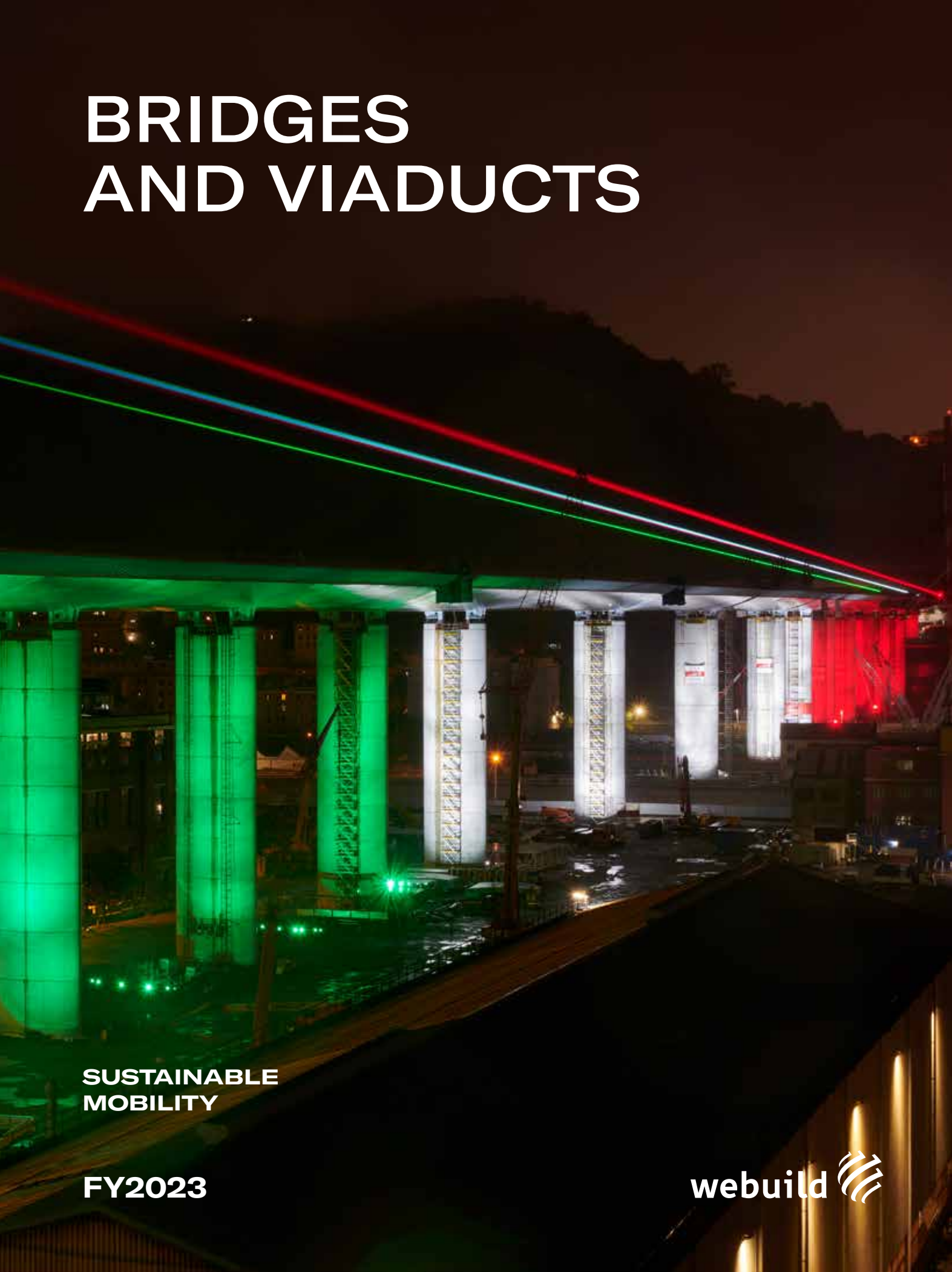
BRIDGES AND VIADUCTS



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CONTENTS

1.
BRIDGES: A METAPHOR FOR PROGRESS

If progress had a monument,
it would be a bridge.

From Ancient Rome to the present day, bridges have always contributed to economic growth and the development of countries. They are designed to meet an apparently simple need: joining two pieces of land, connecting people, improving trade, shortening the distances between otherwise distant communities.

The evolution in their design tells us a lot about how engineering has developed over time, and of the successes achieved by construction. From the first arch bridges to those that are suspended, they mark the journey of human civilisation.

«Building a bridge is a war with the forces of Nature,” Joseph Strauss, the designer of the Golden Gate Bridge in San Francisco, is quoted as saying. It is a war that expresses itself through the effort of joining two points by surpassing an obstacle: a valley, a river, a road... An obstacle that, over time, becomes a reference point when assessing technical challenges and admiring the innovation behind these incredible pieces of infrastructure.
The Webuild Group has contributed to this journey during the last 100 years. Its track record reaches 1,020 kilometres of bridges and viaducts already built. Arch, cable-stayed, girder and suspended bridges along more than 300 large road, highway and railway projects: examples of how construction techniques have evolved during the last century.

