

Background & Objectives

- The research carried out to provide insight into the **seismic hazard affecting flood protection**.
- Presence of significant literature on liquefaction in homogenous sand layers, **natural soil deposits are rarely uniform**.
- Soil stratigraphy plays a key role in lateral spreading, pore pressure generation, and upward flow during dynamic shaking

This research aims to investigate the initiation and propagation of **failure mechanism of flood embankments** resting on shallow foundations composed of different soil layers that includes **liquefiable sandy soils and clay**, during **strong earthquakes**.

Methodology: Centrifuge Modelling

Three dynamic centrifuge tests have been conducted at **60 g level**, on an embankment made with silty sand.

- Three saturated sand models were prepared with **Hostun sand** with a target relative density of **50%**
- Input motion: **1 Hz, 10 cycles** with **PGA of 0.3 g**
- The transparent Perspex of the container allowed for adopting the **Particle Image Velocimetry (PIV)** technique in the analysis.

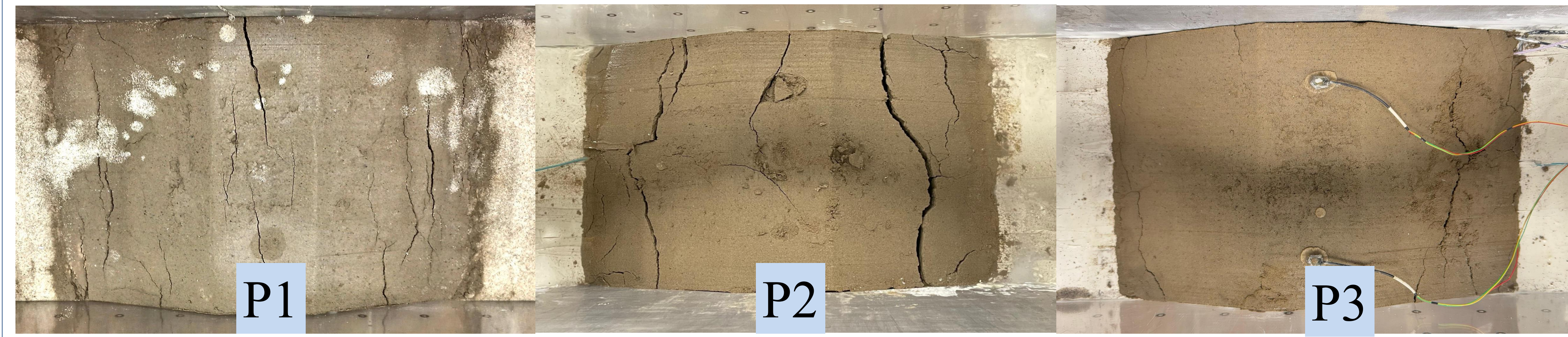


Figure 3. Plan view showing longitudinal cracks, a) sand only (P1), b) thin clay layer (P2), and (c) thick clay layer (P3).

