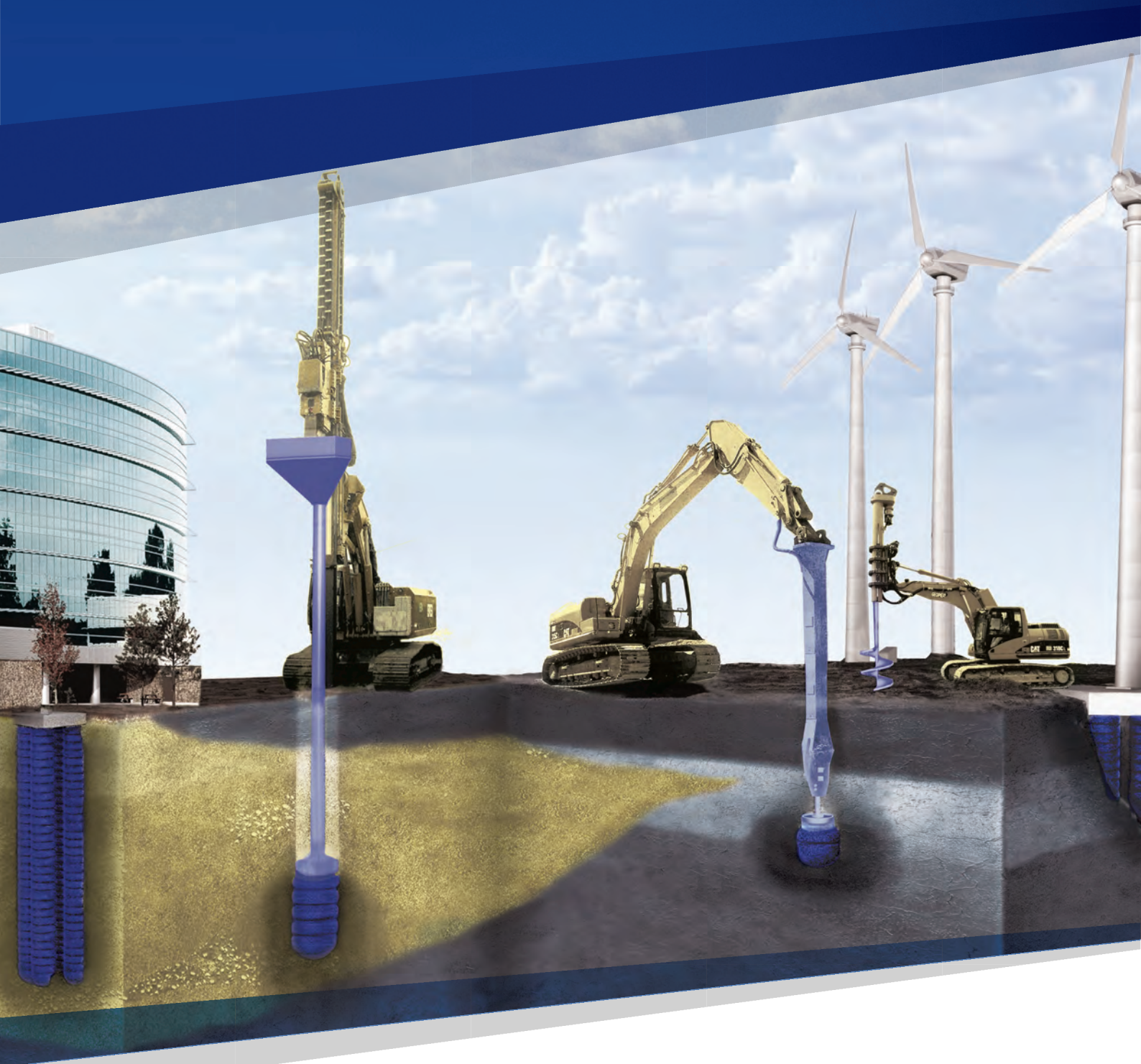


# TENSAR GEOPIER FOUNDATIONS

## RAMMED AGGREGATE PIER® SYSTEMS

YOUR INTERMEDIATE FOUNDATION™ SOLUTION



**Tensar**®

GEOPIER®  
FOUNDATIONS

► Use Rammed Aggregate Pier® systems by  
Tensor Geopier to Strengthen Soft Soils.