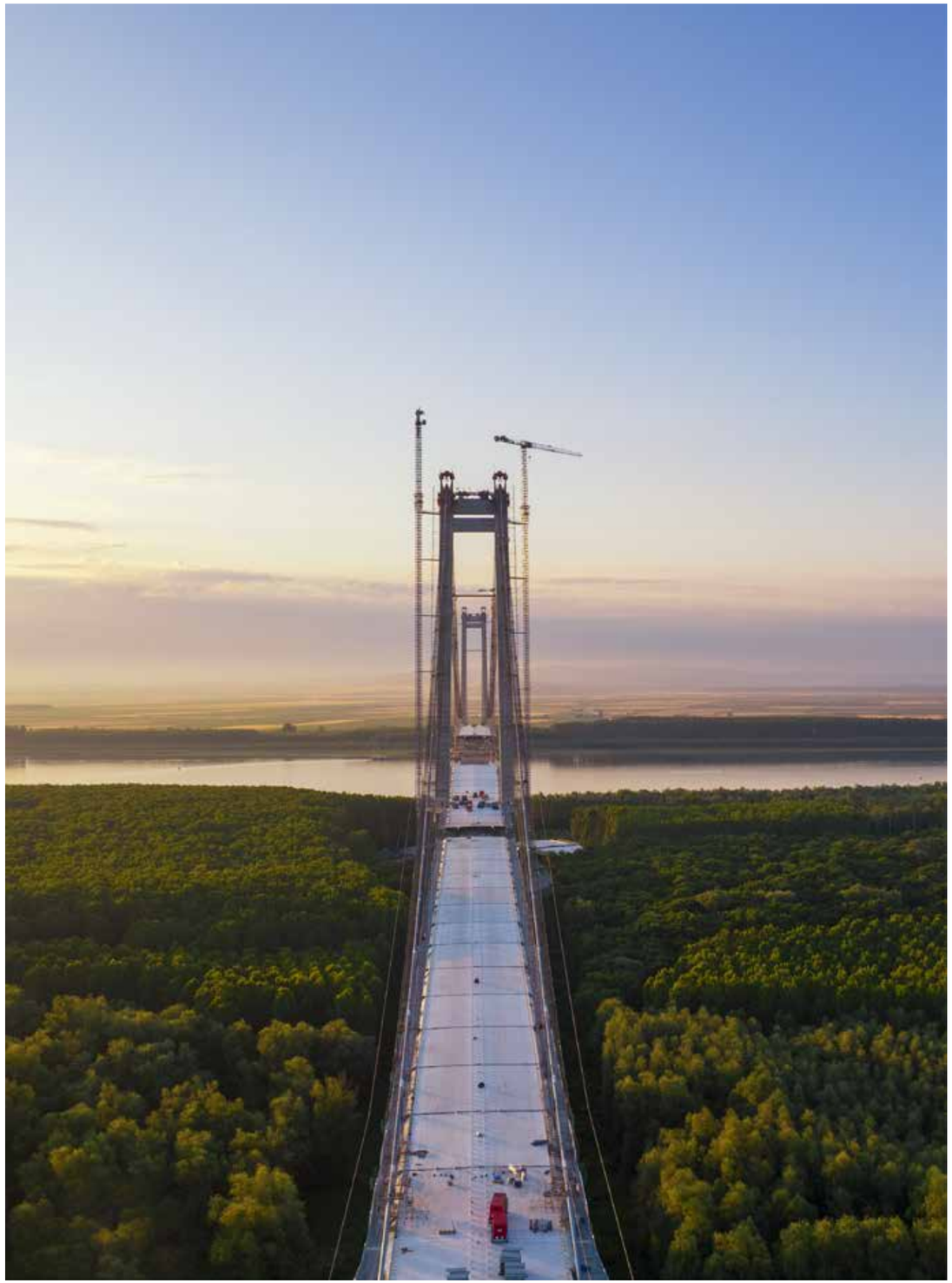
It starts with the Recco Viaduct, built before 1922 and then rebuilt in 1948 after the bombardments of the Second World War. A railway viaduct 376 kilometres long, it has come to stand as a symbol of the Italian construction renaissance.

The Second and Third bridges over the Bosphorus greatly differ from the one at Recco. Between these two Turkish bridges there are almost 20 years (the second was completed in 1988, while the Third in 2016). They have in common the need to connect Europe and Asia, transforming Istanbul into a global capital. Also in Turkey, Webuild completed in 2016 the Osman Gazi Bridge. At the time of its inauguration, it was the world's sixth suspended bridge with regards to the length of its central span at 1,550 metres. It has since become the seventh longest.

Connecting the unending prairies in the United States, overcoming large rivers in South America, modernising Australia's cities, tracing new paths in the mountain regions of Italy... the bridges built by Webuild can be seen as little, tiny dots populating a world map, present at every latitude and longitude.

Some of them, like the Posadas-Encarnacion, connect different states (Argentina and Paraguay). Others, like the skytrain viaduct and curved cable-stayed at for Sydney Metro Northwest, raised the bar for innovation and won the "2018 Project of the Year" award from Engineering News- Record, a respected U.S. trade magazine.

Innovation, design, technical and organizational skills: these are the essential qualities needed to manage feats like the construction of the Genoa San Giorgio Bridge. Completed in 2020 - just over a year since the project began - it helped heal the deep wound suffered by to the city with the collapse of the Morandi Bridge.
This is the meaning of bridges: an expression of engineering born out of the need to reach the other shore by foot, a shore that had previously been reached only with the eyes or the imagination.



