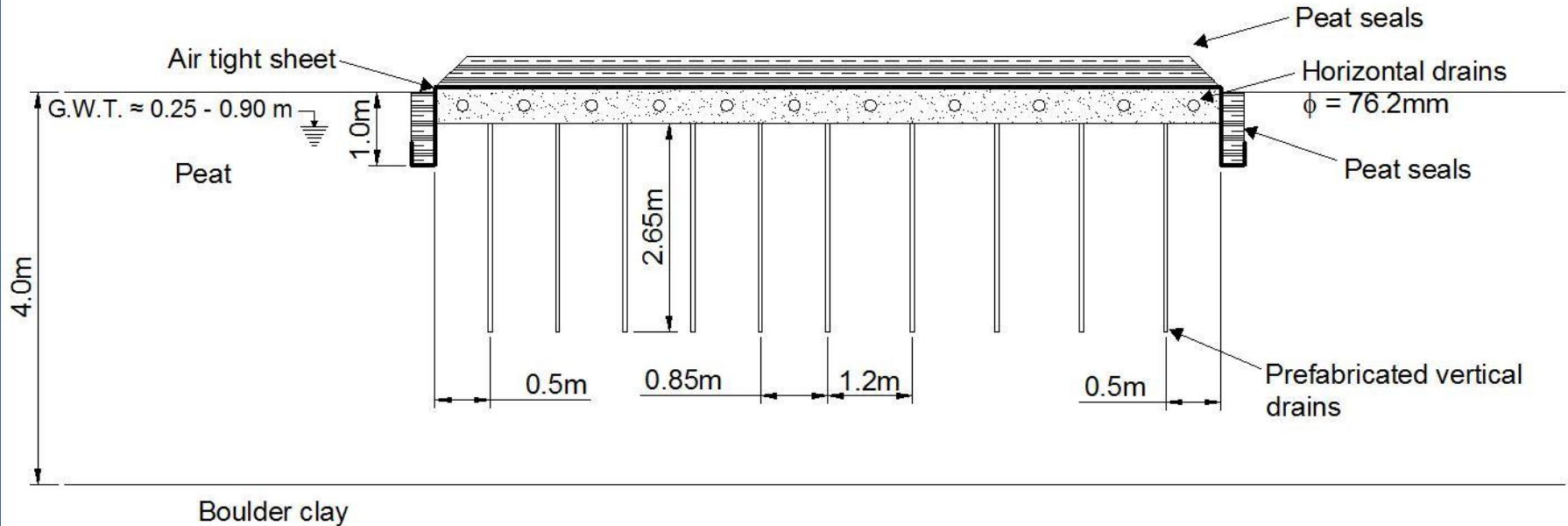


# TCD/NRA VACUUM PRELOADING FIELD TRIAL

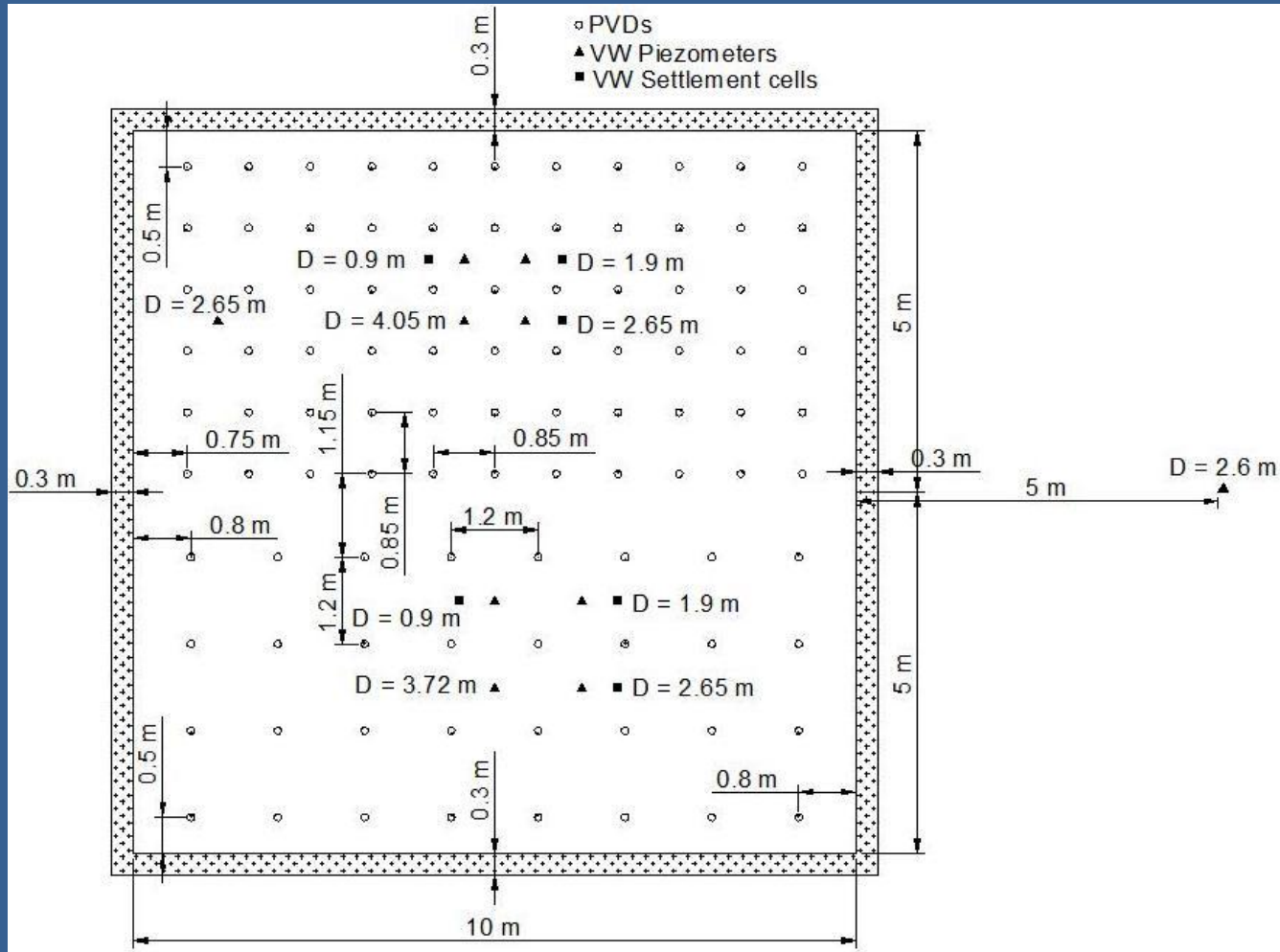
Table 1 – Simplified soil profile

Layer	Depth (m)	Description	Observations and properties
1	0 – 0.7	Man-made fill	Black peat; occasional plastic bags, gravel, pieces of geotextile, machine parts.
2	0.7 – 4.0	Pseudo-fibrous peat	$w = 660 - 1085\%$ $G_s = 1.39 - 1.54$ $LOI = 96 - 99\%$ $pH = 4.5 - 6.2$ Von Post = $H_4 - H_7$
3	4.0 – 7.0	Boulder clay	The clay fraction reduces with depth until only boulders are found.

