View of the existing bridge’s four-span configuration and rigid frame, column and cap type piers, prior to construction. The new bridge will be a two-span continuous structure eliminating the existing shoulder piers located along I-287 and encapsulating the existing pier in the center median. Photo courtesy of Dewberry.
With all the activity happening at the heart of the new interchange currently being built at U.S. Route 22 and Chimney Rock Road in Bridgewater, N.J., reconstruction of the existing bridge carrying Chimney Rock Road over I-287 may hardly be noticed. But for the team of engineers from The Louis Berger Group and Dewberry responsible for designing the interchange, the critical role that reconstructing this bridge plays in the overall success of the larger project was recognized early on. In addition to being a vehicular crossing, the bridge also supports several utilities including water, sanitary, gas, telephone, and electric. It also provides the employees of United Parcel Service with pedestrian access between parking areas and their distribution facility located on the north and south sides of the bridge, respectively.

Critical Infrastructure
The planned interchange required that the existing bridge be widened to furnish a 48-foot curb-to-curb width and six-foot-wide sidewalks along both sides in the final condition. The bridge’s vital role within the local infrastructure was clear, including the need to maintain vehicular and pedestrian traffic, as well as the utility services, throughout construction.

The existing 266-foot-long structure, constructed circa 1960, is composed of four, simply supported spans measuring 36 feet, three inches, 96 feet 9 3/4 inches, 96 feet 9 3/4 inches, and 31 feet; and is positioned on a 24-degree skew with respect to I-287. The bridge provides a 30-foot clear roadway with a six-foot-wide sidewalk along the east side and a three-foot-wide safety walk along the west side. A one-foot-wide by two-foot-six-inch-high concrete parapet, surmounted with chain-link fence, is present along each walkway resulting in an out-to-out deck width of 41 feet. The superstructure consists of an eight-inch reinforced concrete deck composite with six rolled steel or welded plate girders spaced at seven feet, three-and-a-half inches on center. The substructure is composed of reinforced concrete stub abutments and rigid frame, column and cap type piers supported on spread footings founded on rock.

The interchange improvements required the existing bridge to be widened 21 feet, six inches to provide the 48-foot curb-to-curb width, accommodating a 12-foot lane with a five-foot shoulder for northbound and southbound traffic, in addition to a 14-foot center turning lane. A six-foot-wide sidewalk and one-foot-three-inch-wide by three-foot-six-inch-high concrete parapet will also be provided along both sides of the bridge in the final condition. The resulting out-to-out width of the new bridge deck is 62 feet six inches.

Staged Construction
Satisfying the constraints associated with maintaining vehicular and pedestrian traffic, and accommodating the utilities, required that the improvements be constructed using three stages. As design advanced, however, the engineers sought to identify methods to expedite construction. The fact that the existing bridge was founded on rock presented one such opportunity. The team determined that the existing bridge should be reconstructed by completely replacing the superstructure and modifying the substructure to convert the structural framing from four simple spans to two continuous spans. The new, two-span continuous superstructure arrangement offered the advantages inherent with continuous spans, which include more efficient design and fewer deck joints, while also eliminating construction operations associated with widening and modifying the existing piers located along the shoulders of the heavily travelled I-287 corridor. This reduced overall costs and enhanced safety.
The new superstructure was designed as a two-span continuous system with spans of 127 feet 9¾ inches and 133 feet 0¾ inches. The typical section consists of nine welded steel plate girders, having a 44-inch web depth, composite with a nine-inch reinforced high-performance concrete deck. Girders were spaced at either seven feet six inches or six feet eight inches on center to accommodate the construction staging. As noted, by reconfiguring the superstructure framing, the shoulder piers of the existing bridge were completely eliminated. The existing stub abutments and center pier were extended and modified to accept the new superstructure, and were monitored for movement during construction. The design also incorporated lead-core isolation bearings that addressed seismic design forces and offered potential to reduce and redistribute these forces to the substructure.

Encapsulating the Existing Pier

Given that the abutments were readily accessible, traditional cast-in-place construction methods were detailed for the extensions and the associated wingwall construction. Although the median of I-287 offered sufficient width to facilitate work at the center pier, it was still important to minimize the duration of construction activities within this area. With this goal in mind, the design team evaluated various options to extend and modify this pier. The results of these assessments led to the design of a cast-in-place wall pier that encapsulates the existing rigid frame, column and cap type pier. Entombing the existing pier required the stem of the new center pier to be five feet thick. However, the scale of the new center pier complemented the increased span lengths of the rehabilitated bridge, and arch-shaped recesses were introduced as an architectural treatment. The proposed construction also simplified staging and expedited construction by eliminating the need to completely demolish the existing pier.

A Cooperative Effort

Construction of this long-awaited interchange is the direct result of cooperation between the Federal Highway Administration, the New Jersey Department of Transportation, and Somerset County. The interchange will be created by depressing and realigning existing U.S. Route 22 approximately 16 feet to provide both express and local lanes, while Chimney Rock Road and Norfolk Southern’s adjacent track are slightly re-profiled and carried over U.S. Route 22 on new bridges. In addition to reconstructing the bridge carrying Chimney Rock Road over I-287, described above, the interchange requires construction of two new bridges to carry drivers and Norfolk Southern trains over US Route 22, widening the existing bridge carrying U.S. Route 22 over Middle Brook, six retaining walls with a total length of over 2,000 feet and four overhead sign structures. The project’s general contractor, Anselmi & DeCicco, Inc., of Maplewood, N.J., started construction of the $60 million interchange in March 2012. Construction is scheduled for completion in 2015.