



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 bridges is being completed by the design-build team of contractors Tidewater Skanska of Virginia 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 contract 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 December 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 reconstruction project, both on the temporary and permanent structures. 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 (accelerometers 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 analysis. 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 performance of the driving hammer.

The tests performed during initial driving of production piles had the primary purpose of monitoring pile driving stresses, assessing pile structural integrity, evaluating the performance of the hammer driving hammer, and allowing driving according to the established driving criterion. Dynamic Load Tests were also conducted on production piles during restrike 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. ■

عندما ضرب إعصار Ivan الولايات المتحدة الجنوبية في الولايات المتحدة، تعرض جسر Bay Escambia في فلوريدا إلى أضرار جسيمة ما اقتضى تشييد جسر مؤقت كمرحلة أولية ومن ثم إنشاء جسرين متطابقين دائمين. وقد قام مهندسو GRL الشركة الاستشارية المتخصصة في إجراء الاختبارات على الأساسات بمراقبة عملية دق الركائز وبإجراء مئات الاختبارات الخاصة بالعمل الديناميكي في كل من البنى المؤقتة والدائمة.

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