RENZO PIANO'S NEW GENOA

Setting new standards in efficiency in the aftermath of a tragedy

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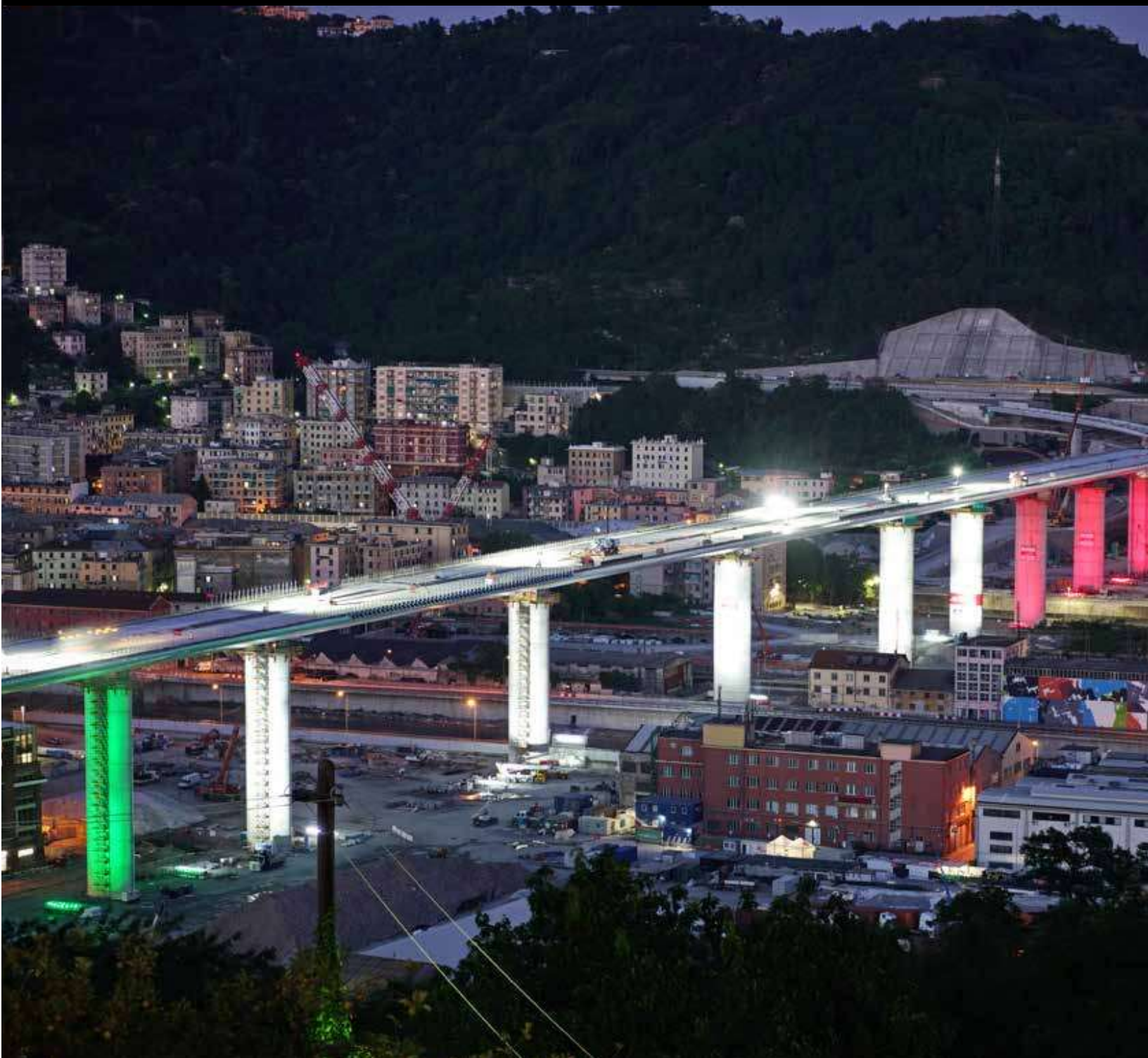

SAN GIORGIO BRIDGE

Development, Canadian Institute of Steel Construction (CISC-ICCA)

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THE TRAGIC COLLAPSE OF THE MORANDI BRIDGE

The Morandi Bridge in Italy was known as the Polcevera Viaduct, and was one of the longest concrete bridges in the world when it opened in September 1967; it spanned 1,102 metres and was both a significant and integral part of Genoa's infrastructure. Tragically, on August 14, 2018, the bridge partially collapsed onto a railway line and a warehouse 45 metres below, tragically killing 43 people and injuring close to 600 others; the city and the country were left devastated. Although the cause of the collapse has yet to be determined, the consensus by experts around the world is that over two decades of neglect was the contributing cause.