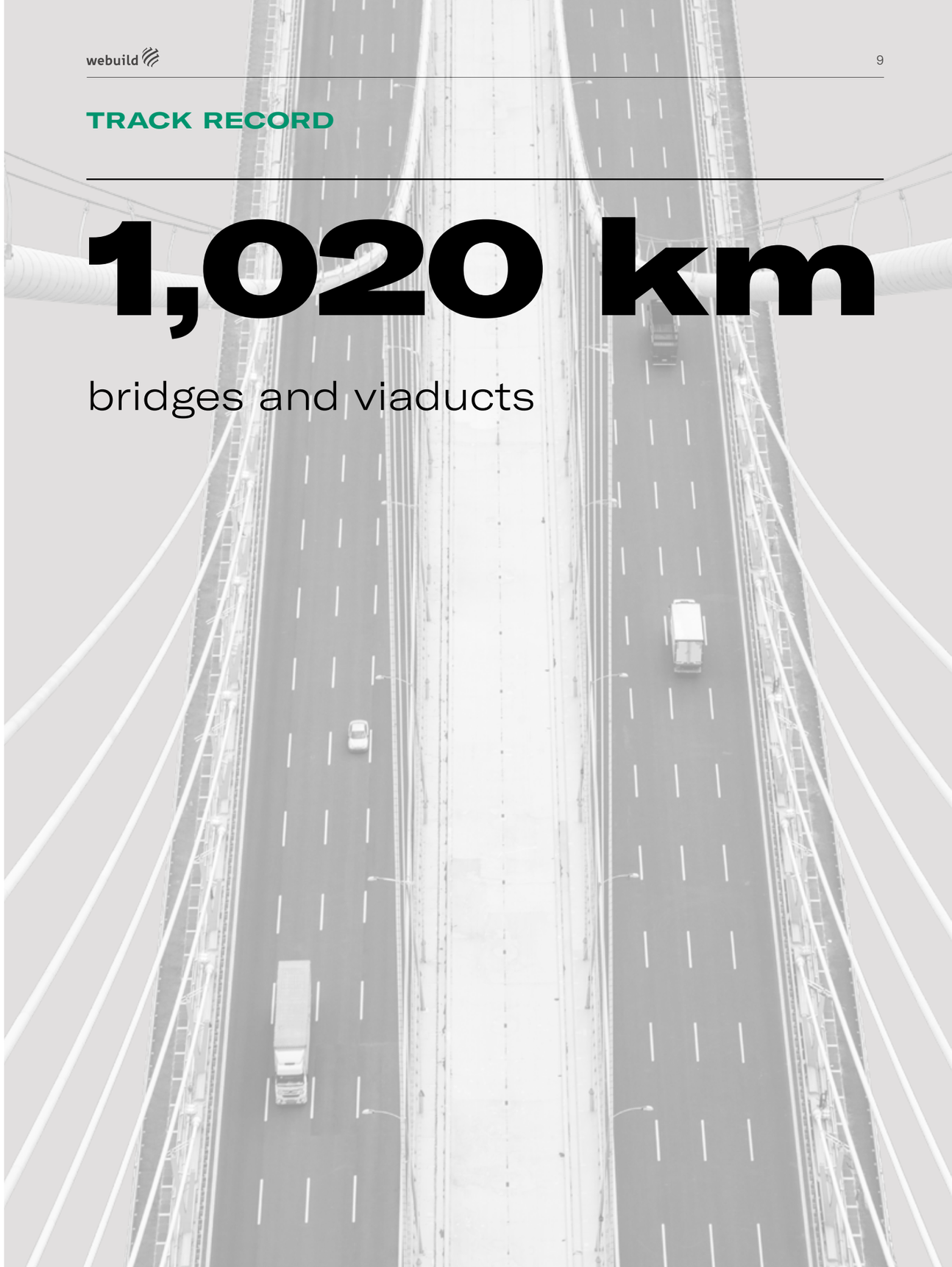
2.
WEBUILD: OUR BRIDGES

Webuild – during its about 120 years of history - has globally built hundreds of bridges and viaducts, totalling 1,020 kilometres in overall length: single projects like the Genoa San Giorgio Bridge or ones included in **over 300 large road, motorway, and railway projects**.

TRACK RECORD

1,020 km

bridges and viaducts



The following are some of main bridges and viaducts already built in **Italy**:

→ The new Genova San Giorgio Bridge, whose structure was completed in record time on April 28, 2020, after just 10 months from the jetting of the first sub-foundation;
→ The **Sfalassà** and **Favazzina Viaducts**, of the **Salerno-Reggio Calabria** highway: the first with a central span measuring 376 metres; the latter, featuring a second cable-structure with a central span of 220 metres and two lateral spans of 110 metres each, with two towers, with a maximum height of 110 metres;
→ The **Roma-L'Aquila Motorway Viaducts**, a very complex structure due to the difficult terrain, which crosses the Apennine mountain range;
→ The **viaducts** of the **A5 Monte Bianco-Aosta** highway;
→ The bridge over the **Po River** and numerous viaducts along the A1 Milan-Naples highway;
→ The **Udine-Carnia-Tarvisio** highway, one of the main connections through the Alps between Italy and Central Europe;
→ The bridges of the **"Direttissima" Rome – Florence Railway**, and of the **Turin-Milan** and **Bologna-Florence lines**;
→ The bridges of the **Genova-Ventimiglia** and **Genova-La Spezia** rail lines, among which the reconstruction of the **Recco Viaduct** after World War II.

Other also characteristic bridges have also been built **beyond Italy**, including:

→ **Bridge over the Danube river in Braila**, a spectacular suspended bridge approximately 1,975 metres long;
→ The **Long Beach International Gateway in California** that improves the traffic flow in one of the most congested bridges in the United States and that stands as one of the **highest bridges in the country**;
→ The skytrain viaduct and cable-stayed bridge for the **Sydney Metro Northwest** in Sydney that received many international awards;
→ The **Third Bosphorous Bridge in Turkey**, the largest hybrid suspended bridge, besides also being the bridge with the world's highest towers at the time of its construction;
→ The **Second Bosphorous Bridge** with a single span measuring 1,090 metres;
→ The **Osman Gazi Bridge** in Turkey, which when it was built was the world's sixth longest suspended bridge (today it is the seventh) with a main span that measures 1,550 metres;
→ The "**A. Max Brewer**" Bridge in the United States, which is 977 metres long including a main structure and three spans;
→ The two cable-bridges of the **Saint Petersburg** highway junction (WHSD), a strategically important project for the city's transport system;
→ The bridges and viaducts system - with a variable length of 74 metres to 1,225 metres for an overall length of more than 4 kilometres - along the **Anchieta-Imigrantes** motorway section, one of the busiest in Brazil;

→ Four bridges on the Paranà River: the **International Bridge** between Posadas and Encarnación and the **Brazo Largo** cable-bridge - respectively 570 and 550 metres long - both with a central span of 330 metres; the bridge between the Chaco and Corrientes provinces and the bridge that connects **Rosario** to **Victoria**, measuring 610 metres in length with a central span of 350 metres;
→ The **Bridge on the Magdalena River** at **Barranquilla** and the **Plato-Zambrano Bridge** in Colombia;
→ The bridges of the **Trans-Iranian railway** built in the 1930s, one of the main engineering works of the 20th Century.