## Tensor® Technology - Proven Practical Solutions and the Know-How to Get them Built

Intermediate Foundation™ technology is widely adopted for soil improvement of soft ground, delivering real savings in cost and time. We can help you apply Tensor® Technology to improve the bottom line on your project.



*Because of the cost effective and rapid installation process, Geopier Rammed Aggregate Pier™ systems can avoid massive over excavation and deep foundations thus ensuring high levels of performance and reliability.*

## Building in Confidence with Rammed Aggregate Pier® Systems

Tensor Geopier is your experienced and reliable partner in soil improvement technologies for foundation support of commercial, industrial, transportation, residential and municipal construction. With more than two decades of proven foundation support, our Rammed Aggregate Pier® (RAP) systems provide resource-friendly, efficient and cost-effective Intermediate Foundation™ solutions. Our patented technologies utilise RAP elements that are constructed by densely compacting successive thin lifts of quality aggregate in 450 mm to 900 mm diameter cavity of depths up to 14 m using patented ramming processes. The vertical ramming action increases the lateral stress and improves the soils surrounding the cavity, which results in foundation settlement control, greater shear resistance, and increased bearing pressure for design.

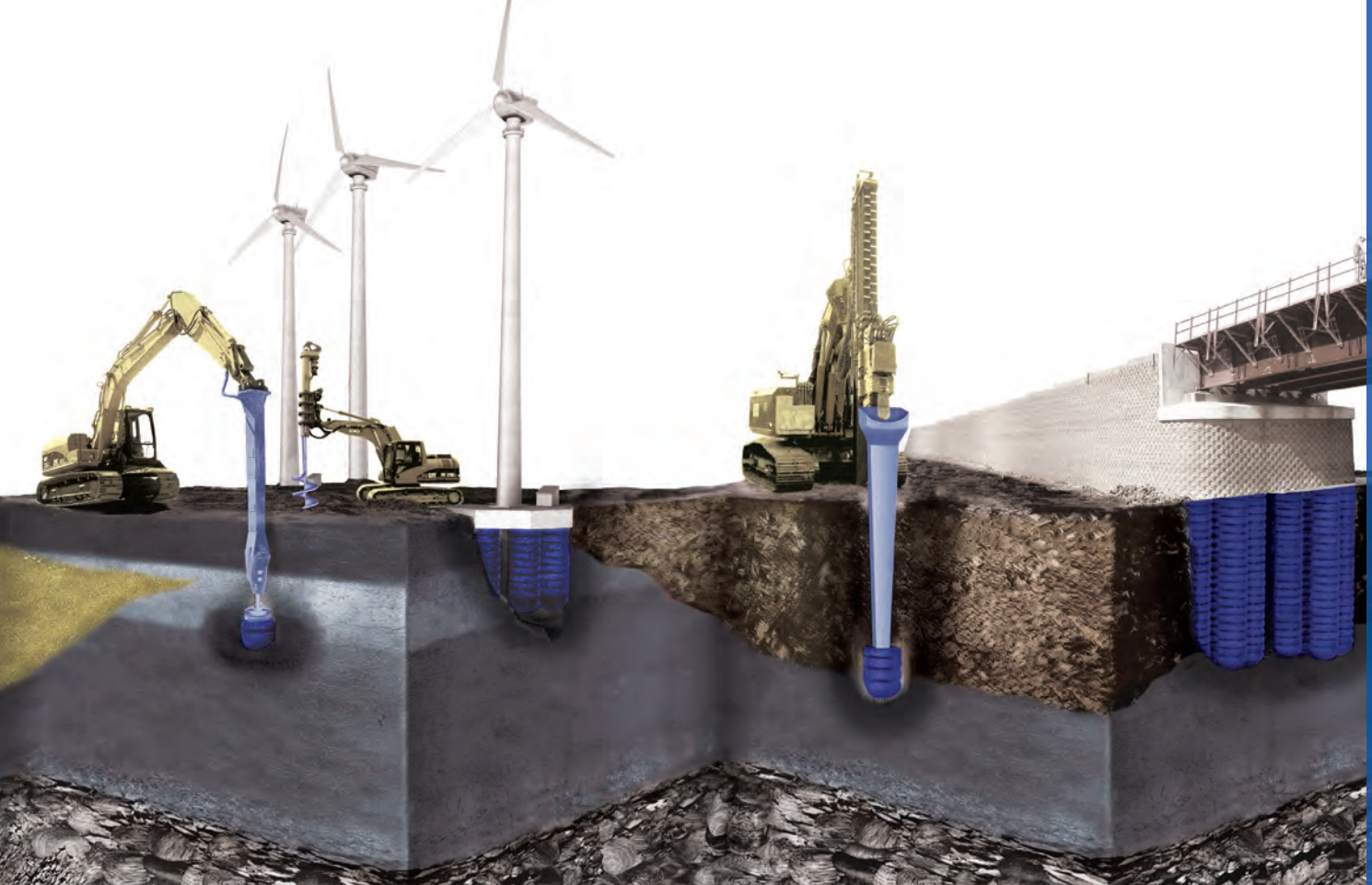
RAP systems can be installed using replacement or displacement methods, depending on site requirements. The individual installation process utilises both direct vertical impact ramming energy combined with downward vertical compaction force, resulting in high strength and stiffness. RAP systems are used to improve good to poor soils, including soft to stiff clay and silt, loose to dense sand, organic silt and peat, and variable uncontrolled fill. RAP systems replace the need for costly and resource-depleting deep foundations or overexcavation.

