Civil Engineering
NEWS

The railroad tracks limited the number and location of columns. As a result, the promenade had to be cantilevered, and 30 upper-level columns had to be transferred at the main concourse level. With high clearances required for the trains, the beam depth was minimized. The girders' thicknesses were tapered from 54 in. at the support to 42 in. at the end to minimize their weight. To make up for the reduced depth, wider beams designed with 7,000 psi high-strength concrete were used, Ales says. The transfer girders spanning the railroad tracks and the columns supporting the service corridor also were made wider and were posttensioned to meet the depth restrictions. A staged stressing system was employed to minimize the initial stresses associated with posttensioning, and this system also eliminated the need for temporary shoring columns. Columns adjacent to the railroad tracks were situated so as to meet the minimum clearance requirements and, as required by the American Railway Engineering and Maintenance-of-Way Association, were encased in crash walls. Precast double tees with a 6 in. topping slab eliminated the need for shoring and made it possible for the tracks to remain operational during construction.

When it came to the right center field portion of the ballpark, which traverses an interstate on-ramp and abuts a parking garage, an initial study was conducted to examine the possibility of cantilevering the seating deck and concourses over the road, but the use of columns proved to be more cost effective. The existing roads and parking garage limited the locations of the columns, however, there being enough room for only three columns adjacent to the garage. As a result, three transfer trusses were used to support the concourse and stadium framing. To accommodate height clearances above the road, an 83 ft long by 11 ft deep transfer truss over the road was positioned at the club level, and hangers were used to support the main concourse framing below. The main concourse beam and girder depths were limited to 14 in., with some girders spanning 40 ft, Barton says. To avoid interference with the existing garage foundations, one of the trusses was framed into a second transfer truss. Here, eccentric foundations were designed, making it possible for the columns to be extremely close to the parking garage without undermining or overloading the garage foundations.

While constructing Target Field on the smallest site in all of MLB presented its challenges, its designers say the end result is a complex that will serve not only as an outstanding venue for America's favorite pastime but also as a civic landmark for Minneapolis and the state of Minnesota. "For Minnesotans, a whole new chapter of Twins baseball is about to be written, [and] legions of fans will now experience outdoor baseball in a facility that will be envied," said Ed Hunter, the project manager for the Minnesota Ballpark Authority, in response to written questions from *Civil Engineering.* "I think at the end of the day [Target Field] will be rated as one of the top five ballparks in the country." —JENNY JONES

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ENVIRONMENTAL ENGINEERING

Federal Funding Advances Everglades Restoration

WHEN STATE and federal leaders launched the Comprehensive Everglades Restoration Project (CERP) a decade ago, no one knew for certain when construction of the first federally funded component of that effort might begin. The project finally reached that milestone earlier this year when contractors began working to return a housing development that had long been abandoned to its natural state.

From the beginning, the CERP, a complex plan to restore,

The Picayune Strand had been a vast expanse of wetlands and uplands that flooded for several months each year, causing a slow sheet flow that fed freshwater to the Everglades. In the 1960s, however, a failed housing development left the property scarred by drainage canals, *above,* disrupting the sheet flow. The Picayune Strand Restoration Project aims to restore the natural sheet flow and to rehydrate the area's wetlands by dismantling roads and using the fill to plug approximately 48 mi of canals. The easternmost canal was plugged in an earlier phase of the project, and the surrounding area has already begun to benefit from increased hydration, *below.*

U.S. ARMY CORPS OF ENGINEERS, *BOTH*

preserve, and protect south Florida's unique wetland ecosystem, has been a partnership between the State of Florida and the federal government. Two agencies lead the effort, the U.S. Army Corps of Engineers and the South Florida Water Management District. The Everglades Partners Joint Venture, an undertaking by Parsons Corporation, which is based in Pasadena, California, and PBS&J, of Tampa, Florida, provides program management support to the Corps. The costs of implementing the CERP are being shared equally by the state and federal governments.

In its first decade, the CERP received federal funding for planning and design efforts. The State of Florida, meanwhile, proceeded with the planning, design, and construction of eight key components of the plan. One of those projects involved restoring a large, failed housing development on a site in southwestern Florida now known as Picayune Strand to its natural state. Last year, Congress finally appropriated approximately $65 million for the construction of the Picayune Strand Restoration Project, which became the CERP's first federally funded construction endeavor.

