By Brenda Silva

'MIGHTY MAC'

MACKINAC BRIDGE RECEIVES ELECTRICAL UPGRADE

AT A COST ALMOST EQUAL TO ITS ORIGINAL CONSTRUCTION, the Mackinac Bridge received an extensive upgrade to its existing electrical systems, with the bridge's massive size presenting only one of the challenges to the project.

Located in Mackinaw City, Mich., the Mackinac Bridge, known as "Mighty Mac" and "Big Mac," connects the upper and lower peninsulas of Michigan over the five-mile-wide Straits of Mackinac, where Lake Michigan and Lake Huron meet. The bridge was originally constructed between 1954 and 1957 at a cost of $3.5 million, in response to demand for a faster and more convenient way to traverse the two peninsulas other than via ferry, the quickest option available at the time.

When constructed, the project employed as many as 3,500 men, with five eventually losing their lives on the job site by the bridge's completion. In comparison, the electrical upgrade employed 11 men, none of whom died during the course of the project, which was completed in less than three years.

Initial apprehensions

The scope of the Mackinac Bridge electrical upgrade encompassed a variety of duties for J. Ranck Electric Inc.'s Sault Ste. Marie, Mich., branch office. In addition to replacing the seven primary substations across the bridge, the upgrade included the installation of additional street lighting, the replacement of all bridge lighting, and the removal and installation of many miles of cable and wire throughout the bridge.

"The main challenge on a job like this is the height, because everywhere you looked, you had height to deal with," said William

Gets a Makeover

Crews from J. Ranck Electric install navigation lighting (above left) and a new primary substation (below), as part of a three-year upgrade project that took the company to new heights.

Faunt, project manager and estimator at J. Ranck Electric. He also noted that safety conditions differed from when the bridge was originally constructed."You didn't have flat land or ground to start from, and a lot of the project was underneath the bridge, where you had to use a lift and various types of apparatus to get from point A to point B."

Faunt said although all crew members were inside wiremen and had worked at extreme heights before, this project was an entirely new experience for many of them because of the specific hazards of marine construction.

"It was a first-time experience for all of them, and they were understandably apprehensive with regard to the height issue. But once they were tied off, they seemed more at ease," he said. "Even though they have worked at extreme heights before, it was nothing like on the bridge, where there is nothing between you and the water for 300 or 400 feet."

Helping to quell any fears was foreman Leonard "Ducky" Nelson, who was a young apprentice on the 1950s' bridge project. Faunt suggested that both Nelson's presence and prior knowledge of the bridge helped give the crew an extended perspective of the bridge's history.

"Our foreman's experience was definitely a help, although when they built the bridge, safety was not as critical as it is now. They did a lot of things that we could not do anymore, like walking the steel without a line on," Faunt said. "But it was definitely a help for him to be there because he knew how things were done in the past, which made his presence very beneficial to us."

Faunt added, "This was our first bridge project, and everybody is very happy, and, of course, one of the things that made everyone happy was that we didn't have any near misses with accidents. That was one of the best things about this project, that we were able to go through the whole thing and we never had one tragedy or even close miss."

PHOTOS OURTESY OF THE MACKINAC BRIDGE AUTHORITY AND THE MICHIGAN DEPARTMENT OF TRANSPORTATION

Mackinac Bridge Facts

Lengths:

Total length of bridge with approaches: 5 miles (26,372 feet)
Total length of steel superstructure: 19,243 feet
Length of Suspension bridge (including anchorages): 8,614 feet
Length of Main span (between main towers): 3,800 feet

Heights and Depths:

Main towers above water: 552 feet
Maximum depth of water at mid-span: 295 feet
Maximum depth of tower piers below water: 210 feet
Height of roadway above water at mid-span: 199 feet
Under clearance at mid-span for ships: 155 feet

Cables:

Total length of wire in main cables: 42,000 miles
Number of wires in each cable: 12,580
Weight of cables: 11,840 tons
Diameter of main cables: 24.5 inches
Diameter of each wire: 0.196 inches

With the electrical upgrade complete, J. Ranck Electric is working on another project with the Mackinac Bridge Authority that focuses on security throughout the bridge itself.

