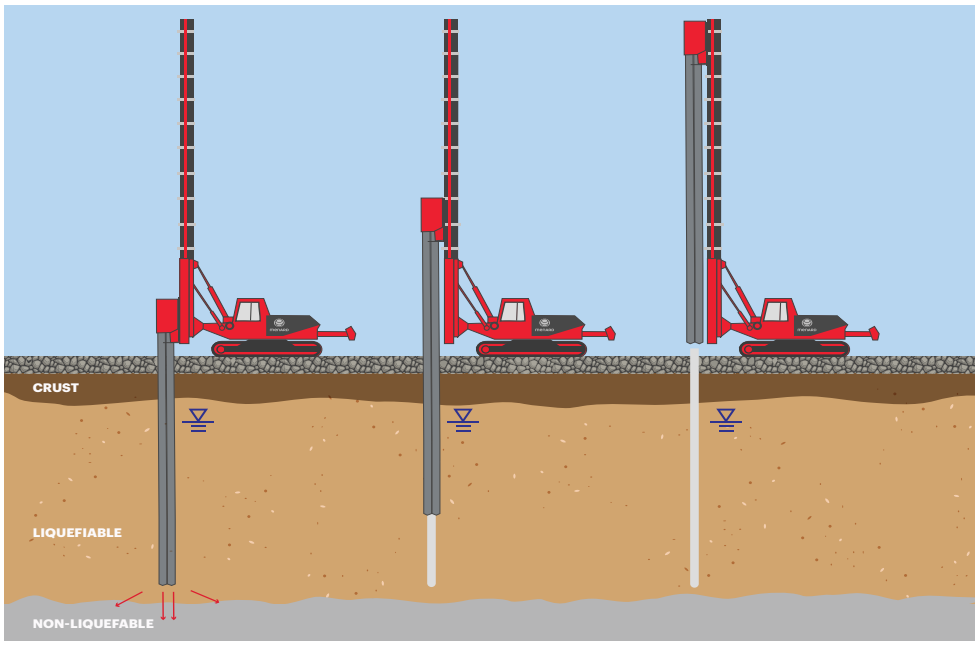
Earthquake Drains

During earthquakes, a phenomenon known as liquefaction can occur when pore water pressures increase as a result of seismic motions. Granular soils such as sands are most prone to liquefaction, and the effects can include loss of shear strength, lateral spreading, excessive settlement, and even bearing capacity failures. Earthquake (EQ) drains are used to mitigate/limit the effects of seismically-induced liquefaction by allowing for the rapid dissipation of excess porewater pressures generated by the seismic event.



Earthquake (EQ) drains are slotted, corrugated pipes that are encased in a geotextile fabric wrap. The drains are typically vibrated into the ground and are designed to dissipate pore pressure during seismic events.

Installation

EQ drains are comprised of slotted, flexible corrugated plastic pipe (typically 4-inch diameter) encased in a filter fabric sock that acts as a filter to prevent migration of fines into the pipe. EQ drains are typically installed by inserting the drain into a hollow steel mandrel (from the bottom of the mandrel) and vibrating the mandrel to the intended depth. A metal anchor plate is placed across the bottom opening of the mandrel to prevent soils from entering the mandrel and to help keep the drain in place as the mandrel is extracted. Predrilling can be used to loosen very stiff/dense soils ahead of drain installation and where vibration-sensitive structures or overhead obstructions are present. Rotary drilling methods can be used to install the drains.

Advantages and Applications

EQ drains are typically installed in a grid pattern at spacings that range from 5 to 10 ft and at depths typically up to 55 feet. Determination of spacing and depths are part of the design which is based on reducing liquefaction-induced settlements and increasing the factor of safety against liquefaction. In cases where the volume of reservoir storage in the EQ drains does not sufficiently alleviate pore water pressures, supplemental reservoir storage can be provided in the form of an aggregate blanket that extends across the site and receives drainage from the EQ drains.

As the drains are most commonly installed using vibratory displacement methods, a corollary benefit of the installation process is densification of some soils, especially of sands with a low fines content.

Advantages of Earthquake Drains Include:

- Simple installation process
- Economical and environmentally-sustainable solution as compared to other ground improvement approaches that require relatively expensive materials such as stone and cement
- Readily installed to depths of 55 ft
- Minimal spoils are generated when installed using driven displacement methods
- Densification of surrounding soils in some cases when installed using vibratory/ displacement methods
- Installation techniques can be modified to protect vibration-sensitive sites/structures