

PDCA project spotlight: new Cruise Pier 3, San Juan, Puerto Rico

Jennifer Raymond, Lester Publications, on behalf of the Pile Driving Contractors Association (PDCA), Gainesville, Florida, USA

Tourism revenue is very important to the Puerto Rican economy. A big part of that revenue is derived from the cruise ship industry. Competition between the various cruise lines is growing very intense as they continue to put more and larger ships into their fleets. These upgrades to the fleets often require upgrades to port facilities.

To meet the growing need, Cruise Pier 3 was commissioned by Royal Caribbean Cruise Lines and the Puerto Rico Ports Authority. The project involved the construction of a pile-supported pier in the bay at Old San Juan, Puerto Rico. The design for the new pier utilised a curved deck to neatly accommodate two cruise ships simultaneously and a fabric canopy over 100' high that resembled the sails of a vintage sailing ship. The new structure would also allow Royal Caribbean to accommodate the largest ships they currently have under design and the Puerto Rico Ports Authority the opportunity to attract additional cruise ship traffic to San Juan. The new facility would also provide increased revenue for Royal Caribbean, the Ports Authority and the people of Puerto Rico.

The project owners contracted with QB Construction, S.E. of San Juan to construct the new pier. PDCA member Continental Construction Company, Inc of Memphis, Tennessee was awarded a subcontract to furnish and install the driven piles and construct the concrete deck.

Getting underway

The project started in March 2004 with the mobilisation of test piles from the US mainland for the on-site Test Pile Installation/Testing Programme. By the end of the following month the test pile installations, PDA analyses, static compression, and tension tests were completed and production piles were ordered. The actual first load of production piles arrived and installation began the first of June 2004.

Over the next five months, the production piles were driven with one rig while a second barge-mounted crane constructed the concrete pier. Approximately 470, 18"x18" prestressed concrete piles, 105' in length, were driven with a hydraulic impact hammer.



The new Cruise Pier 3.

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Obstacles

Supplies

Obstacles had to be overcome early in the project. There was no supplier on the island capable of providing the project with the required prestressed concrete piles. The piles, weighing approximately 8,300 tonnes, had to be cast on the US mainland and shipped by barge to San Juan.

Logistics

Rodney Waits, Vice President of Continental Construction stated, "The logistics of this operation were made even more difficult by the fact that almost all of the piles, which were cast in Tampa, FL and barged to San Juan, were produced and transported during the height of 2004's very active hurricane season." He also noted that in the end it was "good fortune" that allowed the project to stay on track and completed without any serious damage from the storms.

Installation

Almost all of the driven piles were installed on a batter to accommodate the lateral loads imposed by ships, wind and earthquakes. Water depths at the site ranged from 15' to 40' and mud depths ranged from 5' to 30'. Continental Construction constructed a two-tier template to position the piles and accommodate the various, required installation angles.

The new pier was constructed near the site of a previous pier. Based on their review of the geotechnical report, Continental Construction expected some interference problems. However, it turned out that the sea floor was littered with debris both at and below the mudline. Continental Construction worked closely with the construction manager, QB Construction SE and structural engineer, Ray Engineers PSC, to work through the conflicts by relocating piles, adding piles or redesigning portions of the pier.

Debris

The task of driving long, slender piles on a batter through underwater debris proved very challenging. Piles could be easily cracked or broken during driving so great care was exercised throughout the duration of the project. Due to the fact that the piles were manufactured far from the work site meant that there would be tremendous cost and schedule impact if the number of piles that were damaged or lost exceeded the number of 'extra' piles that were added to the production pile order. Great attention to every detail was required to avoid damage. Waits said to keep everyone safe and make sure no damage occurred during pile installation, the production and quality control by the pile supplier, soil probing, template structure, hammer criteria and cushioning as well as employee supervision and training were all tailored to the specific conditions of the site.

The result of Continental Construction's perseverance and attention to detail was a striking new pier that will serve the cruise ship industry and benefit the people of Puerto Rico for many years to come.

Project Specifics

Project name: New Cruise Pier 3, San Juan, Puerto Rico

Project description: Precast pile supported dock that extends into the bay in Old San Juan to berth Royal Caribbean cruise ships.

Piledriving Contractor: Continental Construction Company Inc., Memphis, TN.

Owner: Royal Caribbean Limited and Puerto Rico Port Authority, Miami, FL.

Architect and Engineer: Ray Engineers PSC, San Juan, Puerto Rico.

Geotechnical Engineer: GeoCim, Guaynabo, Puerto Rico.

ABOUT THE ORGANISATION

The **Pile Driving Contractors Association (PDCA)** is an organisation of pile driving contractors that advocates the increased use of driven piles for deep foundations and earth retention systems. This is done by:

- Promoting the use of driven pile solutions in all cases where they are effective.
- Supporting educational programmes for engineers on the design and efficiency of driven piles and for contractors on improving installation procedures.
- Encouraging and supporting research that will improve the reliability, usefulness, and cost effectiveness of driven piles.
- Giving contractors a larger voice in establishing procedures and standards for the installation and design of driven piles.

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