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**ADSC**

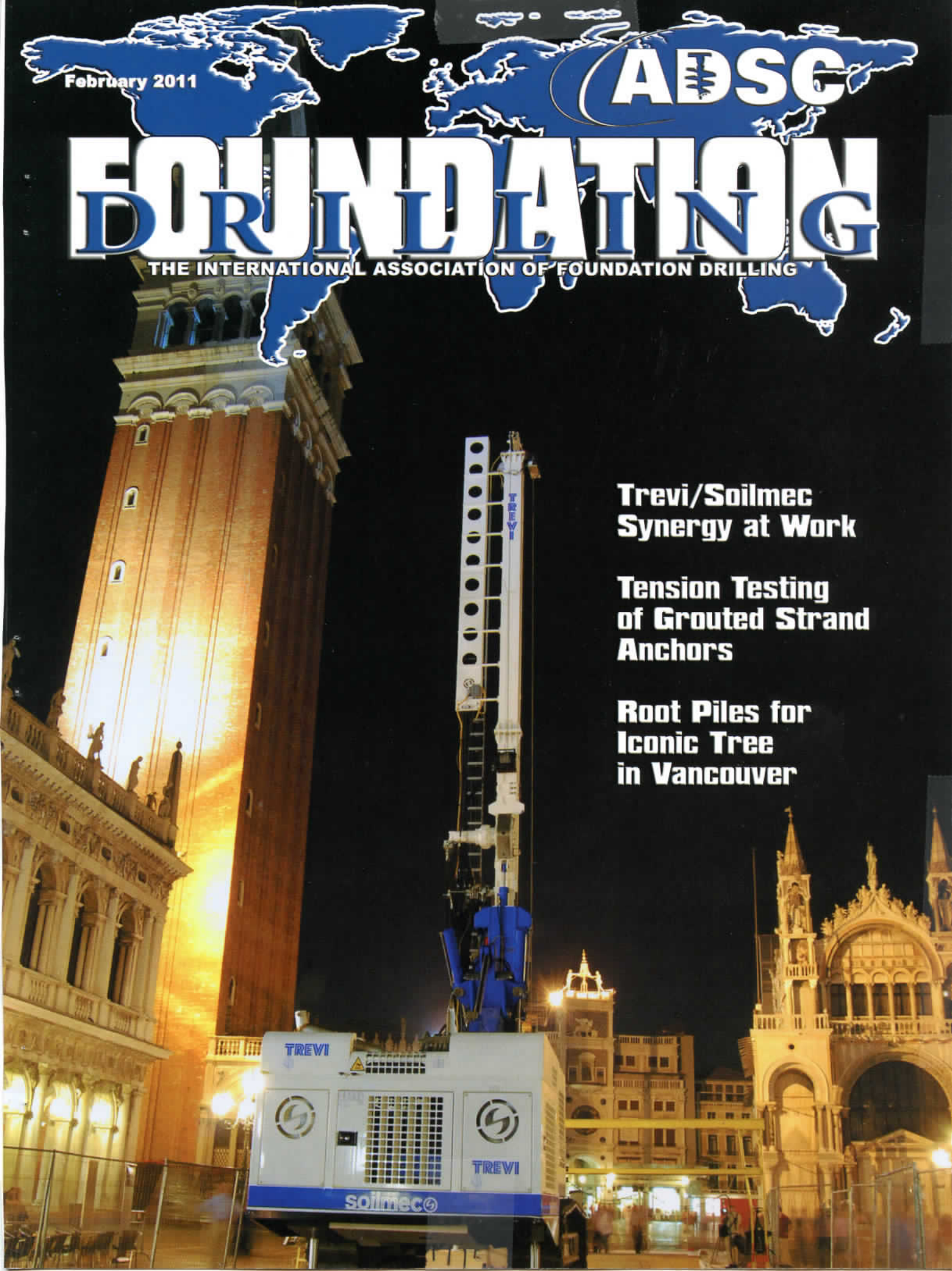
# FOUNDATION

THE INTERNATIONAL ASSOCIATION OF FOUNDATION DRILLING

**Trevi/Soilmec  
Synergy at Work**

**Tension Testing  
of Grouted Strand  
Anchors**

**Root Piles for  
Iconic Tree  
in Vancouver**

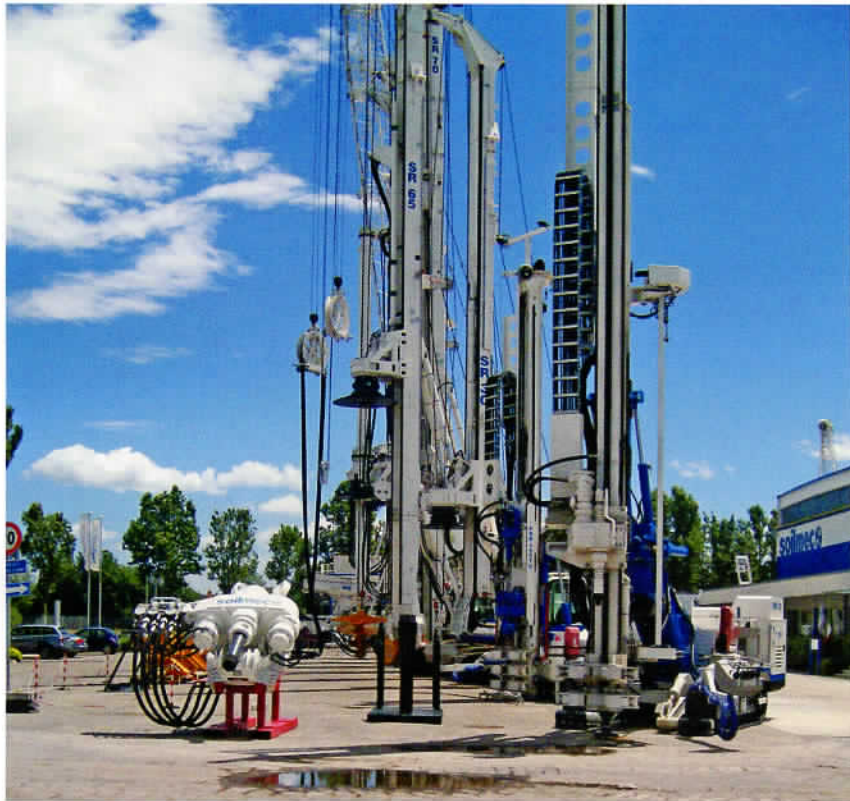




## Trevi/Soilmec a Synergistic Success Story

by S. Scot Litke

*This cover feature takes a somewhat different tack from our normal cover articles which tend to focus on one particular geo-construction project. In this instance, we take a look at Trevi SpA and Soilmec, which are ADSC Member companies that not only take on challenging geo-construction projects around the globe, but include, under its corporate umbrella, a highly regarded manufacturing wing with international customers. This model tends to be a more common one in Europe, and other parts of the world, as opposed to how companies are structured in the U.S. There are exceptions, however, in that the drill rig company that started out as Williams Diggers, and later became a division of Hughes Tool's Micon Division, and was ultimately purchased by ADSC Contractor Member, McKinney Drilling, operates as Atlantic Drill and Equipment.*



*The Soilmec facility in Cesena, Italy.*

In June of 2010, a group of ADSC North American geo-construction specialty subcontractors traveled to Italy to observe a variety of challenging deep foundation construction projects being undertaken by ADSC International Contractor Member, Trevi SpA, and to visit the Trevi Group headquarters and the Soilmec manufacturing facility in Cesena, Italy. The journey took the travelers through a good part of central Italy where they were treated to a close-up view of the kind of major work that Trevi SpA takes on

the manufacturer of equipment designed to address every conceivable deep foundation, earth retention, and ground modification challenge. Soilmec is a long standing ADSC Associate

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routinely around the world. Of particular interest were undertakings that involve construction and ground modification for projects associated with high speed rail which has already taken hold in Europe. The demands attendant to these projects are as wide and varied as the hundreds of miles of variable terrain and soil and rock conditions that are part and parcel of what is to be dealt with. Of particular interest are underground railway stations, tunnel vaults, and soil improvement of the rail bed. The complexity of these efforts, provide an excellent tableau in which to observe the symbiotic relationship between Trevi, the constructor, and Soilmec,

Member, as is the TREVIICOS Corporation, Trevi's U.S. construction entity. This report will focus on the work undertaken by Trevi SpA and the products offered by Soilmec as they most closely mirror the interests of the industries represented by the ADSC.