A few months later, on December 19, 2018, the announcement was made that a new bridge was to be immediately constructed as a replacement, with a then-estimated price tag of €202 million ($229 million USD), plus an additional €90 million for the demolition of the Morandi bridge. The new bridge was to be christened the "Genoa-Saint George Bridge," and the vision for the construction of a new steel bridge was that it would set new standards in efficiency for a project of its size and complexity.

THE OFFICIAL OPENING OF THE NEW GENOA SAN GIORGIO BRIDGE – ON TIME AND ON BUDGET

Amazingly enough, on August 4, 2020, just 15 months after the reconstruction project began, the Italian prime minister Giuseppe Conte inaugurated the new Genoa San Giorgio Bridge. The management of such a challenging and fast-tracked project of this size and complexity was a mammoth achievement by RINA, the management project consultants. They implemented a team of 80 technical specialists, focused on supervising and navigating all stages of construction, critical timelines, financial budgets and controlling the work progress.

The commitment was phenomenal: 20 sites were operating simultaneously and uninterrupted for 7 days a week, 24 hours a day for almost two years. The expert management during deconstruction and construction was unparalleled. The design of the bridge has been termed by RINA as a "statement in its understatement."

A NEW CONSTRUCTION WITH STRATEGIC SIGNIFICANCE

The structure, or the new Genoa San Giorgio Bridge, was designed free of charge by famous architect Renzo Piano. The construction of the replacement bridge was completed by Pergenova in a joint venture with


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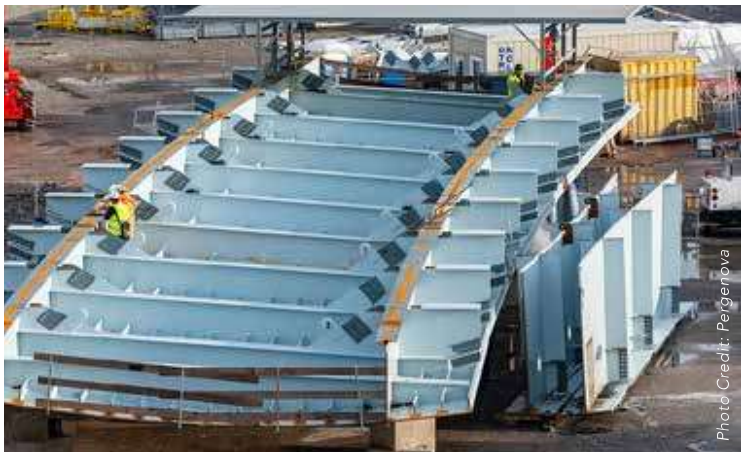


Photo Credit: Pergenova

infrastructure group Salini Impregilo and shipbuilder Fincantieri Infrastructure. Itzler was the consulting firm that handled the engineering. It was designed for a 100-year lifespan.

This new steel bridge is composed of six lanes: two traffic lanes in each direction and an additional lane on either side for emergency traffic and for carrying out maintenance work and avoiding the main lane closures. It is comprised of 19 spans, varying from 26 to 100m in length, and it is 1,100 metres long, having a continuous steel deck over a 30-metre width. It is supported by 18 elliptical-shaped reinforced concrete piers, spaced at 50 metres apart. The three central spans which cross the Polcevera stream and the railway sections are 100 metres each having two steel wings on the sides with an internal passage for maintenance activities.

Solar panels mounted along each side of the wings were intended to power its lights and sensors. To enhance safety and durability, robots run along the hull of the spans for constant monitoring of maintenance requirements, and a dehumidification system was installed to help prevent corrosion.

The new bridge configuration is as follows:

- 14 spans of 50 metres;
- 3 spans of 100 metres;
- 1 span of 40.9 metres;
- 1 span of 26.27 metres.

THE STRUCTURE

Piano has emphasized that using a steel design enhanced the durability of this bridge. He believed that longevity in such a construction was an achievable goal: "If you use steel, you add the right protection and you make every piece accessible, so that you can repair or repaint every five to 10 years."

The design followed the direct alignment of the existing bridge to connect with the existing Coronata tunnels on the west side and the A7 motorway junctions on the east side. The only exception was at the west side, where the bridge was moved an additional 20 metres away from an industrial building that had been an obstruction to the existing bridge.

