

ARE YOU GETTING THE MOST VALUE OUT OF YOUR GROUND IMPROVEMENT DESIGN?

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Using shallow spread and strip footings on improved ground with Geopier can achieve significant value for your project in time and money. But what is the best way to make sure those savings are realized?

- How do you make sure the Geopier Ground Improvement Design is optimized?
- How should the allowable bearing pressure recommendations in the Geotechnical Report be used?
- What bearing pressure values should the structural engineer use for designing footings?
- Have you addressed coordination with site grading, support of excavation and utility installation?

Geotechnical Recommendations – For a typical project without Ground Improvement where shallow foundations can be used, the geotechnical engineer will recommend a single allowable bearing pressure that the structural engineer will use for sizing and detailing the footings for the project. These recommendations may often be made with only a conceptual idea of the range of column loads and footing elevations and no footing layout showing the spacing between footings.

The structural engineer will then produce a set of drawings, including a foundation plan showing the footings and details he or she has designed. The drawings are submitted for review and approval by the appropriate government agency, after which the project proceeds to construction. Rarely is a geotechnical engineer provided an opportunity to review the foundation plan and/or run any settlement analyses on the footings that have been selected to determine if there are any conflicts due to:

- Potential added settlement due to overlapping footing stresses; and
- Potential phased excavation that could compromise footing stability

Consider this same process.... When Ground Improvement is used. A single allowable bearing pressure should be provided by the Geopier design-build contractor that considers the subsurface conditions, the type of structure, foundation loads, and the specific ground improvement technology being used. However, a general recommendation with a range of bearing pressures, say 4 to 6 ksf, is often provided by geotechnical engineers. This is where the value train falls off the tracks. The structural engineer will then use the low end of these values (4 ksf) to be conservative, and your project value suffers because the design requires:

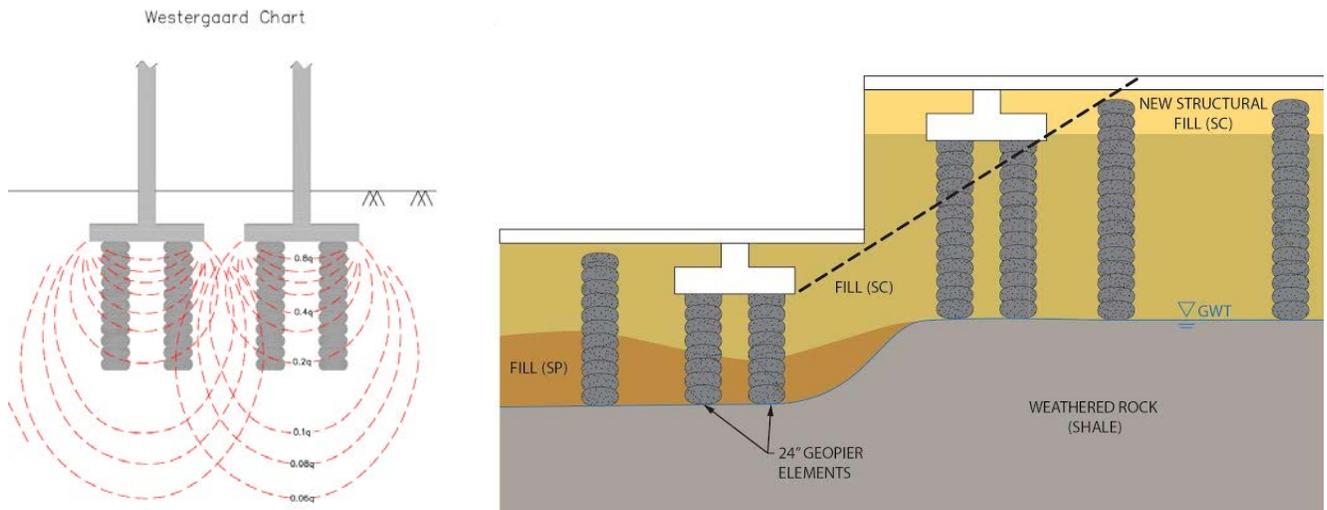
- Larger Footings than needed by approximately 30 to 40%
- Deeper Geopier elements if the larger footings create overlapping stress issues



To Get the Train Back on the tracks....

