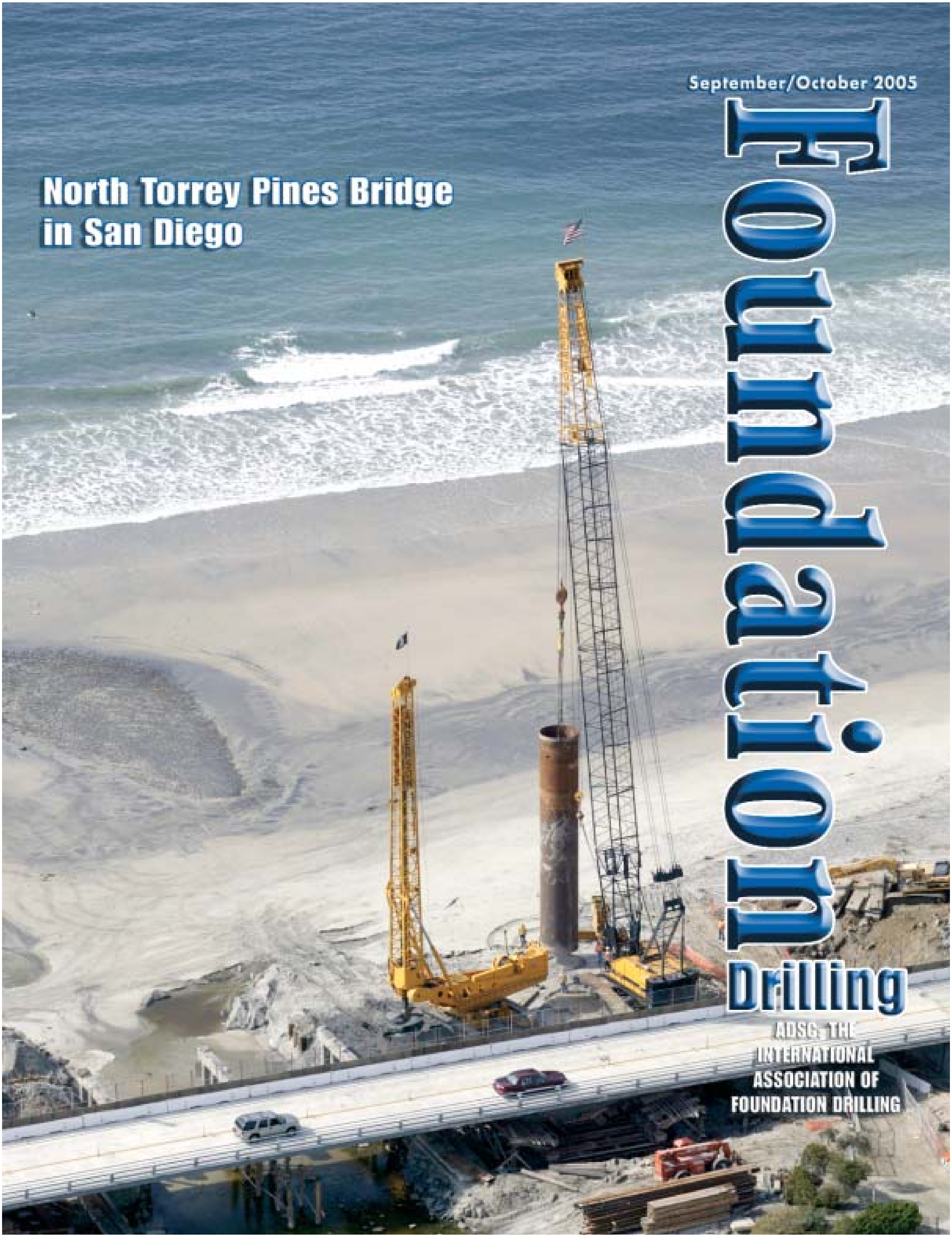
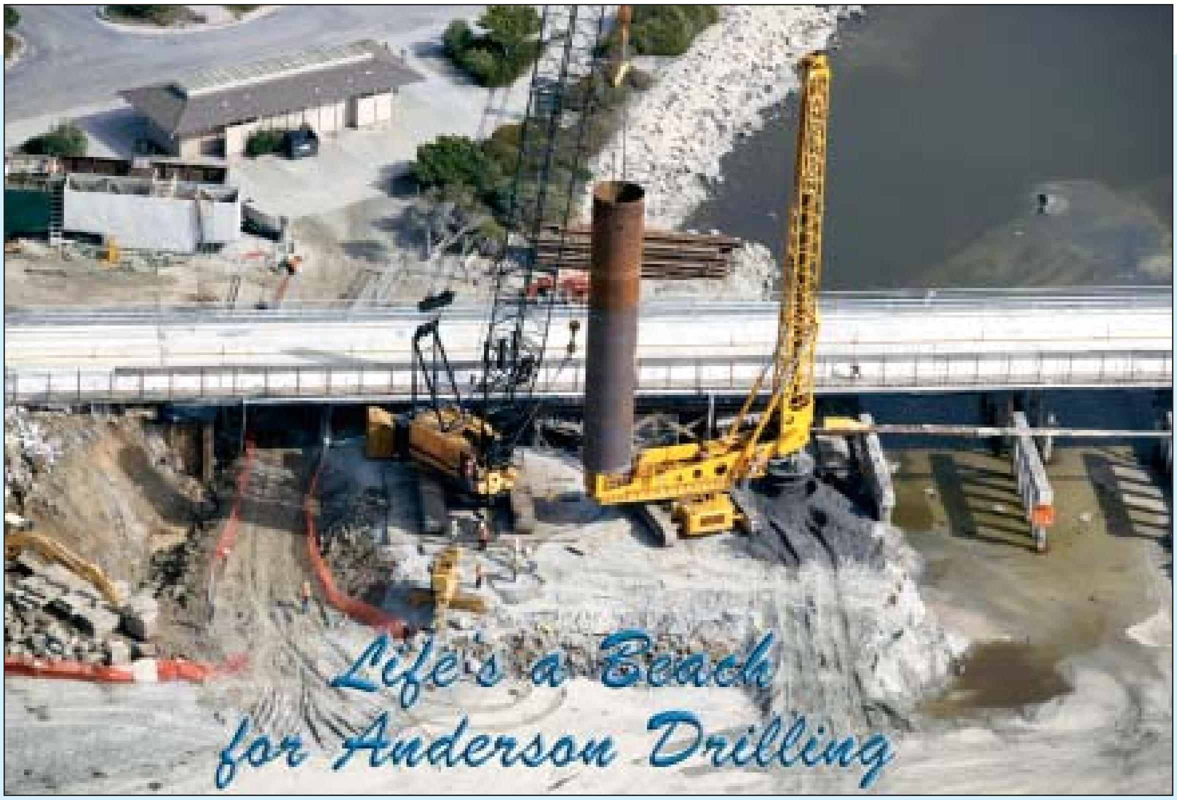