3.
10 BRIDGES AND VIADUCTS BUILT BY WEBUILD THAT TELL OUR STORY

	CONSTRUCTION PERIOD	PROJECT	COUNTRY	TOTAL LENGTH (LENGTH OF MAIN SPAN)	TYPE
1	2018 - 2023	**Bridge over the Danube river in Braila**	Romania	1,975 m (1,120 m)	Suspended
2	2012 - 2020	**Long Beach International Gateway**	USA	2,680 m (310 m)	Girder
3	2019 - 2020	**Genoa San Giorgio Bridge**	Italy	1,067 m (100 m)	Girder
4	2014 - 2018	**Viaduct and Cable Stayed Bridge - Sydney Metro Northwest**	Australia	270 m cable-stayed 4,500 m viaduct	Cable-stayed / Girder
5	2014 - 2016	**Third Bosphorous Bridge**	Turkey	2,164 m (1,408 m)	Suspended
6	2013 - 2016	**Osman Gazi Bridge**	Turkey	3,300 m (1,550 m)	Suspended
7	1967-1974 / 2009-2012	**Sfalassà Viaduct Salerno-Reggio Calabria Motorway**	Italy	826 m (376 m)	Girder
8	2008 - 2010	**Favazzina Viaduct Salerno-Reggio Calabria Motorway**	Italy	440 m (220 m)	Girder
9	1998 - 2003	**Rosario-Victoria Motorway Bridge**	Argentina	610 m (350 m)	Cable-stayed / Girder
10	1985 - 1988	**Second Bosphorous Bridge**	Turkey	1,090 m (1,090 m)	Suspended

Bridge over the Danube river in Braila

ROMANIA

Construction: 2018-2023

This **suspended bridge measures 1,975 metres in total length**. It crosses the Danube **with a main span that is 1,120 metres long, and two towers slightly over 192 metres** in height. It also comprises 2 main lateral spans with a length of approximately 490 metres (on the Brăila River) and approximately 365 metres (on the Jijila), and two access viaducts.
The Bridge over the Danube river in Braila connects two banks of the Danube in the Galati-Braila area, guaranteeing quicker crossing times for approximately 7,000 daily vehicles, which before the bridge's building had only one transport option: the ferry-boat.

PROJECT KPIs

1,975 m
bridge length

2
number of lateral spans

1,120 m
the length of the main span

Long Beach International Gateway

USA (California)

Construction: 2012-2020

The new **Long Beach International Gateway cable-stayed bridge** is a significant strategic node that connects the city to the Port of Long Beach. It **measures 2,680 metres in total** and has **a main span of 330 metres** and **access viaducts of approximately 2 kilometres in length**.
Its construction required replacing the Gerald Desmond Bridge with a more modern and adequate one with anti-seismic features that would improve traffic flow. Built in the 1960s, the previous bridge had been a symbol of Long Beach, but it could no longer meet the increased traffic volumes.
The new project design stood out from the very beginning due to its technical and organisational solutions, typical of strategic infrastructure, where the new is built without hindering the existing.
Work on th enew bridge did not stop rail, road and ship traffic, a prerequisite to its construction.

PROJECT KPIs

2,680 m
total bridge length

330 m
main span length

2 km
length of access viaducts

Genova San Giorgio Bridge

ITALY

Construction: 2019-2020

The Genova San Giorgio Bridge that crosses the Polcevera Valley is one of the essential nodes to connect the port of Genoa with France and other surrounding areas. It is an important engineering piece that hands back to the city its role as a great port and trading hub. Built by Webuild and Fincantieri (partners in the PerGenova group), it comprises a steel deck, a continuous span with an **overall length of 1,067 metres**, divided into **19 spans**. The bridge is supported by **18 elliptical reinforced concrete piers**. The geometry of the ellipse, with no sharp corners, allows light to “slide” off its surface, therefore mitigating its visual impact and presence in the urban context. The deck, made of a mixed steel-concrete structure, lays on these piers. Its steel part is made up of three transversal segments to make the construction and assembly of several spans in sequence both simple and quick.
The bridge's construction, which was finished in record time (just 15 months), has become a symbol of Genoa's renaissance, a city that suffered great pain from the collapse of the Morandi Bridge. But it also stands as a growth opportunity for Italy, too. What made its construction so successful was the model of collaboration used between the private and public sectors. , Collaboration, transparency, teamwork and safety at the service of Genoa and Italy was the result.

PROJECT KPIs

1,067 m
total bridge length

19
number of spans

18
number of piers

Viaduct and Cable-stayed Bridge – Sydney Metro Northwest

AUSTRALIA

Construction: 2014 – 2018

The **Sydney Metro Northwest** project involved building a metropolitan train line north-west of Sydney. The project also foresaw, besides constructing 8 new stations and approximately 15.5 kilometres of tunnels from Epping to Bella Vista, **a 4.5- kilometre-long viaduct** with a **270-metre-long curved cable-stayed bridge**, connecting Bella Vista to Rouse Hill.
The work’s excellence can be seen in every feature, starting from the machinery used to build it. One example is the horizontal cranes with a length of 150 metres and a weight of 600 tonnes, used to position the 1,200 prefabricated concrete segments that brought the viaduct to life.
One of the greatest engineering challenges faced by the project was overcoming the significant torsional effect of the deck's curved shape in the presence of rail and cable-stays.
The bridge is elegant, innovative, environmentally sustainable, a one-of-a-kind bridge in Australia. It received numerous acknowledgements, like the "2018 Project of the Year" award by Engineering News- Record (ENR), a U.S. trade magazine that is a reference point for the sector.