The geotechnical engineer and structural engineer should consult the Geopier design-build contractor to provide the optimal bearing pressure for the geotechnical report, and consult again once actual column loads and conceptual footing layouts are available. This step provides value to the structural engineer so that final design can consider:

- Overlapping footing stresses that may cause added settlement
- Solutions for phased excavation
- Optimizing footing sizes based on actual column loads
- Overcoming potential conflicts with utilities and shoring

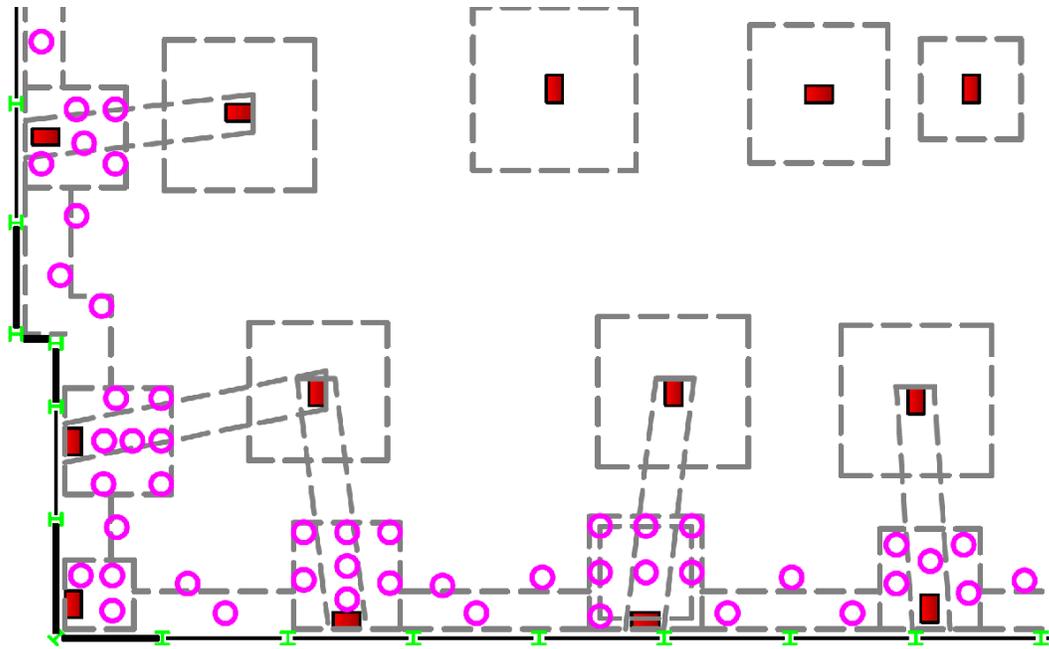


Overlapping Stress Influence from Adjacent Footings

Project Excavation and Phasing Issues



Consideration as to how close you can install piers next to shoring piles



Layout showing the minimum distance between a Geopier element and a shoring pile. The Net Result: strip footings and some column footings were resized to accommodate shoring and piers were eliminated!

Following a review by the Geopier design-build contractor of the project issues, the structural engineer then finalizes sizing the footings, and prepares a foundation plan. By getting project specific Geopier Allowable Bearing Pressures and reviewing project details with the ground improvement designer, they realized savings based on:

- Optimizing the footing sizes
- Avoiding future change orders and delays due to conflicts with utilities, shoring and phasing

But the structural engineer can still save money for the owner on the Geopier Ground Improvement contract by providing the following information on their plans:

- Actual static loading (dead load + reduced live loads) anticipated for each foundation, and NOT the recommended allowable bearing pressure times the footing sizes.

The cost for ground improvement is directly proportional to the magnitude of foundation loading used in design. Using the actual static loading on each footing for Geopier design versus the maximum allowable bearing pressure times the footing size ensures that you are only paying for the ground improvement required to control settlement. This is most evident when footings are very large in order to resist overturning under transient loading but apply static contact pressures well below the recommended allowable bearing pressure. Using the applied static pressure versus the allowable bearing pressure will result in Ground Improvement savings on the order of **10% to 30%** on virtually every project—in addition to schedule savings to construct the Geopier elements.

For structural engineers, this also means that the total and differential settlement will be more accurate because it will be based on the actual bearing pressure from the static loading on the footing. While at the same time, the original recommended allowable bearing pressure for footing design will still be available under each footing.

For general contractors and owners, this ensures that you are getting all the savings available by:

- Optimizing Footing Sizes
- Coordinating Utility, Shoring and Site Grading conflicts
- Minimizing Geopier Ground Improvement Costs

By getting project specific Allowable Bearing Pressure Recommendations for Ground Improvement from a Geopier design-build contractor and by providing the actual static column loading values at bid time, the resulting savings in footing concrete can be on the order of **30 to 40 %**, and the savings in Geopier Ground Improvement costs can be on the order of **10 to 30%** versus using the loading based on the allowable bearing pressure times the footing size.

And that's how you can get the **Most Value** out of your Geopier Ground Improvement Design!

Example Geopier projects where the design was optimized include:



[Brodie Hall at Virginia Tech, Blacksburg, VA](#)



[Navy Federal Credit Union, Vienna, VA](#)