# TCD/NRA VACUUM PRELOADING FIELD TRIAL



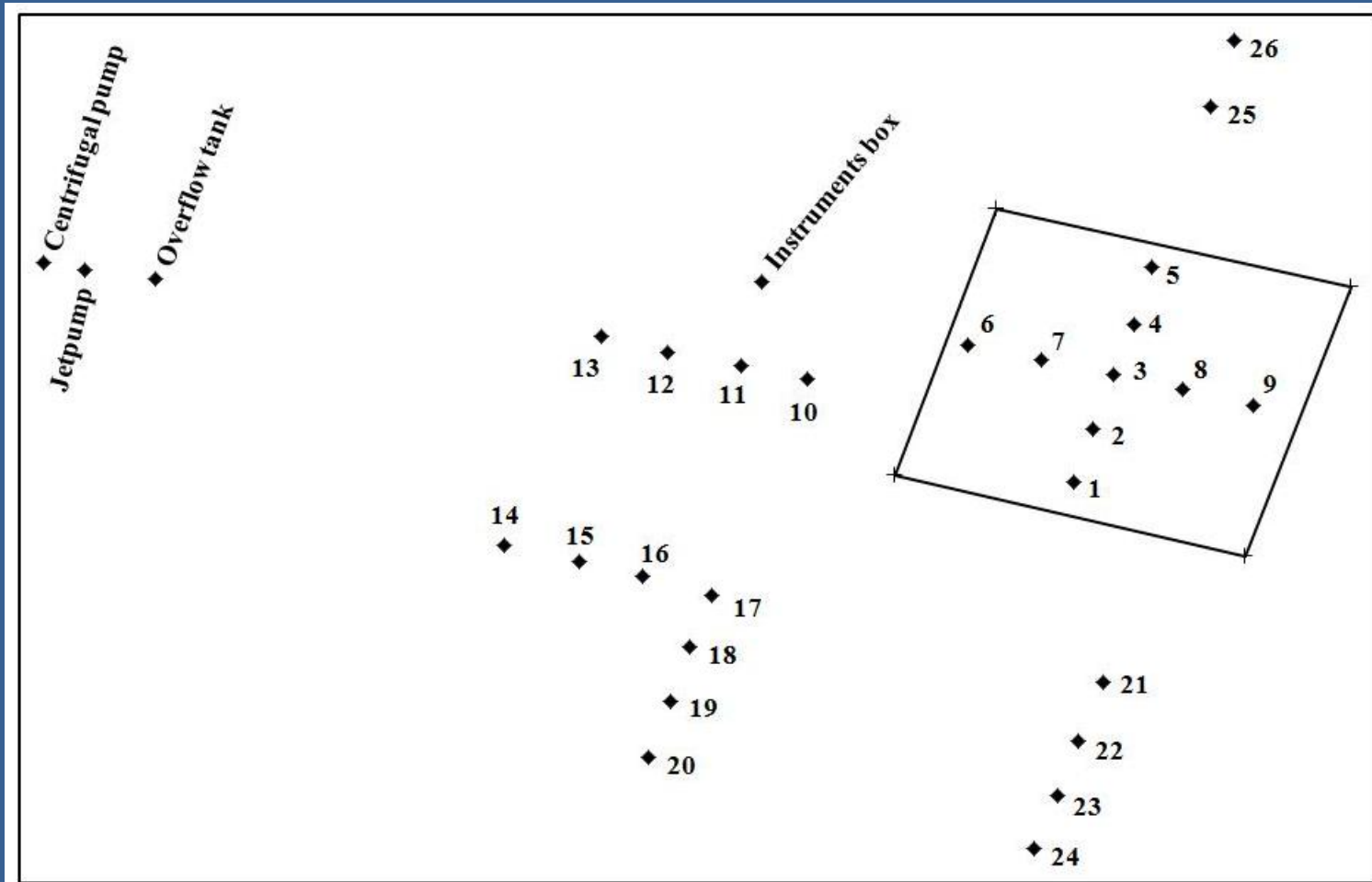
# TCD/NRA VACUUM PRELOADING FIELD TRIAL







# TCD/NRA VACUUM PRELOADING FIELD