PROJECT KPIs

4,500 m
total length of the viaduct

270 m
length of the cable-stayed bridge

1,200
concrete prefabricated segments

Third Bosphorous Bridge

TURKEY

Construction: 2014 – 2016

The **widest hybrid suspended bridge, and the one with the tallest towers, globally, at the time of its construction**. It is part of the project of the North Marmara Highway.
Built with the aim of reducing traffic and creating a corridor that eases trade transits from and towards Greece, it is both suspended and cable-stayed. Measuring **2,164 metres in total length**, its **main span reaches 1,408 metres**.
Its two main towers have their foundations on the banks of the strait. They reach 322 metres in height, a dozen metres more than the Tour Eiffel. The deck includes 8 motorway routes (2 roadways, each with 4 lanes), separated by a double-track central railway corridor, with an overall width just under 59 metres.

PROJECT KPIs

2,164 m
total length of the bridge

1,408 m
length of the main span

322 m
height of the main piers

Osman Gazi Bridge

TURKEY

Construction: 2013 – 2016

The Osman Gazi Bridge is a suspended cable-stayed bridge belonging to a larger project to build the Gebze-Orhangazi-Izmir highway. It was built on the Baia di Izmit, on the western side of the Sea of Marmara, near Izmit, approximately 50 kilometres south-east of Istanbul, in Turkey.
The bridge has an overall length of 3,300 metres and, at the moment of its construction, **it was the world's sixth longest bridge** (today, it is the seventh) with regard to length of **the main span**, which **measures 1,550 metres**.
The **bridge is suspended 64 metres above sea level**, with **steel piers reaching 230 metres in height**.
It comprises six lanes (three in each direction), and its construction has allowed crossing the bay in just 6 minutes, compared to the previous 60 minutes.
It is built in one of the world's most seismic areas, so to make the bridge even more resistant, its piers were built on a cement base resting on a large bed of gravel, allowing them to slide in case of an earthquake.

PROJECT KPIs

3,300 m
total length of the bridge

1,550 m
length of the main span

230 m
maximum height of the towers

Sfalassà Viaduct – Salerno-Reggio Calabria Motorway

ITALY

Construction: 1967 – 1974 / 2009 – 2012

The bridge's construction began staeted from the larger modernisation project of the Salerno-Reggio Calabria Motorway. The Sfalassà Viaduct has a total length of 826 metres, it is 19.10 metres wide, and has a main span measuring 376 metres in length.
The viaduct hangs between the steep mountains of Calabria. It won the CEM prize three times (1968, 1970 and 1972), important at a European level for public works.

PROJECT KPIs

826 m
total length of the viaduct

376 m
length of the main span

19.10 m
width of the viaduct

Favazzina Viaduct – Salerno-Reggio Calabria Motorway

ITALY

Construction: 2008 – 2010

Just like the Sfalassà Viaduct, the Favazzina Viaduct is also part of the larger modernisation project of the Salerno-Reggio Calabria motorway.
It is made of two distinct parallel cable-stayed bridges, a deck in each direction, each 440 metres in total length, a central span of 220 metres, and two lateral spans of 110 metres. Each deck is supported by two steel towers measuring 110 metres at their maximum height, with a diapason shape.

PROJECT KPIs

440 m
total length

220 m
length of the central span

110 m
height of towers

Rosario-Victoria Motorway Bridge

ARGENTINA

Construction: 1998 – 2003

The bridge is part of the highway connection, which extends over a total length of 59.4 kilometres, between Rosario (Province of Santa Fé) and Victoria (Province of Entre Ríos). The connection, which develops through the Rio Paraná valley, was built with the aim of easing commercial traffic between Chile, Argentina, Uruguay, and Brazil.
The bridge is cable-stayed, it is 610 metres long, and has a **central span of 350 metres**, and two lateral spans of 130 metres. The free span, located where the navigable canal is located, has a length of 300 metres and a height over 50 metres.

PROJECT KPIs

610 m
length of the cable-stayed bridge

350 m
central span

130 m
lateral spans

Second Bosphorous Bridge

TURKEY

Construction: 1985 – 1988

The **Second Bosphorous Bridge** was built as an addition to the first one built in 1973 to meet increasing traffic across the Bosphorus.
Named “**Fatih Sultan Mehmet Bridge**", it was built in Istanbul, at approximately 5 kilometres from the first bridge. It has a **sole span measuring 1,090 metres**. The metal piles rest on concrete foundations built on the two banks of the strait.
Its construction required, among other things, the excavation of 600,000 cubic metres of rock and the jetting of 140,000 cubic metres of concrete. Approximately 24,000 tons of structural steel were used to build the piles and the deck, and 9,450 tons of highly resistant steel were used for the cables.
When it was built, it was the world's longest suspended bridge.

