

# Piling the Wembley way - Cisco Aironet revolutionises communication on site for Stent Foundations

## Executive Summary

### Background

The new Wembley Stadium project is now underway and Stent Foundations Ltd., part of the Balfour Beatty Group, is laying the foundations. Its role is to construct the piling that will serve as the legs on which the full load of the structure will be distributed.

### Challenge

Monitoring and keeping records of the excavation and concrete filling of the piles is critical to the engineering of the whole project. Historically, managers have had to rely on manual data collection, which is inconvenient and difficult in the construction site environment.

### Solution

Stent Foundations has deployed a Cisco Aironet Wireless infrastructure on site at Wembley, equipping engineers with tablet devices connected to a server in the site office. Data is entered directly onto the server as it is collected.

### Results

The Stent solution has proved less expensive, faster, more accurate and more convenient than the old paper process. In addition, it has delivered a level of flexibility and data integrity that would not have been possible with a wired solution in so hostile an environment.

## Background

**Wembley is the home of legends. For all the controversy surrounding its conception, the 90,000-seat stadium now under construction is a magnificent edifice, with a sweeping arch that will be a worthy icon to succeed the old twin towers.**

The company charged with laying the foundations on which this mighty structure will stand is Stent Foundations Ltd., part of the Balfour Beatty Group. Stent Foundations employs more than 200 people and has offices in Hampshire, Derbyshire and Glasgow, together with a plant department in Nottinghamshire.

Its role at the Wembley site is to construct the piling, the massive pillars of concrete and steel built as deep as 30 metres into the ground. In effect, they serve as the legs on which the huge load of the structure will be distributed.

### Challenge

To the untrained eye, construction sites can frequently look utterly chaotic. Yet the rubble and the noise belie a painstakingly planned and rigorously documented process in which safety and accurate records are paramount concerns.

Michael Ward is a research engineer from the Centre for Innovative Construction Engineering at Loughborough University, working with Stent Foundations in the application of data capture technology on the construction site. His particular focus is



on the question of data capture with regard to the construction of the piles, seeking to replace the laborious paper-based process with more accurate and efficient electronic alternatives.

“It is a process concerned with quality control and the creation of records for future reference,” he explains. “The piles are constructed by drilling holes deep into the underlying strata, into which steel cages are inserted and concrete poured.. The load-bearing requirements dictate the size and depth of the piles and therefore the amount of steel and concrete required.

“But the actual process is inevitably imprecise; the walls of the piles may be unstable and the fluid nature of concrete is such that it will always find the path of least resistance. You can tell when the hole takes more or less concrete than you expected and the variation has to be taken into account. The quality of the pile construction can be adversely affected by reduced concrete volume.”

Collecting data in the noise and mess of a construction site is difficult and it is axiomatic in any industry that quality declines in direct proportion to the level of difficulty to be overcome. Michael’s Ward’s brief from Stent Foundations called for a solution that improved the process of data collection, achieving a quality of measurement and control that would translate into a better and more consistent finished product.

“The real challenge lay in the site environment itself,” says Michael. “As well as dirt and mud, you have heavy plant moving crashing about, demolition work going on and the unpredictability of the weather. It’s not the kind of place you would expect to find state-of-the-art high technology.”

### Solution

Michael conceived the idea of using a wireless network with web-tablet clients. “The small hand-held devices are robust and easy to carry safely,” he explains, “and the tablet format, linked with process-orientated software, means that the users don’t have to learn a completely new input process.”

The Cisco Aironet solution was selected because, says Michael, it offered the most stable and most developed mature wireless system available. “It gave us the best range we could find and provided the rugged bridge design we needed for the site,” he adds.

