Escambia Bay Bridge
Foundation Testing Program

When Hurricane Ivan hit the southeastern United States in
September of 2004, it severely damaged the Escambia Bay
Bridge in Pensacola, Florida. The bridge was 4 km long. After
determining that damage suffered by the bridge prevented
its reuse, the Florida Department of Transportation (FDOT)
opted for rebuilding it. According to a FDOT press release,
the reconstruction of the bridge is being completed by the
design-build team of contractors Tidewater Skanska of Vir-
ginia Beach, Va.; Flatiron Constructors of Longmont, Colo.;
and design firm Parsons Brinckerhoff Quade & Douglas, Inc.,
of Tampa. The Geotechnical/Foundations design consultants
are Ardaman & Associates, Inc. of Orlando, Florida. The con-
tract amount was US$ 248 million.

The project consisted of first constructing temporary repairs
to bridge to quickly restore traffic to the I-10 highway, and
then permanent replacement twin bridges. The construction
of the temporary bridge was completed ahead of schedule
and the bridge opened to traffic in November of 2004. The
permanent Eastbound Bridge was open to traffic on De-
cember 19, 2006, while, according to FDOT, the Westbound
Bridge will open in November of 2007.

The temporary bridge was supported by steel pipe piles,
while the new twin bridges will be supported by almost 1400
concrete piles 900 mm square size driven to depth of more
than 45 meters. GRL Engineers, a consultant that specializes
in foundation testing, monitored pile-driving and conducted
hundreds of dynamic load tests as part of the reconstruc-
tion project, both on the temporary and permanent struc-
tures. Pile-driving monitoring and dynamic load tests are also
known as high-strain dynamic tests.

GRL Engineers, Inc. from Orlando, Florida conducted the
high-strain dynamic tests by attaching reusable sensors (ac-
celerometers and strain transducers) near the top of each pile
to be tested. As the piles were driven into the ground the
engineers analyzed the measurements in real time with a Pile
Driving Analyzer® and later CAPWAP™ rigorous data anal-
ysis. Special underwater sensors were necessary since some of
the piles were driven in water.
Pile Driving Monitoring performed on indicator piles was
used to establish a driving criterion for the production piles.
A driving criterion is a specified driving resistance at which
pile driving can be stopped. While a driving criterion can be
established prior to driving indicator piles by performing a
Wave Equation Analysis, it is best confirmed by a high strain
dynamic test. These tests gave the engineers information on
soil resistance at the time of testing, monitored pile driving
stresses, pile structural integrity, and evaluated the per-
formance of the driving hammer.
The tests performed during initial driving of production piles
had the primary purpose of monitoring pile driving stress-
es, assessing pile structural integrity, evaluating the per-
formance of the hammer driving hammer, and allowing driving
according to the established driving criterion. Dynamic Load
Tests were also conducted on production piles during restrict
after some time had lapsed after initial driving. In this case,
the piles were re-struck to allow for a reliable evaluation
pile capacity after time dependent soil strength changes had
taken place. The field data was analyzed with the software
program CAPWAP® that determines load bearing capacity
and simulates a static load test. The Dynamic Load Tests were
performed in addition to a smaller number of conventional
static load tests and lateral load tests. Dynamic load tests are
suitable alternative to the time-consuming and expensive
conventional static tests for execution in such large numbers,
since many piles may be tested in one single day.