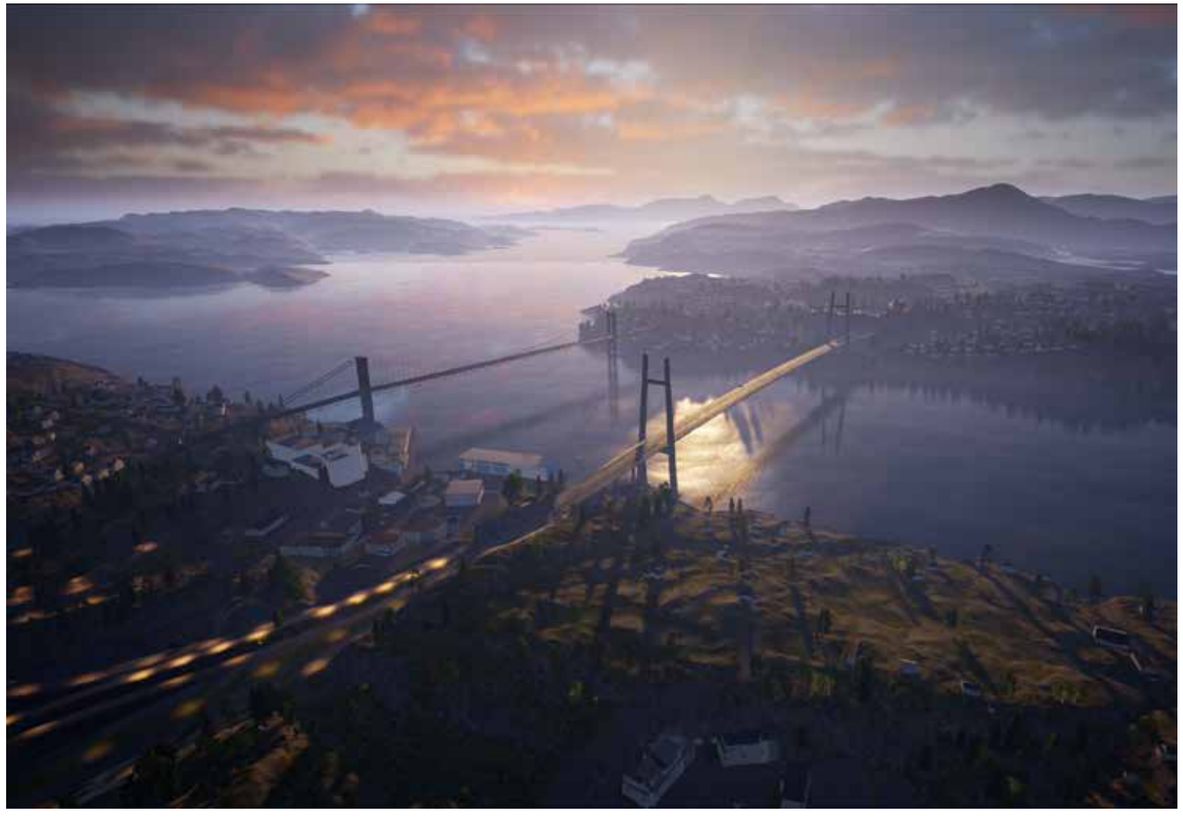
PROJECT KPIs

1,090 m
length of the main span

600,000 m³
rock excavations

140,000 m³
the concrete used for substructures

4.
OUR GLOBAL BRIDGES AND VIADUCTS



Sotra Connection PPP Project

NORWAY

Construction: 2021 – ongoing

The project foresees a road system for Norway's internal mobility, becoming **one of the country's most important Private-Public Partnership (PPP) projects** to strengthen infrastructure under a government plan for the 2018-2029 period. It will consist of a system of bridges, roads, and tunnels in the County of Vestland between the city of Bergen and the island of Sotra on the west coast.
Webuild and its partners will fund, design, build, and manage for multiple years the four-lane-road connection that extends for 9 kilometres, including 4.6 kilometres of tunnels (12.5 kilometres including secondary tunnels) and a **suspended bridge**.
The bidge **will have 4 lanes that extend for approximately 900 metres** (including access viaducts) and **30 metres in width**, with **piers reaching 144 metres in height**. **Three smaller bridges will also be built**.
The road system will also comprise pedestrian paths and bike lanes, extending for 14 kilometres in total.

PROJECT KPIs

900 m
length of suspended bridge

30 m
width of suspended bridge

144 m
height of piers

Unionport Bridge di New York

USA, New York, Bronx County

Construction: 2017 – ongoing

The project involves **replacing a bascule bridge - inaugurated in 1953** - which allows the Bruckner Expressway to cross Westchester Creek. It will ease traffic congestion in the Bronx, one of the most heavily congested areas in New York.
Works are being carried out without interruption to traffic, both for the expressway and the navigable canal. This has been made possible by building two temporary bridges and positioning the last tilting span in open position.
Unionport Bridge is crossed by some 60,000 vehicles every day. It is a fundamental connection for local traffic and for other uses too. It is the sole connection between Bruckner Expressway and Cross Bronx Expressway towards Hutchinson River Parkway and all other destinations in the more northern areas.

PROJECT KPIs

60,000
number of vehicles traversing the bridge daily

2
temporary bridges

Korabelny Bay Bridge, WHSD of Saint Petersburg

RUSSIA

Construction: 2013 – 2015

It is the largest bridge built for the most complex section of the Saint Petersburg (WHSD – Western High-Speed Diameter) motorway access road project to ease traffic.
The project offers a strong visual impact and has been designed as an open door that looks over the sea.
This cable-stayed bridge stands **35 metres above sea level, with a central span of 320 metres** and **steel and concrete towers reaching 124 metres in height**.

PROJECT KPIs

320 m
length of the central span

124 m
height of towers

35 m
height above sea level

Haliç Metro Crossing Bridge

TURKEY

Construction: 2009 – 2014

The Hălic Bridge crosses the famous cove called the Golden Horn on the European side of the Bosphorus, connecting Topкapi to Galata.
Overall, the route extends approximately for one kilometre, allowing the passage of the new Unкapanı-Yenikapımetro line of Istanbul.
The structure foresaw building a **new steel cable-stayed bridge that is 387 metres long**, and a **120-metre-long spring bridge** that can be crossed underneath by ships.

