MANHATTAN BRIDGE REHABILITATION
Steel Is the East River Workhorse
The Manhattan Bridge has repeatedly been described as the workhorse of the East River spans. So it was no surprise that, after nearly a century of service, the crossing was found to be in dire need of repair. In response, the New York City Department of Transportation (NYCDOT) launched a bold 15-phase rehabilitation effort that began in 1982 and, with completion expected in 2013, is nearing $1 billion in costs. The Manhattan Bridge: For reasons that are not entirely clear, the crossing was found to be centuries old, and its design—pivotal in its own time—lacks some of the modern technology and materials that have transformed the construction industry in the years since its opening. The old bridge was found to be in dire need of repair, with significant structural issues and a failure to accommodate the complex conditions of the 21st century.

The Manhattan Bridge was designed by a team led by the renowned engineer Washington Roebling, who designed the Brooklyn Bridge. Roebling's design was innovative for its time, but it was also娇弱, and the bridge was found to be decades old, with significant structural issues and a failure to accommodate the complex conditions of the 21st century. The bridge was found to be in dire need of repair, with significant structural issues and a failure to accommodate the complex conditions of the 21st century.

The rehab replaced the span's original floor beams and decking. The Manhattan Bridge is ready to continue carrying the 80,000 vehicles and 320,000 mass transit riders cross the Manhattan Bridge every day. As part of this effort, the bridge's four stiffening trusses have been reinforced, the deck and bearings have been replaced, and the main cables have been re-anchored, work encompassing thousands of tons of structural steel. That work is so unique for a contractor that it's represented approximately 10 percent of the total budget. The larger proportion of project's steel contract was devoted to deck replacement. Divided into separate contracts, crews ultimately replaced approximately 1,600 roadway and subway track floor beams, and many more stringers. The existing roadway beams were divided into separate contracts, crews ultimately replaced approximately 1,600 roadway and subway track floor beams, and many more stringers. The existing roadway beams were built-up, riveted members, the ones replacing them are welded plate girders of the same size, but with improved section properties and stronger 'Grade 50' type steel. The new members are connected to the trusses with bolted connections, in order to better transfer twisting load into vertical load. The new steel reinforcing and bracing members are attached to the trusses via high-strength bolts.

Although slightly different in appearance from the old lateral bracing, the new steel members are barely visible to drivers. All of the new lateral members are built-up, T-reversed U, or H shapes, with the flanges welded to the stem. All connections are made using ASTM A325 High strength bolts. The cost of this phase of the work represented approximately 10 percent of the total budget. The larger proportion of project's steel contract was devoted to deck replacement. Divided into separate contracts, crews ultimately replaced approximately 1,600 roadway and subway track floor beams, and many more stringers. The existing roadway beams were built-up, riveted members, the ones replacing them are welded plate girders of the same size, but with improved section properties and stronger 'Grade 50' type steel. The new members are connected to the trusses with bolted connections, in order to better transfer twisting load into vertical load. The new steel reinforcing and bracing members are attached to the trusses via high-strength bolts.

Although the problem of the deck's deflection would be solved through the installation of rigid reinforcement and lateral bracing, the root cause of the problem remained. The workhorse, it turns out, was a bucking bronco—its deck tilting as much as eight feet under the weight of a loaded train, forcing suspension cables to shift relative to and abrade against the steel trusses. To find a solution to the problems posed by Moisseiff's design, NYCDOT hired Weidlinger Associates as designer and structural engineer on the rehabilitation project. Assessing the situation, the firm worked out a scheme to brace the bridge's under-designed lateral stiffening system with new structural steel members, thus creating a "torque tube," which along with re-anchoring the bridge and re-anchoring its cables ensured that this vital city artery would not deflect more than three feet. The new members are connected to the trusses with bolted connections, in order to better transfer twisting load into vertical load.

One final aspect of the rehabilitation efforts involved meticulously removing the bridge's lead paint and recovering the structure with safer and more durable epoxy coating—in the bridge's famous blue, of course. Still, Brian Gill, the engineer in charge of the project for NYCDOT, emphasizes that better defenses do not preclude more regular maintenance. Each maintenance schedule depends on the component in question, he says, although, say, spot-patching the paint—one of a bridge's best barriers against corrosion—can happen anytime. But given the well-known resiliency of structural steel, he expects that the Manhattan Bridge will stand for at least 75 more years before another reconstruction of this scope goes up for consideration.
Facing and above: Rehabilitation efforts included restoring the bridge’s signature ornamental ironwork.