September/October 2005
Foundation
Drilling
ADSC: THE INTERNATIONAL ASSOCIATION OF FOUNDATION DRILLING
North Torrey Pines Bridge
in San Diego



Typical work pad configuration and access at Pier 3.

by Dennis M. Poland
Director of Business Development
Anderson Drilling

'California Dreamin'! As your thoughts drift to hanging out on the beautiful beaches of southern California, you can almost smell the coconut suntan oil and feel the cool salty spray of the Pacific Ocean on your face. The sun is beaming and the surf is breaking, your feet are in the sand, a cool one in your hand, not a care in the world…life's a beach, right? Well, when ADSC Contractor member, Anderson Drilling, hit the beach near Del Mar, California, their attitude was anything but laid back, focusing not on the sun and surf but rather the myriad of challenges to drilled shaft construction in a very environmentally sensitive site. Some of the toughest challenges included wet-hole construction in an ocean beach environment (imagine changing tides and wave storm surges), a thick zone of loose sand in the upper portion of the piles, difficult cage installation, and designed pile cutoffs below sea level.

Some of the toughest challenges included wet-hole construction in an ocean beach environment (imagine changing tides and wave storm surges), a thick zone of loose sand in the upper portion of the piles, difficult cage installation, and designed pile cutoffs below sea level.

These challenges were magnified by limited workspace and a requirement to maintain safe pedestrian access to the adjacent public beach.

Constructed in 1932, the original North Torrey Pines Road Bridge consisted of a 10 span concrete superstructure that extended approximately 300 feet across the mouth of Los Penasquitos Creek at the North Torrey Pines State Reserve beachhead. The 50 foot wide deck rested on reinforced concrete girders. The foundation system supporting the bridge consisted of a total of 9 bents, with (8 ea) 16" concrete piles. Foundation support at each abutment included (50 ea) Douglas fir timbers. The design details specified a minimum 20-foot penetration for all piles.