PROJECT KPIs

1
cable-stayed bridge

387 m
length of the cable-stayed bridge

1
spring bridge

Basarab Overpass, Bucarest

ROMANIA

Construction: 2006 – 2011

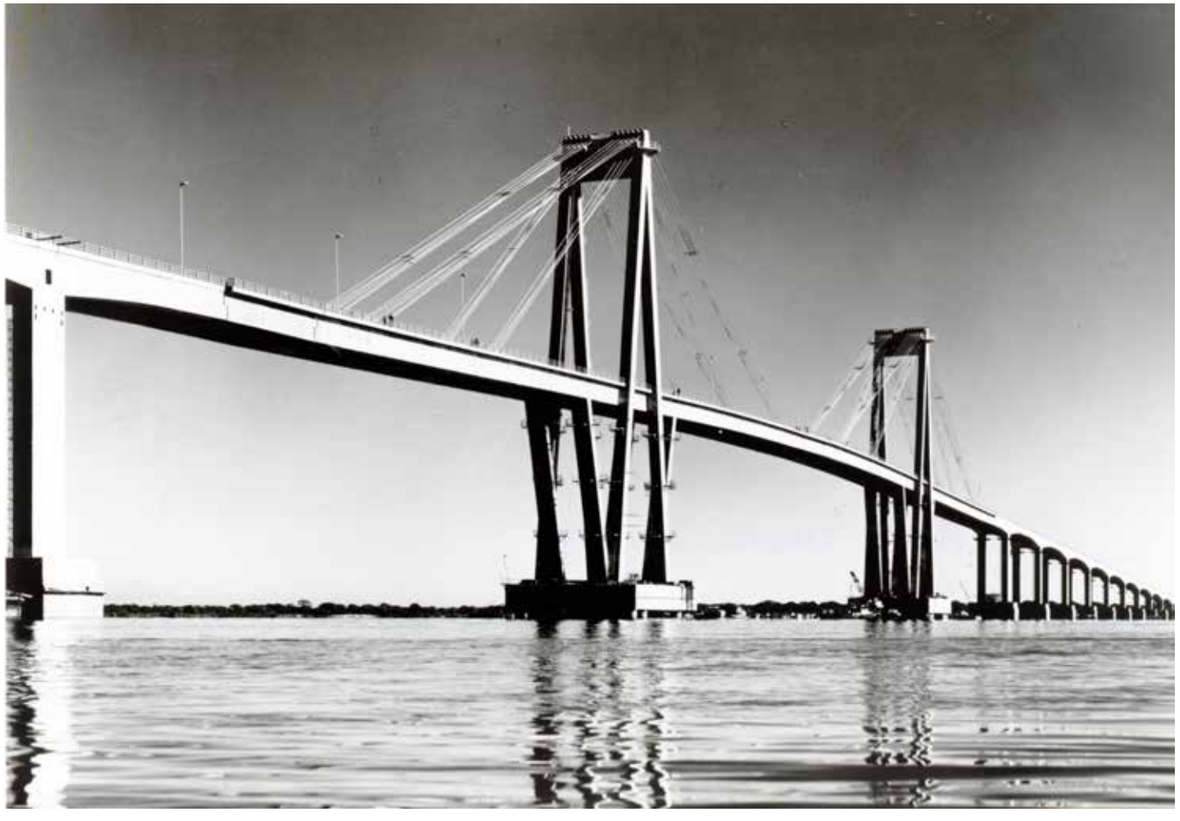
The project for the Basarab viaduct in Bucharest foresaw building and designing an urban viaduct with motorway features of approximately 2 kilometres in length.
This work has a significant impact on the Romanian capital's private and public mobility. It comprises building **two road bridges**: the first (the largest of the two) is of a cable-stayed bridge with a span measuring 250 metres in length, which passes over the tracks of the Northern Railway Station. The second is equipped with a steel arch structure with a 120-metre-span.

PROJECT KPIs

1
cable-stayed bridge

250 m
length of the cable-stayed bridge

1
arch bridge



Bridge over the Paranà between the provinces of Chaco and Corrientes

ARGENTINA

Construction: 1968 – 1973

The Bridge stretches across the Paranà River, the second longest in South America, connecting the Chaco and Corrientes provinces.
As a suspended structure, it was a novelty for its construction features. It is the first example of bridge with a large suspended pre-compressed reinforced concrete span, and a **prefabricated deck**. It was a new achievement at the time in terms of construction technique in light of the bridge's scale.
The bridge comprises a suspended structure with a **central span of 245 metres** and **two lateral spans**, **each measuring 163.9 metres**, connected to the structures on the ground by a series of portal-type girders with spans measuring 83 metres. The length of the part of the project standing over the river measures approximately 1,700 metres. The width of the road section is 14.34 metres for the large central spans and 12.4 metres for the access spans and for the viaducts on the ground.
At the time of its construction, the features of the riverbed, its depth, the speed of the water, the differences between peak and minimum water levels, and the frequency of the river floods and riverbed geology **represented an important engineering challenge**.

PROJECT KPIs

1,700 m
approximate bridge length

245 m
central span

163.9 m
length of lateral spans

Brazo Bridges on the Paranà River

ARGENTINA

Realizzazione: 1971 – 1977

The work comprised building two distinct bridges on the two branches of the Paranà River, (Guazù and Las Palmas), separated by 24 kilometres.
The two bridges were built to also allow transatlantic ship navigation; each has a cable-stayed metal structure, where the navigable canal is located, and two viaducts connecting to the banks.
The cable-stayed structure is 550 metres long. It has a central span that measures 330 metres, **50 metres over the peak river flow level**. It comprises a railway track and four road lanes.
Overall, the connecting road viaducts are 6.5 metres long, while the railway ones, running separately, measure 10 kilometres.
The main towers are built in reinforced concrete, reaching a height of 120 metres over the peak flow level of the river waters; they rest on reinforced concrete plinths supported by two-metre-diameter piles that reach a maximum depth of 73 metres.

PROJECT KPIs

550 m
length of the cable-stayed bridge

330 m
length of the central span

50 m
height of the cable-stayed structure over the level of maximum water level of the river

Bridge over Rio Magdalena, Barranquilla

COLOMBIA

Construction: 1970 – 1974

Building the **bridge** over the **Magdalena River** represented an important phase of the integration process of the coastal region, which has since become more connected with neighbouring countries Panama and Venezuela and the Colombian hinterland.
The **bridge has a total length of 1,500 metres**. The structure comprises **a cable-stayed bridge** that is 279 metres long, with **three main spans** (one at 140 metres; two at 69.5 metres) in correspondence with the river's navigable canal, and 26 standard spans of 45 metres.
The structure's slim feature and uniformity is particularly interesting from a technical standpoint. The design is also original due to the main spans, made from a continuous caisson-type girder of pre-compressed reinforced concrete resting on rigid support structures (piles) and elastic ones (the ends of the tie rods, also in pre-compressed reinforced concrete).