Tensor Geopier offers a wide range of methods and solutions for different soil conditions and challenges. Depending on the specific conditions of the project we are offering three different soil-improvement methods:

- Geopier GP3™ System
- Geopier Impact™ System
- Geopier Rampact™ System



*Cement Clinker Dome Construction  
Medgidia, Romania*



## Construction Advantages

- ▶ Rapid installation process
- ▶ Specific on-site quality control through visual inspection of drill spoils and modulus tests
- ▶ Significantly reduce or eliminate spoils for removal or treatment
- ▶ Besides a working platform no site infrastructure required
- ▶ Displacement approach eliminates casing and allows for construction below groundwater
- ▶ Clean process results in little construction mess or siltation concerns
- ▶ Densifies granular soils and reinforces cohesive and organic soils and fill
- ▶ Often results in significant cost savings
- ▶ Prevents contamination migration and improves stiffness and bearing support by adding cementitious mixes
- ▶ Versatile system allows for use in a wider range of structures
- ▶ Low vibration levels
- ▶ Environmentally safe and sustainable offering contribution to an improved CO<sub>2</sub>-balance
- ▶ Proven and cost effective solution for a variety of applications
- ▶ No delay period for curing accelerates construction schedules
- ▶ Allows deep treatment for liquefaction

## KEY ENVIRONMENTAL BENEFITS OF TENSAR GEOPIER SOLUTIONS:

- ▶ Can replace steel or concrete deep foundations with natural, local aggregate
- ▶ Reduces high fossil fuel consumption needed for massive overexcavation and replacement
- ▶ Reduces construction waste by using reclaimed aggregate such as recycled concrete
- ▶ Eliminates potential for harmful water runoff, siltation and environmental disturbance with our dry RAP construction process
- ▶ Reduces construction disturbance on greenfield sites using small RAP installation equipment and maintaining limited stockpile area
- ▶ Reduces noise levels in the environment



*Heifer International Center  
Little Rock, Arkansa, USA*

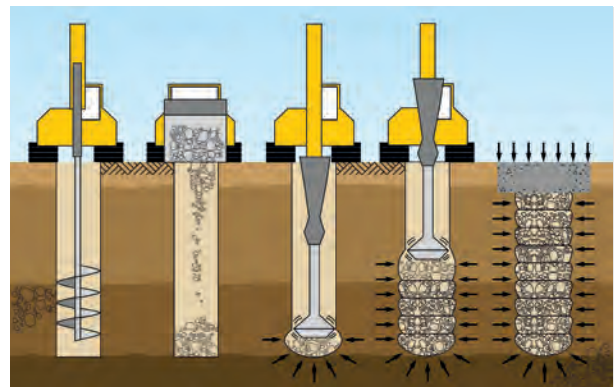
➤ Engineered to meet specific soil conditions and loads, the Geopier GP3™ system provides foundation support for sensitive structures.



