Dynamic tests open timber pile potential

DYNAMIC TESTING of timber piles for a University of São Paulo research project in Brazil proved them to be superior, in some aspects, to foundations built of more commonly used materials.

"The timber piles presented high resistance to both compressive and tensile stresses – in excess of 60MPa – have low weight and high resistance to bending," said PDI Engenharia managing director Jorge Beim. The Brazilian consultant was brought in by the research team to carry out the dynamic pile testing.

Although Brazil is one of the largest sources of timber in the world, wood is very rarely used for piles. But in 2004, increased steel exports to China highlighted the threat of shortages on the domestic market, and the need for proven "alternative" construction materials.

The year-long project, part of the emergency programme for timber bridges in the state of São Paulo, finished this summer. Work focused on the viability of using eucalyptus piles for the abutments of a wooden bridge being built on the university campus.

PDI Engenharia performed pile driving monitoring and dynamic pile testing on 12 of the piles. The aim was to determine pile driving behaviour, the elastic modulus of the piles and their bearing capacity, Beim explained.

The roughly conical piles were about 11m long, with top diameters ranging from 380mm to 464mm, with the diameter 300mm from the toe ranging from 276mm to 343mm. Below this the wood was cut at a sharper angle and the toe was more rectangular, 100mm by 310mm.

The measured specific weight of the piles was 9.8kN/m^3. The design work load for the piles was 300kN in compression – no tensile or horizontal load was expected.

A Pile Dynamics pile driving analyser processed data collected by four strain transducers and two accelerometers installed on each pile.

While Pile Dynamics said similar tests had been carried out on timber piles before, Beim believed this was the first dynamic test performed on timber piles in Brazil.

The accelerometers and two of the strain transducers were placed on the outside surface of the pile. The two other strain transducers were installed in the heartwood (the internal part of the timber), through two 50mm by 70mm windows cut in the pile.

"This allowed separate measurement of the elastic modulus of the whole pile, measured on the outside surface, and of the heartwood," Beim said. "This was important in gaining a better understanding of the characteristics of wood as a construction element."

Sensors collected data as the piles were being driven and during pile re-strikes. The PDA gave information in real time, while later analysis with the CAPWAP software determined other parameters.

"These piles can last almost indefinitely, if installed below the permanent water table," Beim said. "When treated with a special preservative, they have a long life even when experiencing alternate wetting and drying. This experiment may be the first step in examining the economic potential of this structural solution."