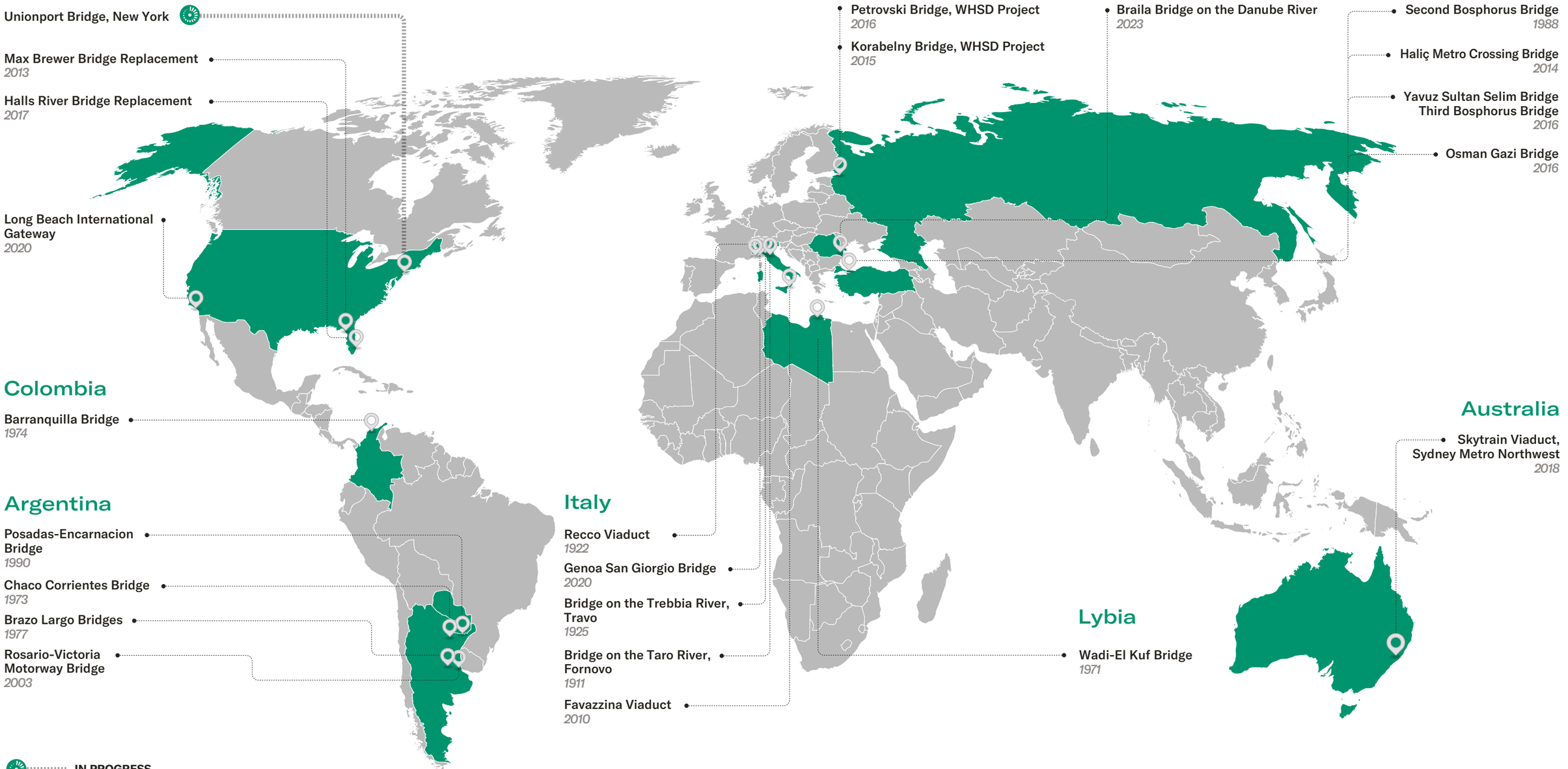
PROJECT KPIS

1,500 m
total length of the bridge

1
cable-stayed bridge

3
the main spans of the cable-stayed bridge

BRIDGES & VIADUCTS IN THE WORLD: MAIN COMPLETED AND ONGOING PROJECTS



United States

- Unionport Bridge, New York
- Max Brewer Bridge Replacement
  2013
- Halls River Bridge Replacement
  2017
- Long Beach International Gateway
  2020

Colombia

- Barranquilla Bridge
  1974

Argentina

- Posadas-Encarnacion Bridge
  1990
- Chaco Corrientes Bridge
  1973
- Brazo Largo Bridges
  1977
- Rosario-Victoria Motorway Bridge
  2003

Russia

- Petrovski Bridge, WHSD Project
  2016
- Korabelny Bridge, WHSD Project
  2015

Romania

- Braila Bridge on the Danube River
  2023

Turkey

- Second Bosphorus Bridge
  1988
- Haliç Metro Crossing Bridge
  2014
- Yavuz Sultan Selim Bridge Third Bosphorus Bridge
  2016
- Osman Gazi Bridge
  2016

Italy

- Recco Viaduct
  1922
- Genoa San Giorgio Bridge
  2020
- Bridge on the Trebbia River, Travo
  1925
- Bridge on the Taro River, Fornovo
  1911
- Favazzina Viaduct
  2010

Lybia

- Wadi-El Kuf Bridge
  1971

Australia

- Skytrain Viaduct, Sydney Metro Northwest
  2018

IN PROGRESS

XXXX COMPLETION DATE

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