A century ago, a visitor to Picayune Strand would have found some 55,000 acres of wetlands and uplands that flooded for several months each year. This seasonal flooding led to slow-moving sheet flow that played an important role in recharging aquifers and delivering freshwater to portions of the Everglades. The landscape changed radically in the 1960s, when a developer bought the land, dug drainage canals, built roads, and divided the property into thousands of lots, promising buyers that the area would one day be an enormous residential subdivision. The scheme failed, and the subdivision never came to fruition. Unfortunately, significant environmental damage had already been done. A network of roads and four large north–south canals remained, disrupting the natural sheet flow and draining the area of its most precious resource.

The Picayune Strand restoration project is intended essentially to reverse the effects of the previous development efforts, primarily by removing roads and plugging canals, says Lacy Shaw, P.E., the project manager for the Corps. Workers will remove some 230 mi of roads and use the fill from the roadbeds to plug approximately 48 mi of canals, which reach widths of 200 ft. These improvements are designed to restore the natural sheet flow and rehydrate the area's wetlands. As a result, the area is expected to once again become a more suitable habitat for wildlife, including such endangered species as the Florida panther.

To be successful, however, the project must do more than remove roads and plug canals, notes John Miller, a senior project manager for PBS&J in the Everglades Partners Joint Venture. At the north end of the site, three new pump stations will control the flow of water into the area. Designed to handle flow rates of 810, 1,250, and 2,630 cfs, these stations will pump the water into a discharge basin that flows over a weir into a shallow pool, or "spreader canal," confined by approximately 3.5 mi of low-level berms. The berms are designed to promote sheet flow by dispersing water across the entire breadth of the site through static weirs at prescribed elevations. The project also involves the construction of approximately 10 mi of levees for flood protection.

The easternmost canal has already been plugged as part of an earlier, $15-million phase of the project funded by the South Florida Water Management District. That initial phase, which ended in 2007, also included extensive road removal and the restoration of 13,000 acres of wetlands. The results so far have been promising. "We are seeing a tremendous amount of hydration in the southeast area," says Stephen Ciulla, P.E., M.ASCE, the project manager for Parsons, which is the engineer of record for the entire Picayune Strand restoration effort. "That's a great early sign."

The current, federally funded phase of the project will build on that early success by constructing the first (810 cfs) pump station and installing 55 plugs in a 13.5 mi long canal. The contractor—Harry Pepper and Associates, of Jacksonville, Florida—will also remove some 95 mi of roads. The bulk of this $53-million phase is expected to be complete within two years.

The remainder of the Picayune Strand project will be split into two additional contracts, one to be awarded later this year and the other to be awarded in 2012, says Shaw. The entire $438-million project is scheduled for completion by 2017.

Overall, the CERP encompasses 68 components grouped into 55 projects in 16 counties. When Congress approved the plan as part of the Water Resources Development Act of 2000, it was expected to take at least 30 years and was estimated to cost $7.8 billion at October 1999 price levels. Today, the timetable for completion is anybody's guess, and cost estimates are approaching $10 billion. —JEFF L. BROWN

BRIDGES

Damaged Eyebar Section Replaced On San Francisco–Oakland Bay Bridge

THE THIRD TIME was definitely the charm when it came to repairing a damaged section of an eyebar on the east span of the San Francisco–Oakland Bay Bridge. A fractured eyebar, one of 1,680 such supports on the 73-year-old double-deck steel structure, was discovered over Labor Day weekend last year during regularly scheduled maintenance while the bridge was closed to traffic for the construction of a detour. Although emergency repairs enabled the bridge to reopen to traffic approximately 70 hours later, a part of the repaired system failed in late October before a long-term repair could be implemented, resulting in a second bridge closure and a second repair effort. The long-term repair of the failed eyebar began in early December, according to a press release from the California Department of Transportation (Caltrans), which maintains the bridge. In the December 7 press release, Randell Iwasaki, the director of Caltrans, explained that this third round of repair work would "keep the bridge safer until it is replaced." Because the east span is considered seismically vulnerable, it is scheduled to be replaced by 2014 with a new structure that will