

A gold-medal solution for changing designs

By Thomas E. Jewett

Aspen tree leaves turned golden and the skies threatened snow, a construction crew assigned to assemble massive bleachers for the rapidly approaching Olympic Winter Games in Salt Lake City had a major problem.

The elaborate 220-foot-wide, 140-foot-tall support structure for the spectator seating at the Deer Valley site of several skiing competitions was well on its way to completion when the seating design was changed once again. Ticket sales were way ahead of projections, and the intricacies of the mountain site made expansion of the seating capacity a designer's challenge. The structural engineer and safety inspector verified that the soil anchors previously installed to secure the structure to the steep mountain slopes at the 10,500-foot elevation were insufficient to provide the required safety margin for the design changes.

The original soil anchors were installed prior to assembling the support structure, which was then built up around and on top of

them. To reinstall higher capacity anchors or to add additional helical anchors would require partial disassembly of the support structure. Construction was already behind on the aggressive schedule, and the opening ceremonies were but a few weeks away. How could the structural engineer provide the required safety margin for such a high-profile event located in such a challenging construction environment that was getting worse daily?

Then, one of the consulting engineers suggested an anchoring system that had been successful in securing other temporary structures at the games: the patented Manta Ray earth

anchoring system. Manufactured by Foresight Products, LLC., the earth anchors could be installed with relatively small, portable equipment — perhaps they could squeeze what they needed into the tight cubicles, the engineers thought.

Jim Kleinschmidt, sole proprietor of Last Chance Services in Woodrow, Colo. had been called in to install "a few" Manta Ray earth anchors for a giant screen television structure at Snowbasin, site of the downhill, combined, and Super-G events. The installation had gone well, and word began to spread throughout the Olympic construction community. He quickly became inundated with requests to demonstrate the system.

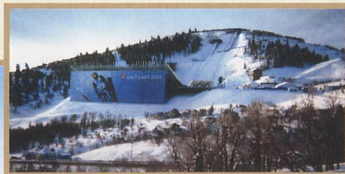
Kleinschmidt was asked to tackle the problem at Deer Valley. After a quick analysis, he laid wooden planking across the lower cross members of the scaffolding and wheeled his small hydraulic power unit and jackhammer between the struts into the designated areas within the structure. He drove two test anchors that were then evaluated by the inspectors and engineers. Based on their results, the anchoring specifications were redesigned, and the bleachers were ready for occupancy with 116 installed anchors.

By the start of the Olympic Games, the number of installed Manta Ray anchors reached well over 2,000. Ultimately, an estimated 80 percent of the earth anchors used at the games were Manta Rays. In addition to staging bleacher scaffolding, and giant television screens, the system was used to anchor such structures as television camera platforms, pedestrian bridges, and portable buildings.

A wide variety of equipment can be used to drive Manta Ray anchors depending upon anchor size, type of soil, and other conditions. Installation equipment includes hand-held hydraulic or pneumatic jackhammers, track drills, rock drills, and skid steer loaders. By driving the anchor, rather than torquing, augering, or excavating, the soil remains relatively undisturbed. In fact, the anchor serves to compact the soil around itself, adding to the capacity.

The relatively small equipment required to drive these anchors was especially welcome when anchoring needed to be installed on steep slopes high on the rocky hills. On several occasions, a tracked snowcat was used to haul the hand-held installation equipment com-

Anchors were installed in extremely rocky soils on steep slopes, and had to be driven in spite of snow and falling temperatures.



ponents up to the virtually inaccessible construction site.

Environmental requirements were also frequently satisfied through the use of Manta Ray anchors. "We were told that we could trim any aspen or oak trees as necessary," said Kleinschmidt, "but under no circumstances were we to touch any evergreens." These types of conditions frequently required installation in cramped spaces, which would have been impossible to access with large equipment.

Soil conditions throughout the various venues ranged from rocky, steep slopes to marsh, and much of the anchoring in the later stages of the project had to be made through several feet of snow. Anchors also had to be installed through a layer of asphalt in some cases and at angles from vertical to horizontal. The Manta Ray system met these diverse challenges successfully.

Construction and erection of temporary structures at the Winter Games has been described as a fluid process, and, as the deadlines for completion rapidly approached, design engineers "realized that they could get more Manta Rays in at less cost than helical piers," according to Wade Gilbert, geotechnical engineer at AMEC Earth & Environmental, the Salt Lake Olympic Committee's "watchdog" for temporary structures.

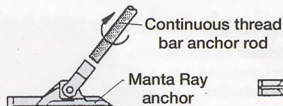
The system could easily accommodate the rapidly evolving requirements that changed almost daily. The fact that each anchor was 100 percent proof tested simultaneously with installation allowed the structural engineers and inspectors to certify quickly that the structure had the safety margins required for the spectators. The Manta Ray earth anchor system truly delivered a gold-medal performance.

As for Kleinschmidt, the games were an overwhelming success. In fact, several vendors have already invited him to participate in the 2004 Olympic Summer Games in Athens. ■



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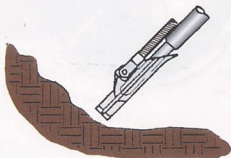
is vice president of engineering for Foresight Products, LLC. He has been with the company since 1987, developing the Duckbill, Manta Ray, and Stingray earth anchor systems. Jewett has a bachelor's degree in aerospace engineering from Purdue University and a master's degree in mechanical engineering from the University of Michigan. He also is a graduate of the Chrysler Institute of Engineering.



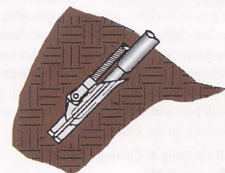
1. Thread anchor rod into Manta Ray



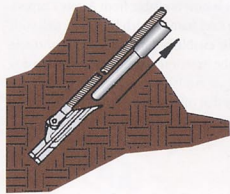
2. Insert drive steel into anchor



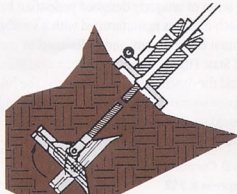
3. Position anchor at proper location and angle



4. Drive anchor to proper depth

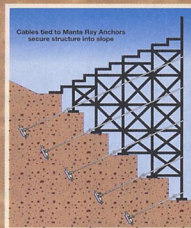


5. Remove drive steel



6. Use Load Locker to rotate and proof test anchor

How it works



Manta Ray earth anchors are driven tipping plate soil anchors for reaction of tensile loads. They have ultimate capacities of up to 20 tons, and larger versions, known as Stingray anchors, can hold up to 50 tons. After driving an anchor to the required depth, it is then tipped and proof tested

with Foresight's Anchor Locking Kit from its edgewise-driving position to present its bearing area to the soil. Called "load locking," this provides an immediate proof test of each anchor.