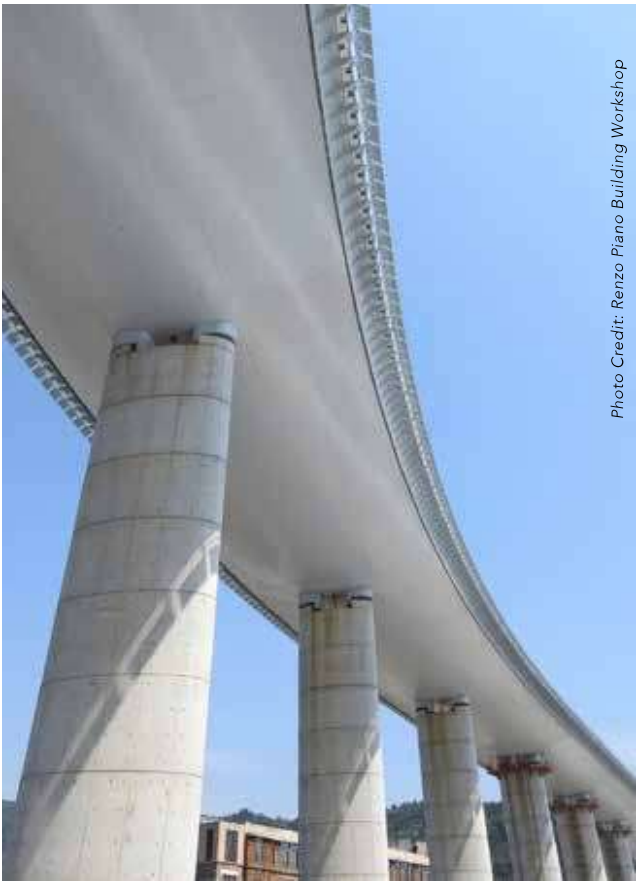


Photo Credit: Renzo Piano Building Workshop

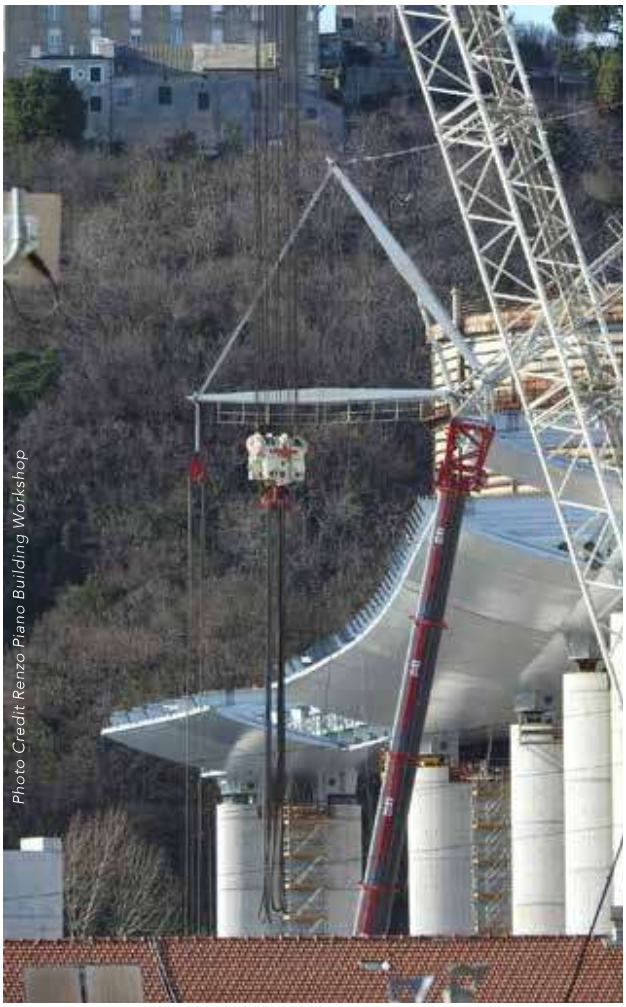
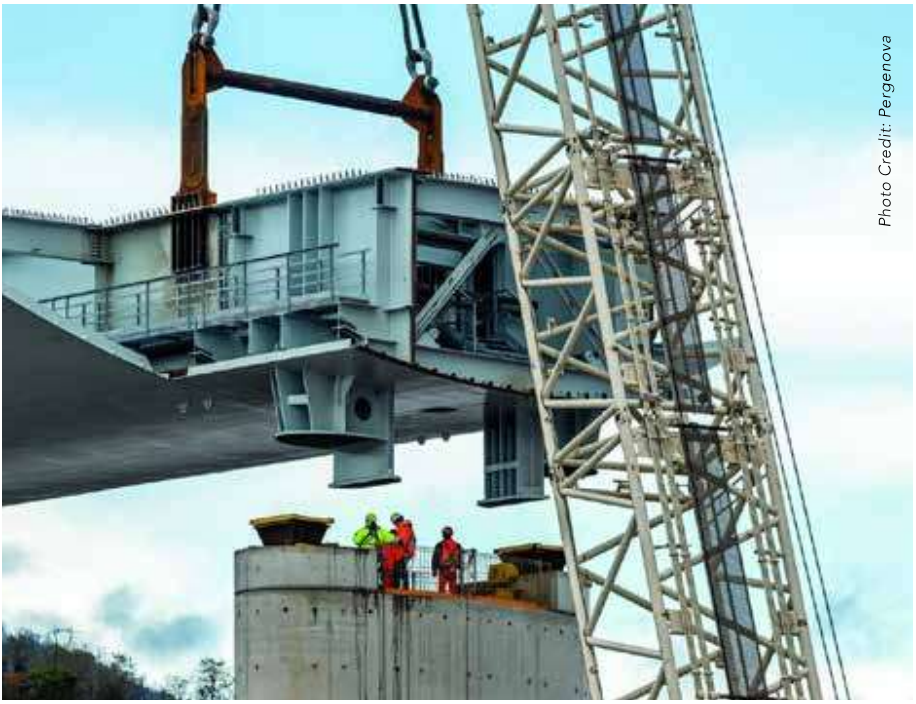


