Mon-Fayette Toll Plaza

ALLEGHENY COUNTY, PA

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ENGINEERING SOFTWARE
STAAD

DETAILING SOFTWARE
AutoCAD 2000

The new mainline toll plaza on the Mon-Fayette Expressway was designed be a cost-effective and attractive facility that was safe for employees. It would be the first facility on the Pennsylvania Turnpike Commission (PTC) system to accommodate three forms of payment: high-speed electronic toll collection, and both manned and unmanned toll booths. The high-speed lanes were located at the center, and the toll booths and facility building adjoin them peripherally. A pedestrian bridge for safe access across the high-speed lanes creates an architectural statement and provides a structure to sustain the Electronic Toll Collection equipment without obtrusive sign gantries. With the Pedestrian Bridge concept, the Commission chose to present the facility as the "Gateway into Pittsburgh," since this highway will lead motorists toward downtown Pittsburgh.

The bridge is composed of two truss-spans, each 139'-5" in length with steel HSS chord and vertical members, and stainless-steel diagonal tension rods. Vertical curvature (arching) was introduced for aesthetic purposes. Other visual contributions include a curved stainless-steel roof that also serves as a canopy over the toll-booths, HSS steel trusses with full-height glass windows, and a centrally located V-shaped pier. The stairwells are glass-enclosed for safety and to present a pleasing visual experience for PTC customers as they pass through the facility. The creative structural design used thin, stainless-steel rods for the truss diagonal members. This choice provided light, non-intrusive views from within the bridge and added detail as a decorative focal point for travelers viewing the structure.

COST-EFFECTIVE DESIGN

Cost estimates were developed for alternatives that included tunneling concepts versus bridges to facilitate PTC employee pedestrian movements across the high-speed lanes. Based on the cost estimates and past problems with tunnels, an arched steel-bridge structure was considered the most cost-effective solution. Pittsburgh's history as the steel capital of the world would be reflected in the use of steel as the main structural element in the bridge. The total construction cost for the bridge was under $2.25 million. The bridge also allowed monitoring of the facility by one individual from an operations room constructed over the pier. This first for the PTC resulted in economical, life-cycle-operations costs.

PROBLEMS AND SOLUTIONS

A structural engineering accomplishment of the Mon-Fayette Pedestrian Bridge included the use of stainless-steel rods as the truss-tension and compression diagonals. This use of thin rods provided a light and unobstructed appearance.

The rods were pre-tensioned prior to erection with a larger force than the compression force that would be introduced by the truss loads, thus always keeping the rods in tension. This avoided larger-size members that would have been required based on slenderness ratios and compression forces. Another achievement was the rod connections to the truss that used steel pipe extended through the main-truss HSS members. The use of pipes at the truss joints along with nuts and washers reflected the pin-type connections of traditional trusses, while providing a technical innovation since this truss is not a true pinned truss.

The use of the facility for personnel while traffic traveled below required that items such as the pier would need to be fire-protected to meet local building codes. The structural-steel pier is coated with a 1/8" fire-protective coating that, when subjected to heat, expands to 6" to provide a two-hour fire rating.

The bridge spans are fixed at the stairwells with elastomeric bearing pads and anchor bolts. Both bridge spans expand at the pier, where expansion and contraction is accommodated by the observation-room doorway sills. To prevent cracking of the bridge-window glass, thermoplastic seals were installed to accommodate thermal and wind movements.

This new plaza, with its featured pedestrian bridge, meets the original design goals of form, function and cost effectiveness. ★