What the project entailed

Costing just under $3 million, the electrical systems upgrade project began in April 1999 and was finished in November 2001, a full six months under the three-year deadline. Weather conditions forced Faunt and his crew to work on the bridge between the months of April and November only.

"For this project, we replaced all seven substations under the bridge at both ends, which required new 5 kV cable that we had to replace all across the bridge," Faunt said. "We also replaced all the lighting on the bridge, as well as the cable lighting, the lights up on top, and all the cable that fed those lights and the receptacles.

"We installed four 100-foot light towers (480V) at the toll booth on the north end of the bridge, where two were already existing," he added. "On the bridge itself, we installed 183 streetlights that were each 40 feet tall. Then on the towers, we replaced all the aerial, navigation, aircraft warning and floodlights."

While each aspect of the electrical upgrade presented challenges, Faunt asserted once again that height was the biggest obstacle, especially with the tower lighting.

"The aerial lights are the vertical ones going up and down the cable (five-conductor cable); the navigational lights (480V) are at the bottom of the tower; the floodlights light the towers themselves; and the aircraft warning lights are the two lights on the top of each tower," he said. "We replaced all of these lights and the cable required for them, and at each stage, we had to be constantly be aware of the height and our safety."

Faunt explained how the tower lighting was accomplished through the use of a ladder within the towers themselves.

"We also replaced all of the receptacles up and down through the tower, and those towers are a long way up," he said. "I think there were about 15 receptacles (120V) on each side, for 30 receptacles in each tower, from the base to the top. The guys working on the receptacles had to climb a ladder to get to top of the tower."

One situation that stands out in Faunt's mind was the problem of installing the aircraft warning lights at the top of each tower, because of the size of the lighting itself.

"The aviation lights were so big that they did not fit through the area the guys were climbing up in, which was the equivalent to a manhole placed at every 20 feet of the ladder, all the way up to the top. So the lights had to be broken down to be carried through, and then reassembled once the guys reached the top," he said. "To put it in perspective, at the top of the ladder, there is 500 feet between the guys and the water, and 350 feet between the guys and the deck, which is the same as 23 or 24 stories."

Charlie McKechnie, lead journeyman on the project, added that the one thing he will remember most is the vision of eight men walking single file on the steel, carrying cable on their shoulders while on their way to pull vertical aerial cables.

Additional hazards

In addition to numerous lighting replacements, the J. Ranck crew also installed a foghorn, a platform and two generators as part of the upgrade.

"Right in the middle of the bridge, there is a foghorn, and it is electronically controlled for shipping; we installed the foghorn and a new platform for it," Faunt said. "The generators were brand-new generators, relatively small, maybe 100 kW, which control signs that, prior to the bridge, tell truckers what the wind velocity is and how fast they are supposed to go.

"We also removed and replaced 14 miles of 5 kV cable, and 80 miles of low-voltage wire," he added. "The cable was all pulled horizontally for feeding the substations, fed from both north and south. The 80 miles of wire was installed both vertically and horizontally, although most of it was installed horizontally. In reality, the only vertical cable we replaced was up and down the towers."

While Faunt and his crew were busy at work, the Michigan Department of Transportation and the Mackinac Bridge Authority helped by securing lane closures, as the bridge could not be shut down completely.

"For us to be able to work, they had to have lane closures. So they always closed a lane for us to be able to go over the side," Faunt said. "We weren't able just to go out and do whatever we wanted, we had to have the lane closures in order to be able to look underneath to decide how we were going to pull wire."

However, as is the case with today's impatient society, McKechnie remembers that even the lane closures did not stop, or even slow down traffic while the crew worked nearby. Perhaps, now that all is said and done, it was not the bridge's height but automobiles and trucks that posed the greatest threat to the men's safety. **EC**