### The Trevi Group

The Trevi Group is composed of five different companies, Trevi SpA, Soilmec SpA, Petreven, Drillmec, and Trevi Energy. Each company has its own area of specialization including Geo-Construction, oilfield exploration, and geothermal applications. Trevi SpA, the Geo-Construction contracting company has local entities in over 30 countries typically working on 250 separate projects at any time.

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While the word “innovation” has become somewhat of a cliché when discussing the kinds of projects and equipment that typify the work of ADSC members, when it comes to Trevi’s approach, it is the most appropriate description. Over time most of the Soilmec equipment that has made it to the production floor has been developed as a response to Trevi’s construction needs, with external customers also benefiting. This has been the case from the very outset when Trevi was founded as *Impresa Pali Trevisani* in 1957 by a young surveyor, Davide Trevisani. Its initial task was to produce small diameter piles using water well equipment. The inter-relationship of construction and equipment was part and parcel of the Trevi model with the first rotary rig designed for installing large diameter drilled piles coming along in 1967. This was the year in which the company took on its first “overseas” contract constructing the foundations for the Apapa Road in Lagos, Nigeria. It became apparent to the organization’s leaders that, in order to be successful, the company needed to build its own machinery to complete its own projects. This led to the formation of Soilmec in 1967. Over the years, beginning in 1997 and through 2009, Trevi has acquired a number of existing companies from all over the world, melding them into the Trevi Group. According to Gianluigi Trevisani, “We started as a small family business, now we have over 6,000 staff members all over the world.” Trevi SpA specializes in large, usually difficult construction projects. These include, but are not limited to, constructing dams, power plants, tunnel support systems, all in some of the most intensely populated and most barren parts of the globe. The Trevi family members, who still are the primary decision makers within the corporate structure, take great pride in providing incomes for well over 15,000 people within the *extended* Trevi “family.” Stock in Trevi Finanziaria, the Group Holding Company, has been traded on the Italian stock exchange since 1999, and has been one of the leading performers for the past five years. Quite a transition from the firm’s modest beginnings.

The transition from drilling entrepreneurs to engineering contractors, mechanical engineers/equipment manufacturers, has been the company hallmark. The process for overall success goes some-



*North American delegation with Soilmec reps at Cesena plant.*

thing like this; one begins with a construction problem; this leads to an engineering solution, which stimulates the development of a new technology; that results in the creation of new equipment. In this regard, a reading of the company’s Mission and Vision statements is instructive.

## **Florence, Italy, High Speed Rail Underground Station**

One of the Trevi construction projects that the North American delegates observed was for an underground station for a high speed rail line in Florence, Italy. For this project, Trevi is acting as a Joint Venture Partner responsible for the ground improvement and foundation construction of the project. The ultimate Trans-European Transport Network, of which this is a part, is to have a high speed rail line run from Naples, Italy, to Norway by 2013. This ambitious undertaking is being funded by the European Union, the Italian Government, and Tren Italia. The Florence project visited involves construction along (and below) an active rail line that goes from Florence to Bologna. In order to accommodate the exacting demands of high speed rail with trains cruising at speeds reaching 180 mph, stations must be either built from scratch or reconfigured to allow for optimal system efficiency and safety (it takes nine kilometers for a high speed train to stop from full speed) and for best passenger access and egress, stations typically are located in the City Center. The Florence project is being constructed at 50 ft. below the water table and required that a number of advanced techniques be employed. The ground improvement phase called for the use of the “Turbo-Jet” technology.

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*Mission: We plan, execute and offer technologies and innovative services for any kind of work in the field of foundation engineering.*

*Vision: Becoming the main technological partner in the field of soil foundation engineering and in the research and development of water and energy resources.*





High speed rail station being built in Florence, Italy.

