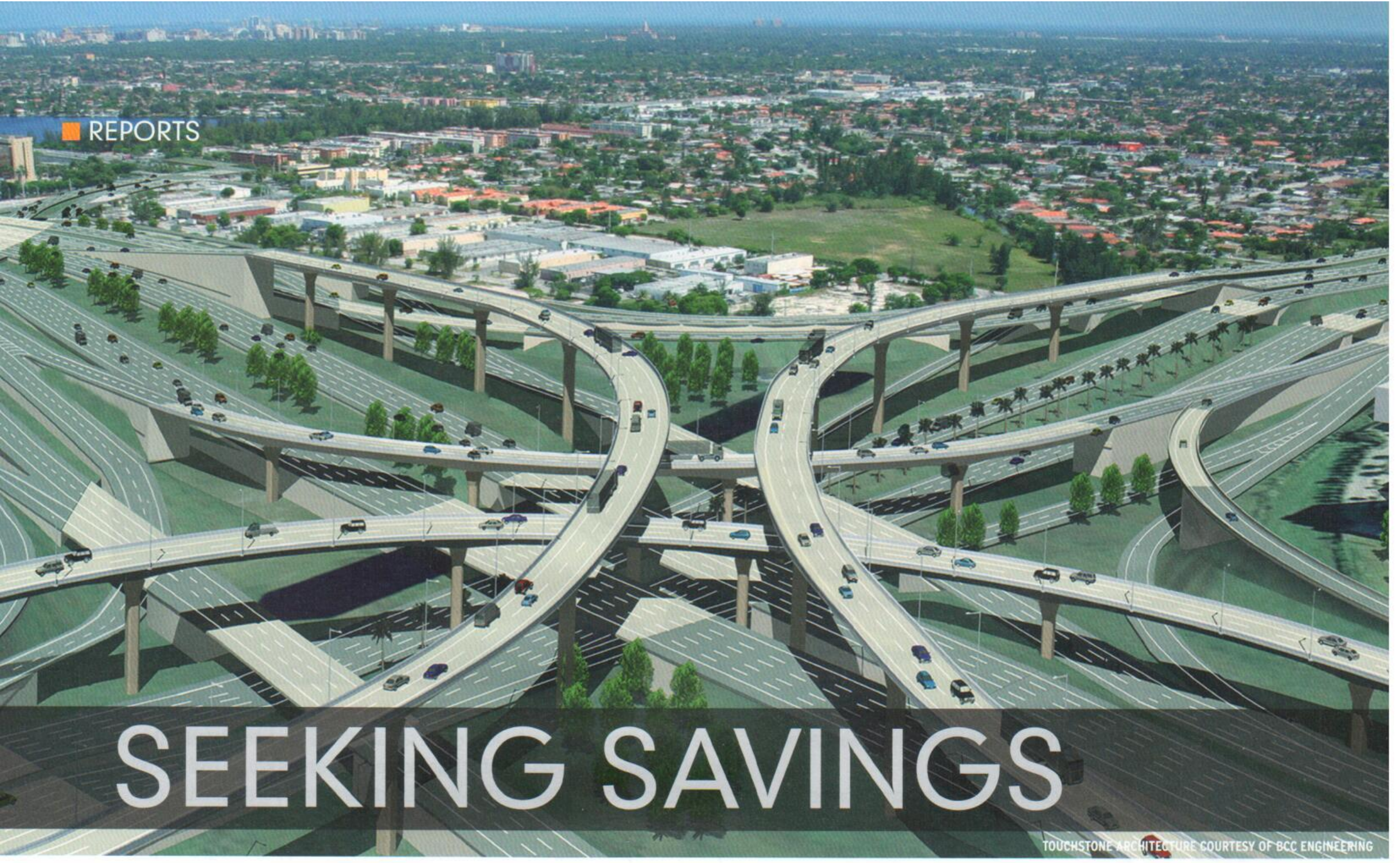

TOUCHSTONE ARCHITECTURE COURTESY OF BCC ENGINEERING

SEEKING SAVINGS

A long-term programme to widen the Palmetto Expressway in Florida, USA, is moving into its final stages. **Craig Finley, Jose Muñoz** and **Enrique Espino** report on how changes to one section of the work have saved money and time for the owner.

With 12 parts and a schedule stretching over three decades, the programme to improve the Palmetto Expressway in Miami-Dade County has been no minor undertaking for the Florida Department of Transportation. It is now almost 30 years since the DOT recognised that State Route 826 would need to be improved to cope with the predicted increase in traffic. The solution – the Palmetto Expressway Improvement Programme – was started in the early 1990s and is now nearing completion. The aim is to redesign and reconstruct each of the interchanges along the 26km-long corridor to improve safety and traffic flow. One lane will be added in each direction, bridges will be widened and improved and ramps at all interchanges reconfigured, among other improvements.

Section five is the final and largest part – a US$559 million, design-build-finance project to reconfigure the junction where the expressway meets State Route 836 in Miami. SR 836 connects to Miami International Airport and the junction is used by more than 430,000 motorists daily, making it a critical intersection.