The ultimate decision to replace the structure was based on many factors including the current state of physical condition, future traffic requirements, public safety, community needs and environmental impact on the adjacent wetland habitat. The

(continued on page 3)

aged structure experienced significant deterioration over the last 10 –15 years. The concrete deck and railing surfaces showed extensive corrosion and the piles were exposed at several locations along the bridge. Occasionally, chunks of concrete fell away from the bridge, to the point that state park officials' posted hazard warnings to the beach-goers. The configuration of the structure adversely impacted the traveling pubic since the bridge was significantly narrower than the approach roadway. Additionally, the 72 piles supporting the bridge obstructed the natural flow of water into and out of the adjacent lagoon. Finally, the City of San Diego determined that the bridge was functionally obsolete and structurally deficient. This determination qualified the bridge for Federal Aid Project relief funding for the construction of the new structure.

The original 1932 structure was functionally obsolete, structurally deficient and an impediment to lagoon health.

In early 2000, AMEC Earth & Environmental* performed a geotechnical investigation at the site. The purpose of the investigation was to characterize the subsurface conditions for foundation design considerations. The ground surface along the bridge alignment ranged in elevation from ~ (approximately) 5 to 10 MSL. Based on the subsurface investigation, we anticipated three "zones" of material that would behave quite differently under our proposed wet-hole drilling method. In general, AMEC described the three separate "zones" as follows: upper zone (existing ground surface to elev. –10), either artificial fill or alluvium, consisted of loose to medium dense fine to coarse sand with gravel and occasional cobbles. Drilling fluid loss during the investigation was noted at several borehole locations; middle zone (elev. -10 to ~ elev. -40), medium dense to dense silty to fine sand with clay and occasion gravel lenses; the remaining substrate (below elev. -40) consisted primarily of medium dense to dense clayey sand overlying dense siltstone (at ~ elev. -65).

The foundation and bridge structure system needed to address inelastic foundation deformation and column plasticity to resolve the seismic concerns.

The local office of TY Lin International was contracted by the City of San Diego to provide the new bridge design. The foundation and bridge structure system needed to address inelastic foundation deformation and column plasticity to resolve the seismic concerns. TY Lin's design integrated architectural considerations with their need to address seismic and structural load concerns. The solution provided for a 340-foot long x 70-feet wide CIP Prestressed Concrete Box Girder bridge supported by straight (Cast-In-Drilled-Hole) CIDH piles. See chart for detailed specifications for the new bridge foundation system.

Additionally, (50 ea) 36" diameter x 35 ft in length CIDH piles were installed for retaining wall support along the east side roadway approach to the south abutment.

On paper, TY Lin created an architec-

(continued on page 4)

Location	Piles #	Diameter (Inches)	Cut-Off (Elev.)	Specified Tip (Elev.)	Total Length (LF)
Abutment 1	6	60	0.25	-105.00	631.50
Pier 2	2	108	-5.00	-105.00	194.00
Pier 3	2	108	-5.00	-105.00	202.00
Abutment 4	6	60	0.25	-65.00	391.50

Installing the 111" diameter steel casing with a King Kong quad-clamp vibratory hammer, Pier 3.

turally significant landmark structure, however, imposing physical constraints and design issues were complicating the CIDH piles construction. To begin with, traffic maintenance requirements dictated that the new structure be built in two separate stages. The community prioritized maintaining public beach access and limiting impacts to the environmentally sensitive lagoon, which minimized our site access and working pad configuration. Further, the creek opening could not be blocked at any time during the bridge construction. The physical height of our working pad had to accommodate fluctuating ocean tides (on the order of 5 to 7 ft. differential), wave storm surges and rising creek levels as a result of winter rains (the 3rd heaviest on record). The design posed several constructability issues included installation of a "flared" figure-eight main column which embedded 18 feet into each pier shaft and the requirement (aesthetic only) for a smooth concrete finish along the upper 5 ft of the pier piles. The low cutoff design elevations (0.25 MLLW at the abutments and -5.00 MLLW at the piers) magnified and complicated all of these construction challenges that faced Anderson Drilling.