TRIAL



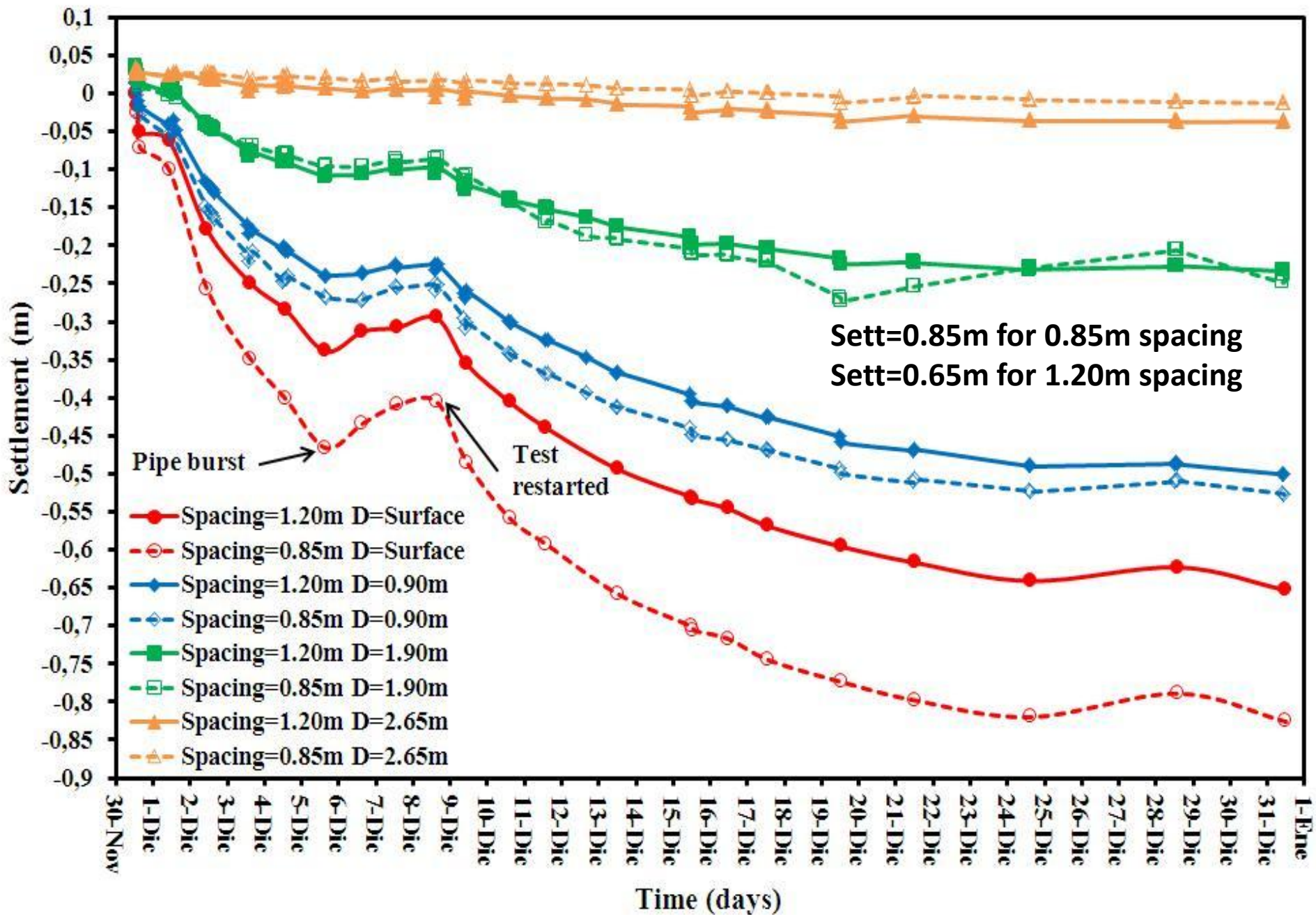


# PRELIMINARY RESULTS

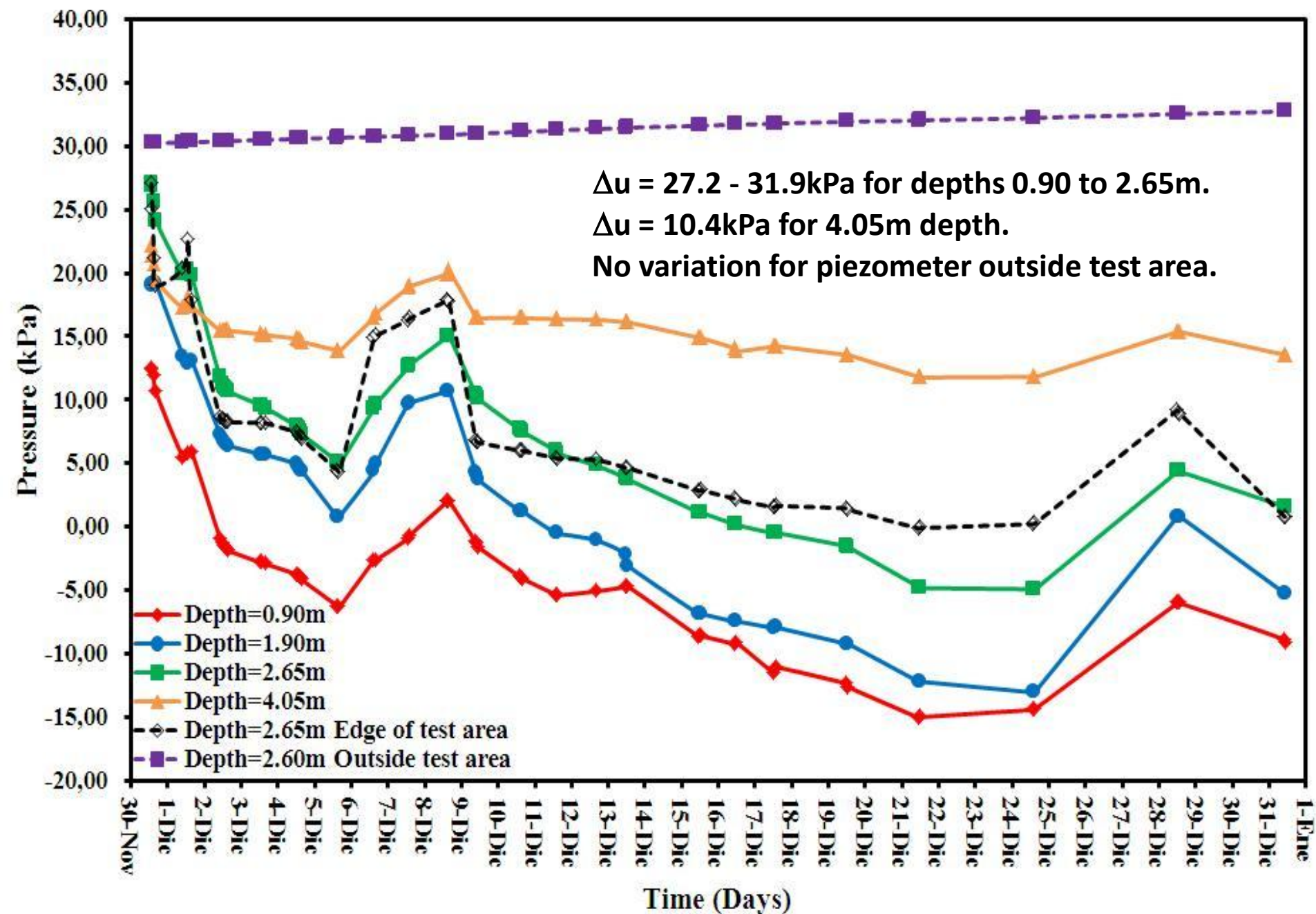
- The TCD/NRA vacuum preloading field trial commenced on the 30th November 2009.
- The results from the first month are presented here.
- An average vacuum level of 50kPa was achieved in the gravel layer.