Houston Fuel Oil Terminal Company Tank Yard Construction Houston, Texas, USA

## The Geopier GP3™ System

Tensar Geopier developed the Geopier GP3™ system as an efficient and cost effective Intermediate Foundation solution for the support of settlement sensitive structures. The Geopier GP3 system has since become an effective replacement for massive overexcavation and replacement or deep foundations, including driven piles, drilled shafts or augered cast-in-place piles. Thousands of structures are currently supported by Geopier systems – proven experience that ensures high levels of performance and reliability compared with traditional systems.



Geopier GP3™ Construction Process

### THE GEOPIER GP3™ CONSTRUCTION PROCESS

The Geopier GP3 system uses replacement Rammed Aggregate Pier (RAP) elements to improve good to poor soils, including soft to stiff clay and silt, loose to dense sand, organic silt and peat, and variable, uncontrolled fill.

The installation process utilises pre-augering and vertical impact ramming energy to construct RAP elements, which exhibit excellent strength and stiffness. RAP systems are designed to provide reliable and imposing total and differential settlement control and increased bearing support to meet project requirements.

**1.** The process first involves drilling a cavity 60 cm or 75 cm in diameter. Drill depths normally range from about 2 m to 7 m. Both diameter and drill depths are depending on design requirements. Pre-drilling allows you to visually inspect the soil between the borings, ensuring that the piers are engineered to improve the right soils.

**2.** Layers of aggregate are then introduced into the drilled cavity in thin compacted lifts. A bevelled tamper rams each layer of aggregate using vertical impact ramming energy, resulting in very high strength and stiffness. The tamper densifies aggregate vertically and forces aggregate laterally into cavity sidewalls. This results in excellent coupling with surrounding soils and reliable settlement control.

**3.** Following installation, RAP elements reinforce slopes and embankments, support shallow foundations, floor slabs, and tank pads. The footing stresses are attracted to the stiff RAP elements, resulting in engineered settlement control.



*KIA Manufacturing Plant Construction  
West Point, Georgia, USA*



*Cement Clincer Dome  
Medgidia, Romania*

### CONSTRUCTION ADVANTAGES

- ▶ Better quality control through visual inspection of drill spoils and modulus tests
- ▶ Besides a working platform no site infrastructure required
- ▶ Environmentally safe and sustainable offering contribution to an improved CO<sub>2</sub>-balance
- ▶ Clean and rapid installation process
- ▶ Accelerated schedules
- ▶ Versatile system allows for use in a wider range of structures
- ▶ Reliable and cost effective

### DESIGN / PERFORMANCE ADVANTAGES

- ▶ Strong and stiff elements
- ▶ Excellent settlement control
- ▶ High support capacity
- ▶ Increased bearing pressure
- ▶ Designed for structural support of buildings
- ▶ Often results in significant cost savings
- ▶ Engineered to meet specific soil conditions and loads

### APPLICATIONS

- |                                    |  |
|------------------------------------|--|
| ▶ Foundations                      | ▶ Transportation                               |
| ▶ Floor slabs                      | ▶ Embankments                                  |
| ▶ Biofuel facilities               | ▶ Railways                                     |
| ▶ Industrial tanks                 | ▶ Liquefaction                                 |
| ▶ Wind turbines                    | ▶ Lateral load resistance                      |
| ▶ Earth retaining walls and slopes | ▶ Drainage to accelerate consolidation process |



## The Geopier Impact™ and Geopier Rampact™ Systems

The Geopier Impact™ and Geopier Rampact™ systems are efficient and cost-effective Intermediate Foundation solutions for the support of settlement-sensitive structures. Like the GP3 system, both the Impact and Rampact systems create stiff Rammed Aggregate Pier (RAP) elements using patented vertical ramming processes. Where the Geopier GP3 system uses a replacement method, the Impact and Rampact systems use the displacement method, ideally suited for contaminated sites where spoils or overexcavation is not an option. Both systems are extremely cost effective for installations in soils subject to caving because construction is facilitated using patented displacement mandrel, eliminating casing risks. The Impact and Rampact solutions replace massive over excavation and replacement and deep foundations, including driven piles, drilled shafts or augered cast-in-place piles. This high-performing systems provide high strength, stiffness and excellent levels of performance.

