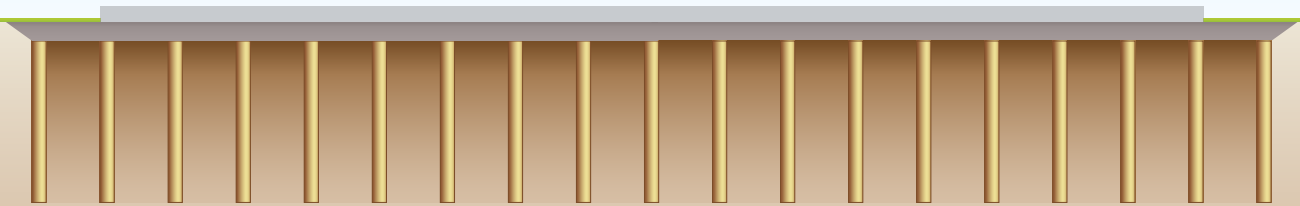


TTT Ground Improvement is designed to improve ground using timber piles. It is a Type G5 ground improvement method listed in MBIE Guidance April 2015, part C, p. C15.7.



## The system

### Foundations

TTT Ground Improvement uses specifically designed TTT MultiPole Uglie piles spaced closely together at shallow depths. These reinforce in-situ soils against seismic-induced shear strain and in doing so, prevent the soils within the pile-soil matrix from being subject to the critical strains that trigger liquefaction.

After installing the piles, the ground is improved to the TC2 level of performance. Residential foundations typically use 200–300 Uglie piles, 2.4–4.8m long, spaced 1.0–1.5m apart. Commercial foundations typically use 300 Uglie piles, 6.0–15.0m long, spaced 1.0–2.5m apart.

### Floor

After the piles are installed, a 200–300mm gravel load transfer platform is placed on top in preparation for a TC2 concrete slab. Alternatively, additional piles may be installed in-between the ground improvement piles to receive bearers for a timber floor (designed either to NZS 3604 or according to specific engineering design).

## Installation

Installation typically takes 3 days for a residential foundation. The piles are installed using a high frequency vibrator mounted on an excavator. This installation process leaves the piles structurally undamaged, doesn't generate excessive noise, and doesn't transmit excessive vibrations. Combined with fast installation, this minimises disturbance to neighbouring properties.

## Site requirements

Access to pile positions is generally required to be a flat, level, straight path that is 3.1m wide with 4.0m vertical clearance for a 25 tonne excavator. A gravel working platform may be required if the upper soil layers are too soft to support the piling equipment. Piles can generally be installed up to 1.0m away from existing structures.



# TTT Ground Improvement

## Testing and sign off

The engineer will observe the pile installation. In conjunction with a Producer Statement PS3 – Construction from the pile installer this will enable the engineer to sign off a Producer Statement PS4 – Construction Review.

According to MBIE Guidance April 2015, appendix C4, p. C4.22, post-installation geotechnical testing doesn't need to be carried out to verify the improvement of the ground if a minimum area replacement ratio (ARR) of 5% is used, which can be specified in the design phase.

## Additional design options

For sites where more than 300mm of lateral movement is expected for a future event, additional rows of piles can be added along the edge(s) of the building, on the side(s) most susceptible to the lateral movement.



## Quick reference information

	Technical Category	Type of MultiPole used	Typical pole diameter	Typical pole length	Typical pole spacing	Typical installation method
Residential foundations	TC2 & TC3	Uglie	200–300mm	2.4–4.8m	1.0–1.5m	High frequency vibration
Commercial foundations	TC2 & TC3	Uglie	300mm	6.0–15.0m	1.0–2.5m	High frequency vibration

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