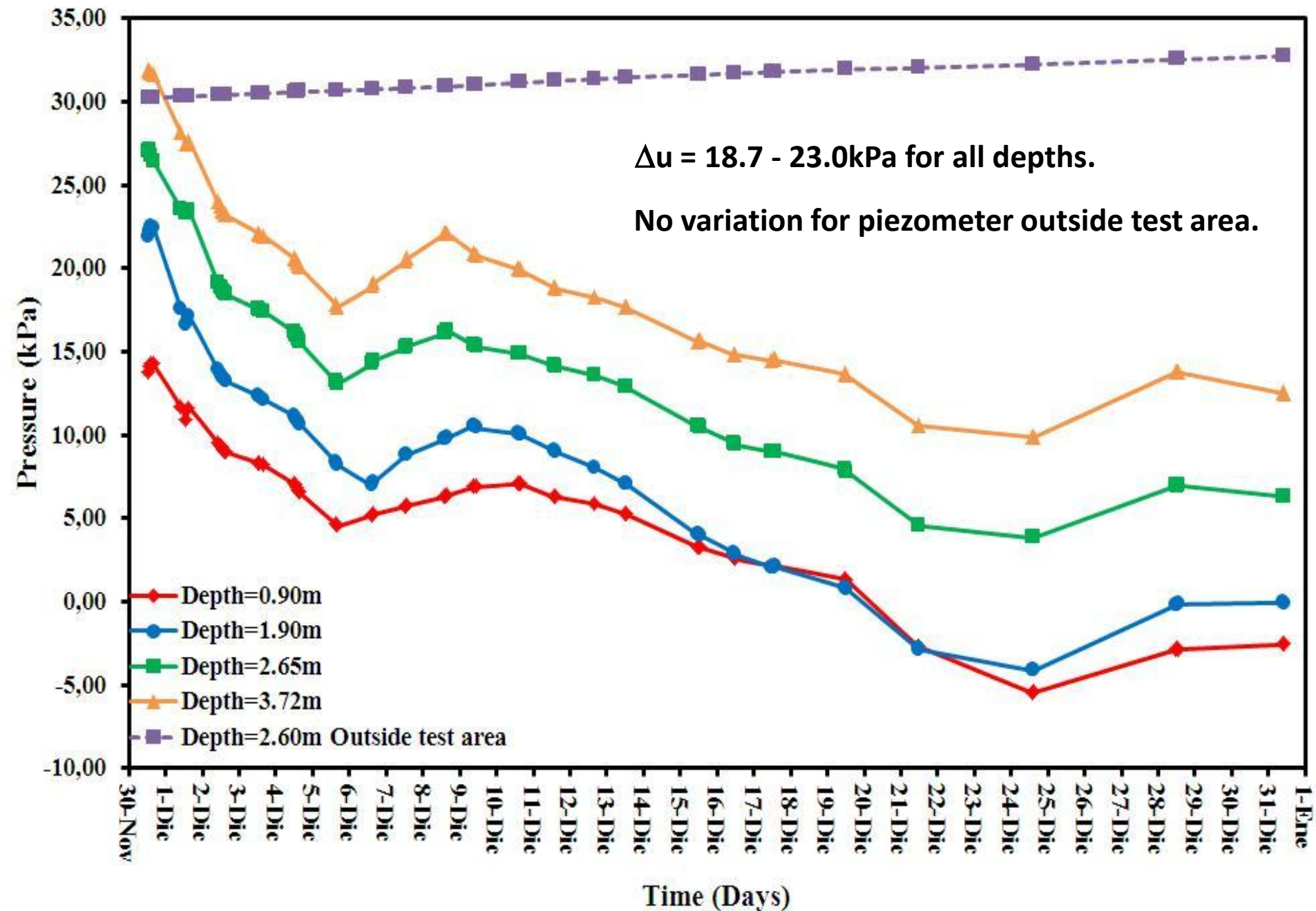
# SETTLEMENT vs TIME



# PORE PRESSURE vs TIME – Spacing = 0.85m



# PORE PRESSURE vs TIME – Spacing = 1.20m



# CONCLUSIONS

- The TCD/NRA vacuum preloading field trial was implemented and showed that this technique can be successfully used in peat soils.
- The drainage system comprising PVDs, horizontal drains and a granular bed, was effective in distributing the applied vacuum pressure and collecting the drained water.

# CONCLUSIONS

- An average vacuum level of 50kPa was recorded, though lower than the maximum 80kPa achievable according to the literature.
- A uniform reduction in piezometric pressure with depth was observed, even 1.0m under the bottom of the PVDs.

# CONCLUSIONS

- There was a noticeable difference in the time settlement plots, the pore pressure reduction, and the magnitude of settlement between the areas of different drain spacing.
- The findings indicate that a drain spacing of 1.2m can be effectively used to achieve significant ground improvement, albeit less than that achieved for a closer spacing.

# CONCLUSIONS

- The recorded settlements at the two spacing areas, for the same depth, are similar in magnitude. However, there is a significant difference in the surface settlement and the reasons for this require further investigation.

# ACKNOWLEDGEMENTS



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