### CONSTRUCTION ADVANTAGES

- ▶ No drill spoils reduce project costs – especially advantageous in contaminated soils
- ▶ Besides a working platform no site infrastructure required
- ▶ Specific Quality Control program including modulus load tests
- ▶ Environmentally safe and sustainable offering contribution to an improved CO<sub>2</sub>-balance
- ▶ Clean and rapid installation process
- ▶ Accelerated schedules
- ▶ Versatile system allows for use in a wider range of structures
- ▶ Reliable and cost effective



*Bogazici Shipyard  
Altinova, Turkey*

### DESIGN / PERFORMANCE ADVANTAGES

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- ▶ Excellent settlement control
- ▶ High support capacity
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### APPLICATIONS

- ▶ Foundations
- ▶ Floor slabs
- ▶ Biofuel facilities
- ▶ Industrial tanks
- ▶ Wind turbines
- ▶ Earth retaining walls and slopes
- ▶ Transportation
- ▶ Embankments
- ▶ Railways
- ▶ Liquefaction
- ▶ Lateral load resistance
- ▶ Drainage to accelerate consolidation process

With more than two decades of proven foundation support, Geopier® systems provide resource-friendly, efficient, and cost effective foundation support.



Wind Park Construction  
Purzien, Germany



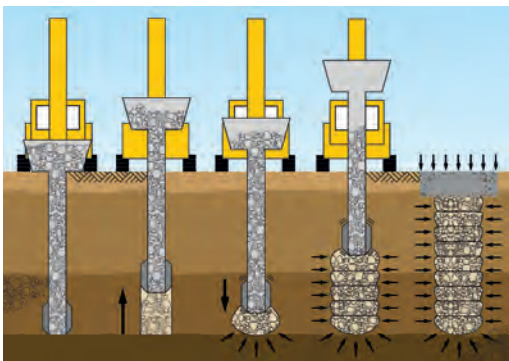
Geopier Rampact™ Construction  
USA

## The Geopier Impact Construction Process

1. A specially designed mandrel and tamper foot is driven into the ground using a strong static force augmented by dynamic vertical impact energy. Depths normally range from 3 m to 14 m, depending on design requirements. A sacrificial cap or other flow restrictors prevent soil from entering the tamper foot and mandrel during driving. The process eliminates spoils and displaces soils laterally, densifying and reinforcing the existing soils.
2. After driving to design depth, the aggregate is fed into a hopper at the top of the mandrel by use of a telehandler. The hollow mandrel serves as a conduit for aggregate placement. The mandrel is then lifted approximately 1 m and then driven back down 60cm, forming a 30 cm thick compacted lift. Compaction is achieved through static

down force and dynamic vertical ramming from the hammer. The process densifies aggregate vertically and the patented bevelled tamper foot forces aggregate laterally into cavity sidewalls. This results in soil improvement, excellent coupling with surrounding soils and reliable settlement control with excellent strength and stiffness.

3. Following installation, the Rammed Aggregate Pier elements support shallow foundations, floor slabs, and reduce liquefaction potential and improve stability support of embankments, walls and storage tank foundations. The footing stresses are attracted to the stiff RAP elements, resulting in engineered settlement control.



Geopier Impact™ Construction

## The Geopier Rampact Construction Process

The Geopier Rampact system, like the Geopier Impact system, is a displacement technology. RAP elements provide effective support in relatively shallow deposits of man-made fill and other heterogeneous profiles to depth of approximately 6 m. Through its tapered shape, the Rampact system laterally compacts the matrix soil along the entire profile of the mandrel as the mandrel is driven into the ground. The blunt bottom is then used to compact each lift of aggregate which is introduced through the mandrel as the pier is constructed.

The Rampact system is faster to install and provides higher capacities relative to the displacement Impact system in appropriate soil profiles.

Your local installer is:

Contact Tensar Geopier or your local installer to receive further information about:

- ▶ **The Geopier GP3™ System**
- ▶ **The Geopier Impact™ System**
- ▶ **The Geopier Rampact™ System**

Tensar Geopier is part of Tensar Corporation, a leading global developer and manufacturer of proprietary, highly engineered, nontraditional site-development solutions for infrastructure end-markets, including transportation, commercial and industrial construction.

Tensar provides its customers with an integrated suite of innovative products, technologies and application expertise for a wide variety of end uses, including high performance roadways, earth retention structures, building foundations and erosion and sediment control.

**Tensar** | GEOPIER®  
FOUNDATIONS

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Printed November 2012, Issue 2, 485, EN

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