The project was competitively bid and awarded to FCI Constructors (Southern California operations) in September of 2003. Prior to mobilization, Anderson Drilling and the project team met on several occasions to come up with workable solutions to the CIDH construction challenges. The approach to pile construction centered on a single concern, how could we safely construct high quality piles without significant revisions to the design? After extensive team communication, Anderson Drilling proposed and negotiated a constructable solution that addressed the most serious physical and design challenges while promoting good construction safety. The solution at the pier locations was to install smooth wall permanent casing (111" inside diameter) that extended from the working grade (~ elev. +12) through the loose sand zone (~ elev. -40). Installation

(continued on page 5)

Shaft Detail

CIDH Piles (Cast-in Drilled-Hole)	25 ea. 30" diam. x 33' and 25 ea. 30" diam. x 35'	(1,700 LF)
	6 ea. 60" diam x 65' and 6 ea. 60" diam. x 105'	(1,020 LF)
	4 ea. 100' x 108" diam.	(392 LF)

Installing the 60" diameter steel casing with an "APE" King Kong dual-clamp vibratory hammer, Abutment 1.

of the permanent casing allowed for a construction joint at the base of the column embedment (elev. -23). The portion of casing that extended above the pile cut-off served as a drill fluid surge chamber, as well as, provided a measure of safety around the excavation. Since all of the column work would be performed within a cofferdam that was already planned for, the only additional work imposed on the GC was removal of the casing extension above the pile top. A similar construction method was accepted at the abutment piles, however, since there were no columns (no need for the construction joint) the pipe was considered temporary and thus was "slip-pulled" during the concrete pour. Our casing installation and construction joint solution greatly simplified our pile installation by removing the cumbersome column cage from the construction sequence. Most importantly, the team was satisfied that the solution provided a higher level of safety without sacrificing pile quality.

The approach to pile construction centered on a single concern, how could we safely construct high quality piles without significant revisions to the design?

The clean lines of the new structure are environmentally friendly.

Stage-1 pile construction began in January 2004. Anderson Drilling mobilized our proprietary "Big Stan" drill unit to perform the large diameter pile excavations at the pier and abutment locations. Since the opening to Los Penasquitos Creek was to be maintained during construction, FCI was only able to provide a 50 foot wide work pad / access road at each of the drill locations. Pedestrian beach access was routed away from the immediate construction zone and monitored by flagmen during work hours. The work pad consisted of an artificial sandy fill retained on the outboard sides by driven interlocking sheet piling.

The construction sequence for the bridge piles began with vibrating the 111" diameter x 50 ft long x 1" thick steel casing to elev. -40. The casings were installed using an American Pile-Driving Equipment, Inc.* (APE) Model 400 King Kong vibratory hammer held by an Essex* Manitowoc 4100 Series crane. The "quad-clamp" system was used on the 111" diameter pier

(continued on page 6)

Tidal flow and beach access are unimpeded beneath the new structure.

Both pedestrian and vehicle traffic move easily over the new structure.

casings, however, the dual clamp configuration was used for the smaller 60" diameter abutment pile casings. Excavation of the shaft was accomplished under wet-hole methods using KB Technologies* Slurry Pro CDP products for borehole stabilization below the casing tip. The service crane was also used to hoist and place the cages (pier cages weighing up to 40,000 lbs). Due to the heavy traffic volume and public safety concerns, the cage hoisting was performed between 1:00 a.m. and 6:00 a.m. The 200+ cubic yards of high slump concrete needed for the piers was placed via 10" tremie serviced by a 28M concrete boom truck. Each pier shaft took approx. 2.5 hours to pour. The abutment piles were constructed similarly. A Watson* Model 3000 drill rig was used to excavate the retaining wall CIDH piles along the northbound approach lane. It should be noted that our LS-218H II (110-ton) Link-Belt* service crane was used in Stage-2 construction in place of the Manitowoc 4100.

The aesthetically pleasing, environmentally friendly, structurally sound bridge, is now complete. The ribbon cutting ceremony took place on July 22, 2005.

Just another day at the beach for Anderson Drilling!

**Indicates ADSC Members.*■

PROJECT TEAM

Job Name:	North Torrey Pines Road Bridge Replacement Del Mar, California
Owners:	City of San Diego, California
Designer:	TY Lin International Joseph Tognoli – Bridge Design Engineer
General Contractor:	FCI Constructors, Inc., Vista, CA Kurt Hindman - Project Manager
Subcontractor:	Anderson Drilling Christie Rowan – Project Manager Patrick Anderson, Paul David and Mike Fish– Project Superintendents