This is a high pressure/low volume soil mixing technique used to stabilize the existing right-of-way over the train tunnels bored to the new station in alluvial materials (silty sands). The roof of the tunnel in some locations is only 3-5 meters below the existing grade where the tracks are currently located. Trevi is required to remove the tracks, treat the soil, execute the foundation construction component, and then replace the tracks. Turbo-Jet technology and parameters were chosen after computer simulation indicated significantly better results compared to either continuous flight auger or jet grouted columns. The ground im-

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provement consists of thousands of overlapping soil mixed columns, each with a specific surface location, angle to vertical, and below ground start/stop depths. Trevi uses a sophisticated GPS system coupled with computerized real time measurement and wireless reporting in an effort to eliminate, or at least minimize, the chance for human error. This theme is carried on over to the equipment manufactured by Soilmec and will be discussed later.

The station will be 460 meters long and 60 meters wide with track level depth of 70 ft. A variety of ground improvement and foundation technologies are being utilized for the station including Diaphragm Wall, Secant Pile Wall, Jet Grouting and Drilled Shaft Construction. The installation of drilled shaft foundation piles will be accomplished with a Soilmec rig that is convertible from Cased Secant Pile to Kelly bar drilling with a casing oscillator in about three shifts.

Utilizing the Trevi Group collective brain thrust to identifying the problems to be solved, coming up with an engineering design

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Drilling in Las Vegas, Nevada.



and construction solution, and in many cases designing and building special equipment, is the way in which Trevi approaches all its major projects. For them innovation starts with a mindset, a receptivity to looking at the entire equation differently and advising the project owners of the proposed solution. You will note that a traditional “engineer intermediary” is not part of the equation. This is a common model applied in Europe for the really large projects. Trevi feels that, in large part, this works in Europe and other countries in which they operate because there are only a few, capable, specialty contractors working in relatively small countries. This form of contracting is dependent upon a high level of trust. The attitude of the owners of these kinds of projects is “We are partners. We know that you know how to do it. We all want a positive outcome, so let’s work together.” This particularly European model for the really big projects might not work in an adversarial environment such as that which is the modus operandi in the United States. While one would hope that successful project management should place a premium on innovation and cooperation, in reality one must consider the entire cultural context including geographic, geotechnical, contractual, political, social, and economic



Trevi in Naples, Italy.

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factors. In a cynical fashion, unfortunately, innovation and cooperation may not be in the best interest of all parties involved here.

## Soilmec

The Trevi Group headquarters housing Trevi SpA and Soilmec, is a large campus location in Cesena, Italy. The Soilmec manufacturing plant, is a state-of-the-art manufacturing facility including a new assembly building. It is founded on 80 each, 120 ft deep geothermal piles, and features floor heating. The HVAC system is a combination of geothermal and solar sourced energy. There are a number of immaculately maintained build-

ings where the full line of Soilmec rigs are assembled. “Assembled” is the operative word here, as the parts that go into a Soilmec rig are fabricated by subcontractors under rigorously defined manufacturing and quality control specifications. Soilmec rigs are powered by Caterpillar, Cummins, and Deutz engines, which soon must conform to worldwide Tier 4 emission control specifications. There are approximately 500 workers kept busy in the multiple phases of assembly. An interesting sidelight is that, unlike most manufacturing facilities in the U.S., at the Soilmec plant you will not see any “lunch pails” as plant employees are provided the opportunity to eat at the company dining hall. A new 10,000 sq.

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*A Soilmec SR-90 with hydromill attachment is making history by participating in the largest deep soil mixing job ever performed in the U.S. This is intended to better protect New Orleans from hurricane and storm surge.*





Work under way at iconic tower in Pisa.

meter headquarters facility is planned and will come on line in the near future.

