

# Tensar®

## Renaico Wind Farm

### Working with the Wind Energy Industry & Developing Integrated Construction Solutions

**APPLICATION:** In the Araucanía Region of Chile, forty-four 100 meter wind turbines were constructed to establish a new wind farm spreading over 2,965 acres in Renaico, located at about 8.08 miles (13 km) from the city of Angol. Access roads, internal roads, and working platforms were necessary for the construction of the wind farm, and foundation improvement was needed for the wind turbines.

**THE CHALLENGE:** All work was performed on a composite of soft clay and silty soils, in a limited time frame and with ground deformation restrictions. According to the European wind farm equipment suppliers, a subgrade with a shear strength of  $C_u > 28.45$  psi ( $2.0$  Kg /  $cm^2$ ) is required to support the wind farm turbines and equipment, but the natural subgrade had a  $C_u = 3.56$  psi ( $0.25$  Kg /  $cm^2$ ). In addition, temporary platforms to support the crane during the installation of the turbines required a  $C_u > 35.56$  psi ( $2.5$ Kg /  $cm^2$ ).

**TENSAR® TRIAX® SOLUTION:** More than 17 km (10.56 miles) of internal roads were built between the turbines that make up the wind farm. In addition, 44 temporary working platforms were built to support the crane during the installation of the wind turbines. Tensar TriAx geogrids stabilized both the roads and crane pads, resulting in significant savings in costly imported granular fill.

**GEOPIER® SOLUTION:** Geopier Rammed Aggregate Pier® (RAP) elements were installed to increase the rotational stiffness and substantially decrease the differential settlement at the base of the foundations. The project management team evaluated an alternative solution based on concrete piles, which proved to be more expensive. The Geopier solution consisted of 79 RAP elements for each wind turbine, with effective lengths of 13.12-26.25 ft (4m to 8m) each, in order to reinforce the soft soil stratum underlying the foundations.



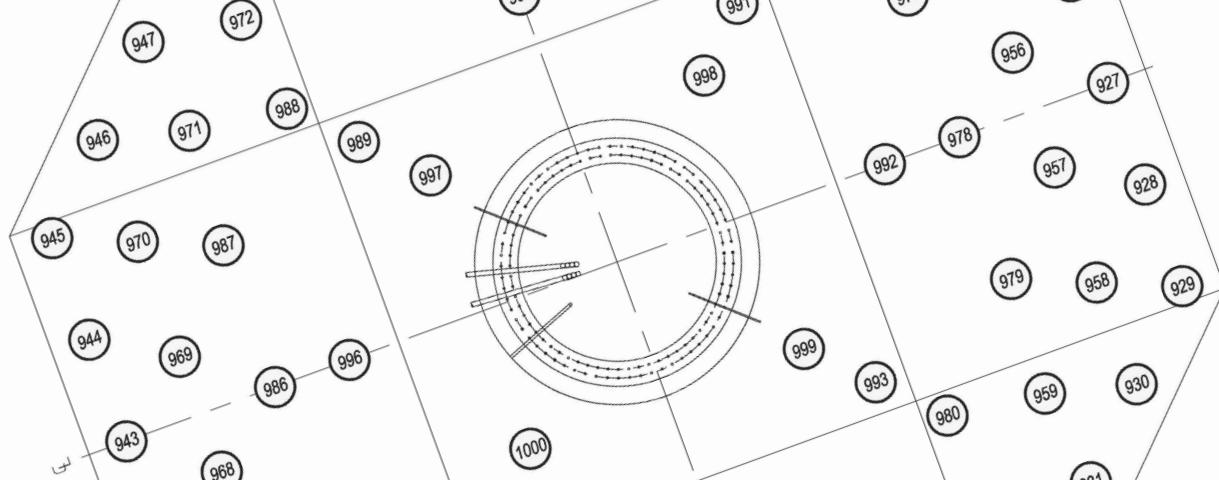
*Ground Improvement*



*Access Road Stabilization*



*Access Road Stabilization*



# GEOPIER® Tensar Solutions

For more information:  
800-371-7470  
[www.Geopier.com](http://www.Geopier.com)

## UNIQUE FOUNDATION CHALLENGES

Wind turbine structures present unique design challenges, including high applied foundation bearing pressures resulting from significant overturning moments, minimum rotational/dynamic stiffness requirements, and total/differential settlement design tolerances. Geopier® ground improvement provides site-specific solutions to address these challenges.

## IMPROVED BEARING PRESSURE

Geopier ground improvement systems provide high internal friction angles and soil improvement to allow significantly improved design bearing pressures of 5 to 10 ksf, depending on soil conditions. The improved bearing pressure provides support for the large foundation edge pressures and may also reduce footing sizes, saving time and money on your project.

## SUPERIOR SETTLEMENT CONTROL

Geopier systems are engineered to provide you with a cost-effective approach that meets your specific project requirements. Geopier design-build engineers are experienced in providing superior settlement control for thousands of projects. In addition, site specific modulus testing provides an unmatched level of support and reliability.



Rammed Aggregate Pier® Installation



Victory Wind Farm  
Carroll & Crawford Counties,  
Iowa

## FOUNDATION STIFFNESS IMPROVEMENTS

The vertical energy imparted during construction results in piers with exceptional stiffness, delivering documented, proven settlement performance. The stiff Geopier elements improve the composite shear modulus beneath the tower foundation, increasing the rotational and dynamic stiffness to the reinforced soil for reliable foundation support. The Geopier design is specifically tailored to deliver the required rotational/dynamic stiffness values specified by tower designers.

## SOLUTIONS FOR ALL SOIL CONDITIONS

Subgrade conditions for wind turbine structures are usually the biggest variable in tower foundation design and construction. Whether your site is challenged by soft clays, loose sandy deposits, or even organic soils, Geopier design engineers have numerous Geopier ground improvement options to choose from to help satisfy your project's performance needs.