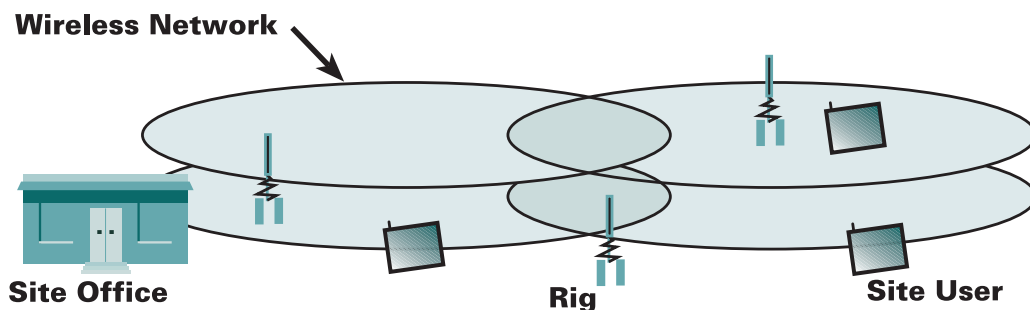
The Wembley infrastructure incorporates four Cisco Aironet AIR-BR350-E-K9 wireless bridges, with 5.2Dbi omni-directional antenna. Cisco Aironet LMC cards are installed in the tablet devices.

Power is delivered to the bridges from 12 volt sealed lead acid batteries, via RJ45 cable. To provide the 42 volt supply required by the bridges, Michael developed a solution which involves placing a power injector between the battery and the cable. This takes 12 volt input and delivers the 42 volt output through the cable. The whole infrastructure links back to a single server in the main site office.

All data is stored on the server computer and the users access a database system using the touch-screen tablet computers to record the pile construction information. No data is stored on the wireless tablets, thereby eliminating potential loss from damaged computers.

“In reality the execution of the solution is comparatively simple,” he adds. “We don’t have hundreds of users and multiple workgroups to pull together. Our only management issue lies in ensuring that the bridges are working correctly and from time to time we use the IP addresses to see what’s going on.

“The real challenge is the dynamic nature of the site. Areas of work can change and it is not feasible to have fixed access points. We needed the ability to reconfigure the network to suit the changing site environment. Portability, scalability and freedom of movement were key issues, as well as low maintenance and the ability to run on an independent power supply. Cisco Aironet delivered in every way.”



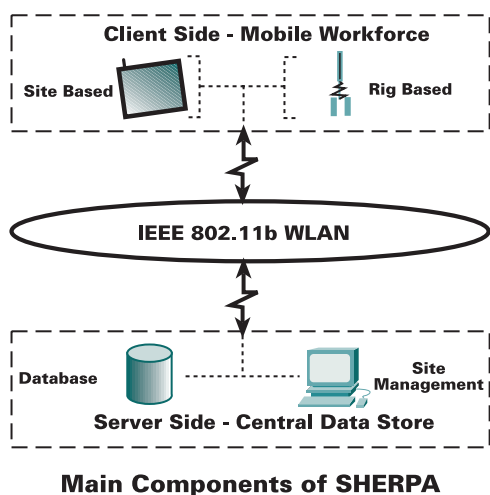
**Wireless network cells provide network coverage to all site users**



## Results

For Michael Ward and Stent Foundations, the Cisco Aironet infrastructure has delivered all the classic benefits of a technology solution, despite the hostile environment in which it is deployed. "It is less expensive, faster, more flexible, more accurate and more convenient than the old paper process," he says. "Moreover, it would simply not be possible to do this with a conventional hard-wired system. The only other alternative would have been to use a dial-up connection to a server, which would have been expensive and more difficult to manage. The data would also need to be stored locally, putting its integrity at risk if the machine were damaged."

From the user's perspective there is virtually no change in terms of their day-to-day tasks, except that they are made considerably easier now that unwieldy and unsuitable paper based records have gone.



## Future

With the Wembley solution rapidly becoming established, and a similar deployment at King's Cross underground station working successfully, Michael plans to continue his research, investigating the possibility of replacing site radios with IP phones.

"Construction sites traditionally use short-wave radio communication," he says. "However, this is not always feasible and mobile phones are becoming increasingly used on construction sites. With the emergence of technology enabling Voice over IP over WLAN, it is possible to use a single network infrastructure for both voice and data services. Within my research I am also going to investigate the application of the wireless network for location, detection and tracing of vehicle movements."

As Stent Foundations has demonstrated at the Wembley site, wireless networking opens possibilities far beyond the conventional office LAN and corporate WAN. It extends the capabilities of technology into areas that were previously too dangerous, or simply too impractical to benefit from them. It remains to be seen whether or not the inventiveness and technical excellence applied to the building of the stadium will eventually manifest itself on the pitch...



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