www.pinfoundations.com
253-858-8809 ph
253-858-8607 fx

HEAVE AND EXPANSION

Soils around the country will freeze to varying depths during the winter months, but they may not cause any harm to foundations if they don't also heave. Frost heave will only occur where and when the right conditions are in place – fine grain soils such as silts, high water saturation, and just the right rate of temperature drop –usually where there is not enough snow cover to provide ground insulation.

Most soils in colder climates are categorized as having either low or moderate risk of heave. The Diamond Pier®DP-50 is designed to resist soil movement in these areas, for up to one inch (1") of vertical heave. In properly drained sites, the spread Pin configuration works like a bell shaped footing to hold down the concrete head, which is pointed at its base, and designed to cleave the heaving soils around it. As long as there is enough Pin length to counteract these upward forces, the heaving surface soils will move up (and down), past the fixed pier. Pin length then is based on providing sufficient resistance to heave pressures, rather than reaching to a specific vertical depth. Typically the Pin length should closely match the number – in inches - of the local frost line. In a 48 inch frost zone for instance, a Pin length of 50 inches is recommended, and this is the maximum Pin length of the DP-50 pier.

Where severe heave is well known - in parts of New Hampshire, Vermont, Minnesota and Alaska, for instance – *all* types of foundations are at risk, including deep straight cylinder piers. However, if heave pressures in these locations ever exceed the uplift resistance of the Diamond Pier, the concrete head will continue to stay centered and locked on the Pin cluster. Like a pressure relief system, the Pins may be left slightly higher out of the pier after a winter of severe heave, but they can be reset in the spring, without losing pier position or bearing strength. In the most extreme conditions, larger Diamond Piers, with larger diameter and deeper Pins, may be necessary. Depending on the drainage conditions and the height of the superstructure, Diamond Piers may also be installed with a rounded pea gravel backfill to enhance the drainage and soil movement around the concrete head.

Soils can also heave in warm climates – due to the expansive swelling of clays. As with freezing soils, not all clays are subject to heave or swell, and those that are may only heave near the surface, while others experience "deep swell". Clays that do not typically heave at all, or heave only a small amount, are called *lean clays*, and they dominate the northern Midwest. Where more *plastic clays* are abundant – Colorado and Texas for instance – the soils will swell (and shrink again) according to wet and dry periods.

The Diamond Pier® DP-50 is designed to work in lean and low to moderate swelling clays. Again, the Pins provide anchoring resistance for the concrete head, and as long as there is enough Pin length to counteract these upward forces, heaving soil is forced to cleave past the pointed base of the fixed pier. This upper heaving soil layer is known as the *saturation zone*. Its heave is caused by infiltrating rainfall or irrigation, and the zone is typically only a foot or two deep. Diamond Pier Pin lengths in heaving clays should be a minimum of this zone depth – in inches – plus 12 more inches in length. For more difficult expansive soils, larger Diamond Piers, with larger, deeper Pins may be necessary, and rounded pea gravel backfill may also be added around the concrete portion of the pier to enhance drainage and soil movement.

Deep swelling clays however, like severe frost heave, can be a problem for all types of foundations. They are generally the result of the movement of deep sub-surface waters, often caused by man-made excavations and/or or off-seasonal irrigation, which can cause otherwise dormant deep clays to expand. One of the benefits of the Diamond Pier® is that its low impact installation avoids the kind of excavation in these unique soils that can often lead to deep swell problems. However if deep swell already exists, large-scale vertical piling may be the only foundation option to consider.