Photo Credit Renzo Piano Building Workshop

THE TEAM:

CLIENT: COMMISSARIO RICOSTRUZIONE GENOVA **CONCEPT AND SUPERVISION:** RENZO PIANO, ARCHITECT **DESIGN TEAM:** S.RUSSO (ASSOCIATE IN CHARGE), A.MONTANARI, A.ZANGUIO WITH M.CARROLL (PARTNER), G.SPADOLINI; B.PIGNATTI, A.PIZZOLATO, G.SEMPRINI, C.ZACCARIA (CGI); M.ABIDOS, D.LANGE, F.TERRANOVA (MODELS) **TECHNICAL:** PROJECT ITALFERR **GENERAL CONTRACTOR:** PERGENOVA SCPA - WEBUILD SPA (SALINI IMPREGILO) / FINCANTIERI INFRASTRUCTURE SPA (GENERAL CONTRACTOR) **PROJECT & CONSTRUCTION MANAGEMENT AND QUALITY ASSURANCE:** RINA CONSULTING SPA **LIGHTING CONSULTANTS:** IGUZZINI



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The five-metre-deep composite deck was an aerodynamic concept design, isolating it from the piers to protect the structure from seismic activity. This method of separation using support devices allows the bridge to "breathe," optimizing the structure, substructures and foundations, permitting the bridge to naturally expand and contract without compromising stability or strength.

From an architectural perspective, the hull of a ship-shaped deck permitted a gradual reduction of the section towards the ends of the bridge, mitigating the visual impact of the new infrastructure. Light-colour painting of the steel elements makes the bridge bright, harmonising its presence in the landscape.

For the design and construction processes, technology, innovation and experience were key. At every step, Bentley BIM was utilized to provide a digital twin for each segment of steel and concrete component, the mechanical and electrical systems and even the road and surrounding terrain. Focusing on the use of technology was the effective means to reduce costs, promote collaboration and attain accuracy.

Laser scanners flown over the area provided scans with details that could be digitally reconstructed into a 3D surface of the bedrock, enabling precise depth measurements needed for the foundation piles. These templates for both small and large components used the dataset with information on physical elements, construction schedule, dimensions, volume and other vital factors.

FABRICATION

The prefabrication of some major components supported the targeted timeline. The 5m-deep, 30m-wide hollow hybrid steel shell concrete slab structure was fabricated in shops across Italy and shipped to Genoa.

Piling commenced in mid-April, and as pier work expanded along the viaduct, the steelwork was arriving by boat from Sestri Ponente or on trucks from Valeggio sul Mincio, Verona.

Noise and dust levels were monitored throughout the construction process and mitigation steps were instigated to minimize any environmental or social impacts. Roads were wetted to reduce dust, and noise levels were controlled during operations.

Load tests were conducted, during several weeks prior to inauguration, to ensure the loading capacity of the new bridge, using 16 trucks driven along the bridge before static load tests began using 56 trucks, weighing 44 tonnes (48.5 US tons) each. Further tests were done, using a total combined weight of 2,500 tonnes (2,756 US tons).

COVID-19

The effect of COVID-19 cannot be discounted. Teams had to be organized in smaller groups to maximize social distancing. RINA's challenge was the procurement of sufficient personal protective equipment for the approximately 450 people at the site daily. The RINA team held a high level of safety standards and received constant praise from authorities. AS

Credit for info and photos: Pergenova ScpA - Webuild SpA (Salini Impregilo , Renzo Piano Society, Fincantieri Infrastructure SpA

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