Results: Dynamic Response

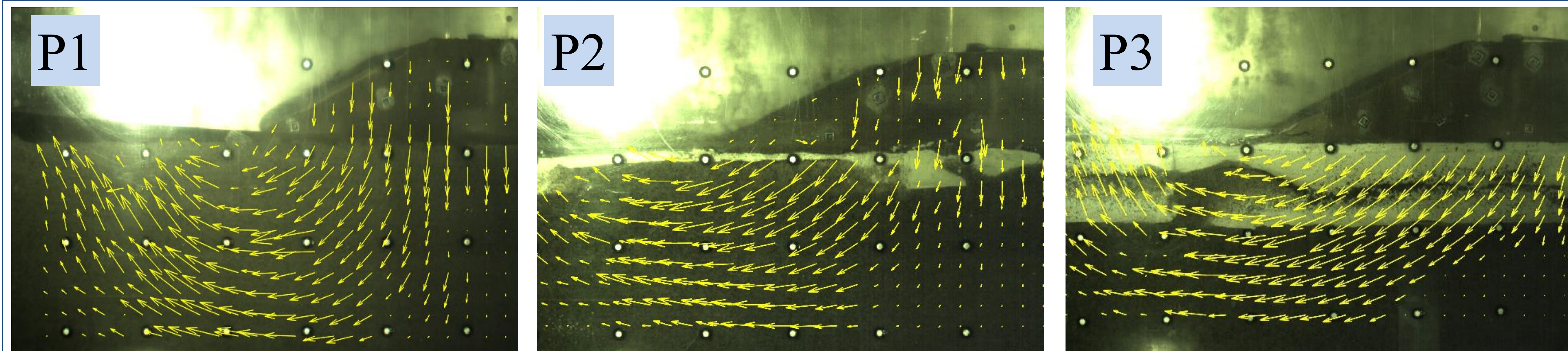


Figure 4. Traces of soil displacement vectors in the saturated soil, a) without clay layer, b) with thin clay layer, c) with thick clay layer

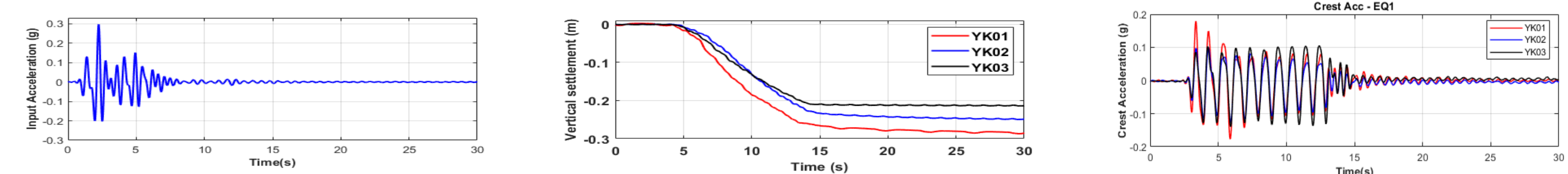


Figure 5. Results recorded from with the instruments; a) input acceleration, b) vertical settlements, c) crest accelerations

Conclusion

- **Larger embankment deformation and cracks were observed** when tested without a clay layer, and the deformation and formation of cracks were smaller when tested with the clay layers.
- The presence of clay layers in the foundation resisted the formation of wider cracks and deformation.

References

[1] Stanier, S. A., Blaber, J., Take, W. A., & White, D. J. (2016). Improved image-based deformation measurement for geotechnical applications. *Canadian Geotechnical Journal*, 53(5), 727-739.

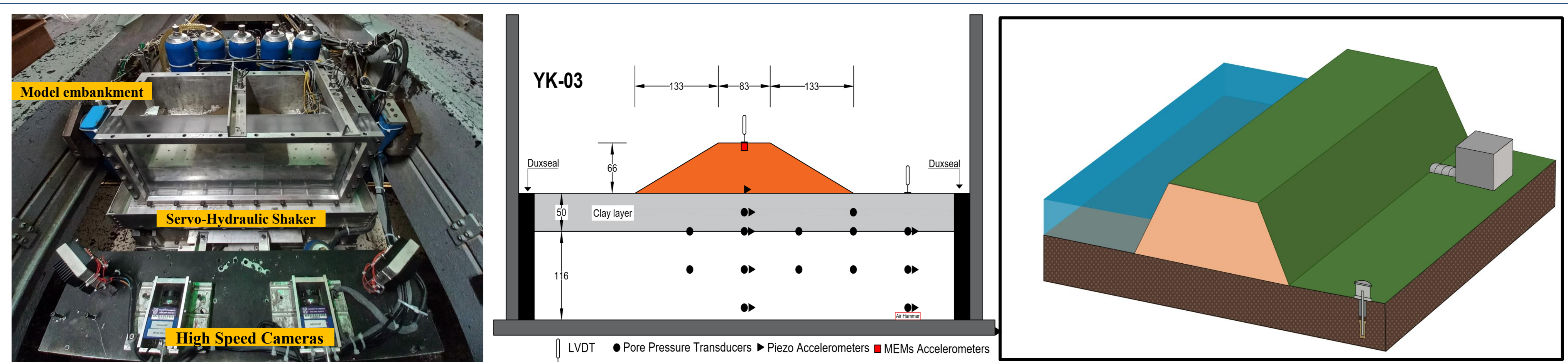


Figure 1. a) Completed testing model before spinning, b) Centrifuge model layout, c) Typical geometry of embankment

Figure 2. Soil profiles investigated in the centrifuge experiments.