In addition to the foundation machines currently offered in the Soilmec line, several "experimental" rigs are in advanced stages of development. Soilmec works closely with the Trevi construction divisions and its long list of external contractor customers to develop machines that address all ground engineering construction needs. Soilmec rigs working throughout the world today number in excess of 4,000 units, working in 90 countries, with machines ranging from 4-150 tons. The Soilmec line includes Hydraulic Rotary Rigs mounted on crawlers or trucks, Crane Attachments, CFA rigs, Cranes, Hydraulic-type Diaphragm Wall Grabs, Rope-type Diaphragm Wall Grabs, Micropile rigs, and even rigs used in tunneling operations. One of the Soilmec drilling machine innovations is that multiple drilled foundation technologies can be performed by the same rig transformed with special kits to accommodate a range of technological applications from Kelly bar, CFA, Cased Secant Pile, and circulation drilling of large shafts. Safe machine operations are a critical concern for Soilmec. They place a strong emphasis on building safe design, assembly, and operating procedures for its machines. This is right in line with the ADSC's safety focus.

The Soilmec mantra, "to provide products and solutions for all geotechnical construction," is realized everyday at the immaculate manufacturing plant where enterprise and efficiency are everywhere in evidence.

## Soilmec North America Locations

Soilmec was one of the first European drill rig manufacturers to enter the U.S. market becoming an ADSC Associate Member in 1985.

Soilmec is represented in North America by a number of Branches and Agents. One Soilmec North America U.S. Branch and assembly facility, (shared with oil field company Drillmec), is located in Houston, Texas. The second branch, of which Soilmec is particularly proud, and with whom the company has established a new partnership, is U.S. drilling rig manufacturer Watson, Inc., Ft. Worth, Texas. Watson, Inc. is also providing assembly capabilities. U.S. Agents are Champion Equipment Sales, LLC, with offices in Paramount, California and Salt Lake City, Utah, and American Equipment and Fabricating Corp., located in East Providence, Rhode Island. Their continuous relationship with Soilmec for over 25 years is a bench mark in the United States. That training, experience, and trust has benefited Soilmec, its agents, and its many North American customers.

The U.S. dealers, Champion Equipment Sales, led by company president Vince Jue, and AE&F, headed by Gil Peel, have been staunch supporters of all of the ADSC's educational programs, providing sponsorships, equipment and personnel whenever called upon.

## Soilmec Rigs and Trevi Construction Command Central

One of the most fascinating capabilities being developed by

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Command Central in Cesena headquarters.



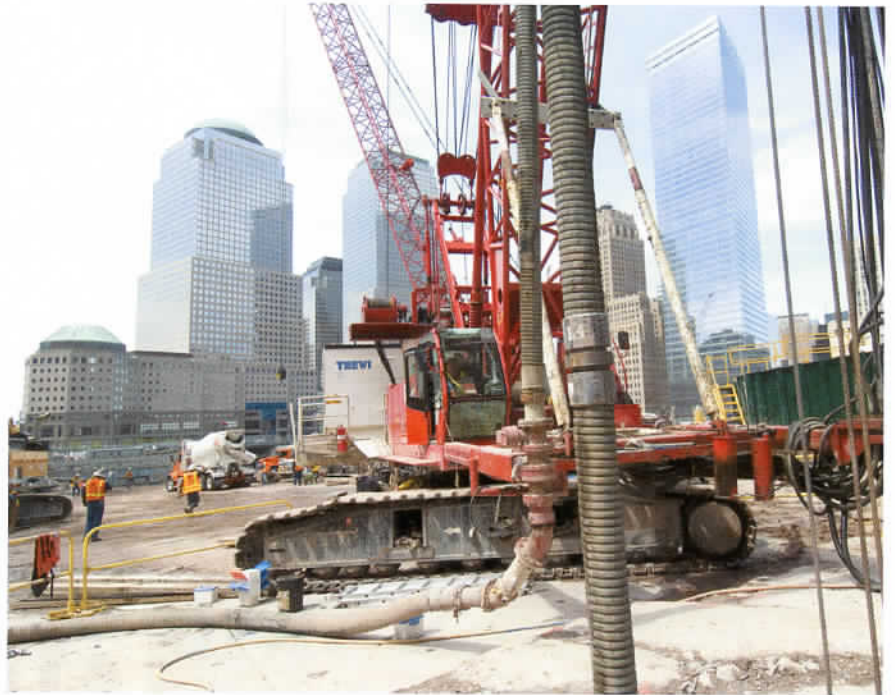
Trevi and Soilmec is a wireless, integrated, drilling rig performance, real-time-monitoring system. I realize that is a mouthful but so is the operating theater, which strongly resembles a NASA control room. This "control room" is located at the Cesena facility. Imagine, if you will, a long wall of high-definition monitors mapping everywhere a Soilmec rig is working, recording drilling rates, concrete or grout placement cycles, rig condition, and operating parameters, all being recorded in