This section entails the construction of a new four-level interchange between the two routes, as well as the reconstruction and modification of two existing interchanges. Capacity improvements include road widening and the construction of 46 bridges, new direct connector ramps for major improvements and collector-distributor ramps to eliminate existing geometric and operational deficiencies. Four complex segmental bridge ramps traverse the core of the interchange.

Florida DOT requested proposals in 2009, offering bidders five alternatives ranging from the minimum scope necessary to build a functional road system, up to the entire site masterplan. Given the financial climate, the department decided to see what it could accomplish with its available budget. Bidders had to identify the highest level they could achieve within the maximum budget of approximately US$559 million and the maximum contract time of 3,500 days.

However, all teams proposing on the project were required to submit a design for the first alternative – full scope of the plan – no matter which preferred alternative they identified in their proposal. The more of the scope a team included in its proposal, the higher the priority it received in the selection process.

The design-build team led by Community Asphalt Corporation, Condotte America and the De Moya Group was the only one of three teams to propose taking on the full scope. The joint venture was able to achieve this by reconfiguring the FDOT plan to lengthen the four complex segmental bridges. Two loops in the middle of the new interchange were replaced by a turnaround slightly further west. This created a more open layout at the centre of the interchange, while eliminating four of the eight segmental bridges and several other bridges along a canal running through the site.

The redesign led by BCC Engineering reduced the overall cost of the project by US$80 to US$100 million, which gave the team leeway to complete the full scope. It also allowed the design-build team to reintroduce three points of access to the expressway that would have been lost in the original design plan, a much-preferred option for FDOT. The new design also lowered outside directional movements from the third level to the second level, and optimised use of the Florida I-beam shape precast concrete girder.

The Community/Condotte/de Moya JV earned the top score for its preferred alternative, but also finished first in terms of technical approach and shortest construction programme – five years, cutting the schedule by more than four and a half years.

Team member Finley Engineering Group is responsible primarily for design and construction engineering of the four segmental bridges, which are each 14m wide and range in length from 335m to 747m. Total deck area is 33,511m^2 and total length 2.3km, made up of 775 segments. The longest span is 81m and the tallest pier is almost 25m.

The curved segmental bridge ramps form the third level of the interchange with radii down to 180m and a proposed maximum superstructure deck height of almost 29m above ground. All of the bridges are supported on 600mm-diameter pile foundations and reinforced concrete piers and caps.

Finley's role includes minimising the construction impact on traffic, which was addressed in a variety of ways. This included using piers with non-traditional shapes, adjusting the footing sizes to accommodate site conditions, increasing the span lengths and spending extra time on design solutions, all aimed at minimising traffic sequencing.

Most significant was the decision to build the four segmental bridges top-down. Rather than erecting segments from ground level, the team will use a self-launching overhead gantry supplied by Deal, currently in fabrication. This will enable the bridges to be built using the balanced cantilever method from the piers. No temporary supports are needed on the ground and segments are stabilised off the pier caps.

Maintenance of traffic is also a consideration in the construction schedule of the segmental bridges. One of these is a major flyover on the south side of the interchange, and it will be the last of the four to be opened to traffic. But to accommodate sequencing that will minimise traffic impact, three of the bridge's foundations will be built long before they will be needed. Casting of the first segments is expected early next year with erection currently scheduled for July or August of the same year.

The segmental bridge construction scheduling must also work within the overall project schedule, hence the work of three contractors performing different tasks, but all working at the same time, must be coordinated. To make this easier the site and schedule was split into five zones. Each zone has its own project schedule, which is coordinated with the overall schedule. Team members are less likely to be idle while they wait for colleagues to complete work.

Perhaps the most difficult aspect of the Palmetto Expressway section 5 project is the very tight geometry of the site. To one side is a runway for Miami International Airport and on the other is a large building. A canal runs through the new interchange.

Vertical restrictions also exist; the location limits the height of any permanent or temporary structure such as an erection gantry, because of its proximity to the airport. In South Florida the water table is high, so bridge foundations and highway infrastructure can only go to a certain depth. Ideally, footing depths stop just short of striking water, but contractors must occasionally pour concrete in water with a sealant in the hole.

The team uses bridge information modelling, which infuses 3D CAD models with data that allows engineers to more easily manipulate design and construction drawings. The system instantly reflects how a change in one component affects all others, saving significant time drawing and redrawing plans.

Design-build-finance is being used because the project requires a level of gap financing. FDOT's payment schedule initially meshes with the design-build team's progress. At about 18 months, however, the FDOT money falls below the point of cumulative work completed and the JV must cover the gap in financing. The fixed-fee price includes the cost of borrowing to finance work until FDOT's final US$46.5 million payment in January 2017, more than a year after completion. Work was two months ahead of schedule as *Bd&e* went to press with design 75% complete and construction about 25% finished ■

Craig Finley is managing principal of Finley Engineering Group, Jose Muñoz is president of BCC Engineering; Enrique Espino is president of Condotte America

Design/build team: Community Asphalt Corporation, Condotte America, De Moya Group
Lead designer: BCC Engineering
Design & construction engineering: Finley Engineering Group
Gantry supplier: Deal