*This capability to objectively monitor up to hundreds of parameters, and to remotely analyze, by experts, for better solutions, is the epitome of the Trevi-Soilmec symbiotic/innovation process.*

real time and observed by operators much like air traffic controllers. The sophisticated monitoring allows experts in Italy (or in the customer's office) to monitor and optimize jobsite performance and equipment parameters. As processes and equipment become more and more complex, this lightens the operators burden and allows him to concentrate on the job at hand occurring outside the cabin window. This capability to objectively monitor up to hundreds of parameters, and to remotely analyze, by experts, for better solutions, is the epitome of the Trevi-Soilmec symbiotic/innovation process.

## Trevi's Foundation Technology Academy

As further evidence of the methodical and comprehensive way in which Trevi approaches every aspect of operations and customer service is the founding of its *Foundation Technology Academy* where Trevi Group personnel and representatives from its international customer base will receive specialized training. Current courses are in equipment maintenance, equipment operation, and jobsite



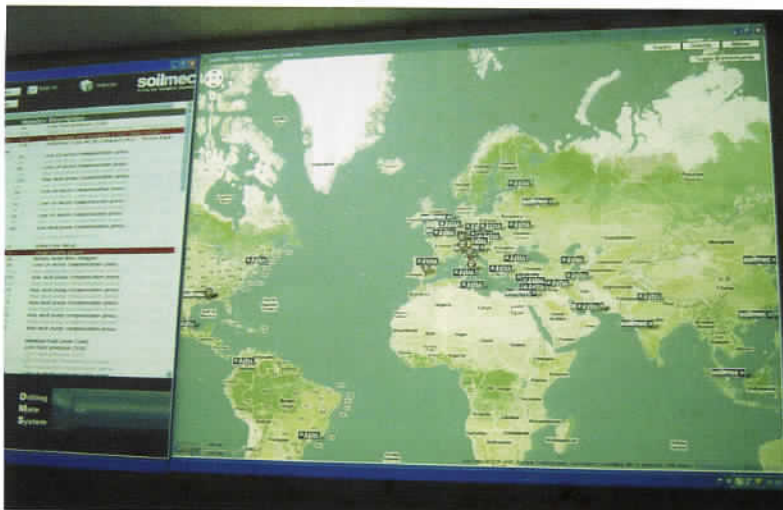
*New York City's World Trade Center - another construction venue.*

management, and are specifically for the foundation and ground construction industry. The first Academy is working at the Cesena location and has trained over 45 personnel from Soilmec's North American customers. It is anticipated that a smaller scale, but similar training center, will be established at the Soilmec North America facility in Houston.

## Conclusion

An underlying theme of this article is the creative synergy created between the Trevi construction and equipment divisions. At the outset of this feature, you might recall that it was Davide Trevisani, the original company founder, that realized the importance of designing and building foundation engineering machines that were specifically suited to the demands of a project. That concept is at the very core of the Trevi-Soilmec partnership, moreover, a partnership that Soilmec offers to all of its customers. The folks at Trevi like to say that, "Innovation and Invention are in the Trevi Chromosomes." I am certain that there are many, many ADSC member companies of all classifications that feel the very same way, which in the end is what the engineered foundation industry is all about.

*To learn details about the full Soilmec product line, visit the company website at: [www.soilmec.com](http://www.soilmec.com), or consult the ADSC On-Line Membership Directory on the ADSC website: [www.adsc-iafd.com](http://www.adsc-iafd.com) where you can link to Soilmec's dealer agents.*



*Location of Soilmec rigs being monitored throughout the world.*







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