Studio DE MIRANDA Associati

is a Consulting Engineering Company specialising in the design of Bridges and Structures.

Founded in 1968 by professor Fabrizio de Miranda, the firm operates in Milano and Rio de Janeiro in the field of structural design, under the management of the senior partners Mario de Miranda and Elena Gnecchi Ruscone.

The continuity of the design experience, developed through fifty years of studies and designs, often characterized by innovative ideas, represents the strong philosophy of the Company.

Studio DE MIRANDA Associati has built a wide design know-how in many areas of bridge and structural engineering over the years, and is highly specialised in design and construction of Suspension and Cable Stayed bridges.

The Company designed and has been involved in the construction of more than 20 Cable Stayed Bridges, many of which are long span, all over the world.

Bridge Design, from Concept to Construction

- Cable-Stayed
- Suspension
- Girders
- Arches
- Road bridges
- Railway bridges
- Footbridges
- Pipeline bridges

Design of special structures

- Towers and stayed masts
- Special buildings structures
- Hangars
- Helidecks

Construction Engineering

- Conception and study of Construction Methods
- Analysis of staged construction of bridges built by span by span methods, or:
  - Precast full span box girders
  - Longitudinal launching
  - Progressive cantilever construction
  - Construction by rotation
  - Construction design and analysis of cable stayed and supension bridges
- Aerodynamic stability analysis
- Design of special Equipment for the construction of bridge decks:
  - Self launching trusses and self launching formworks
  - Any type of special structure and method for allowing and easing the construction of bridges
- Supervision and control of bridge construction

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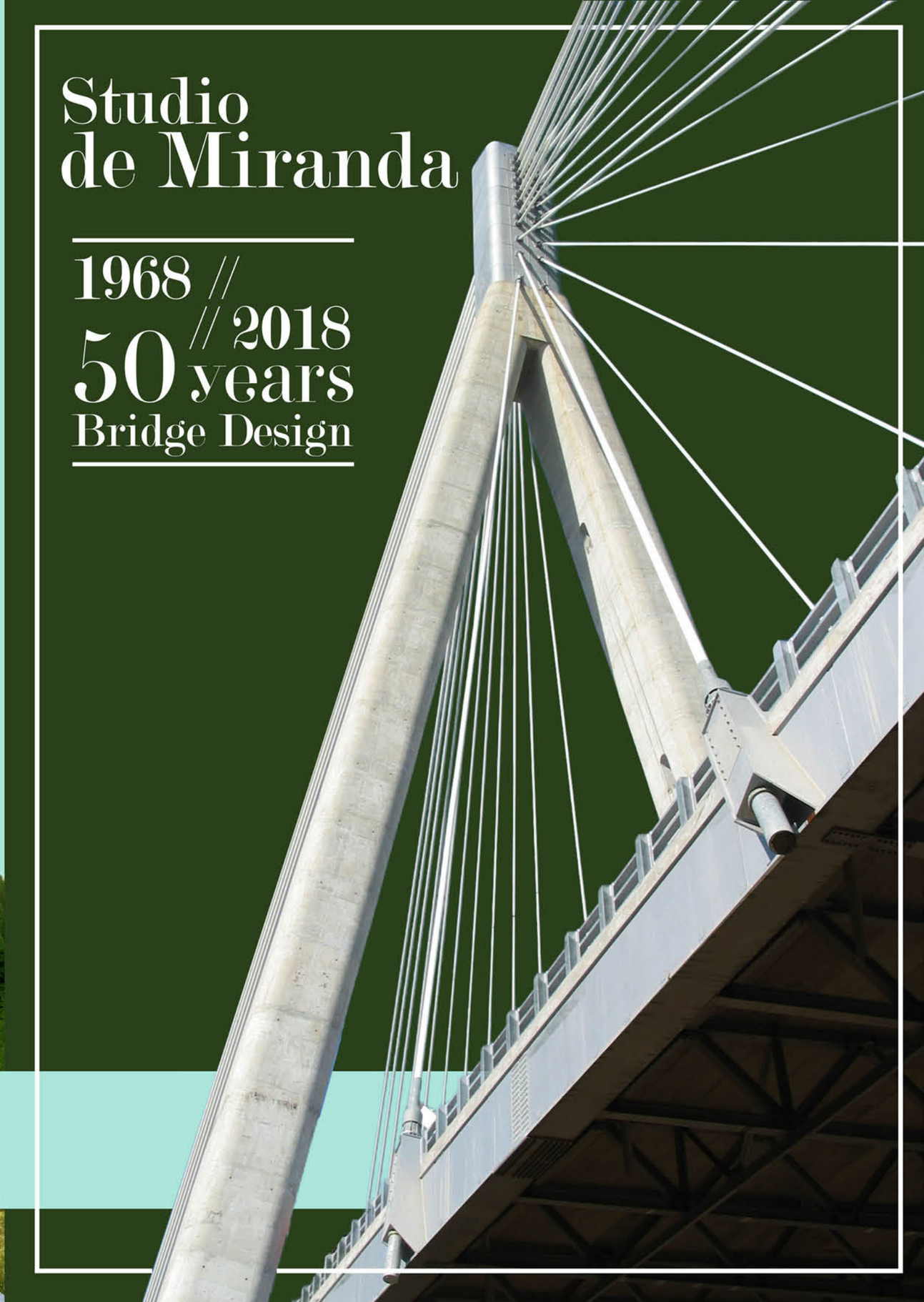
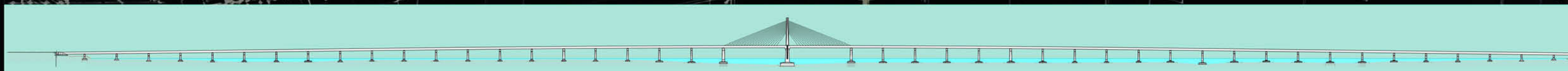
Studio de Miranda

1968 // // 2018
50 years
Bridge Design



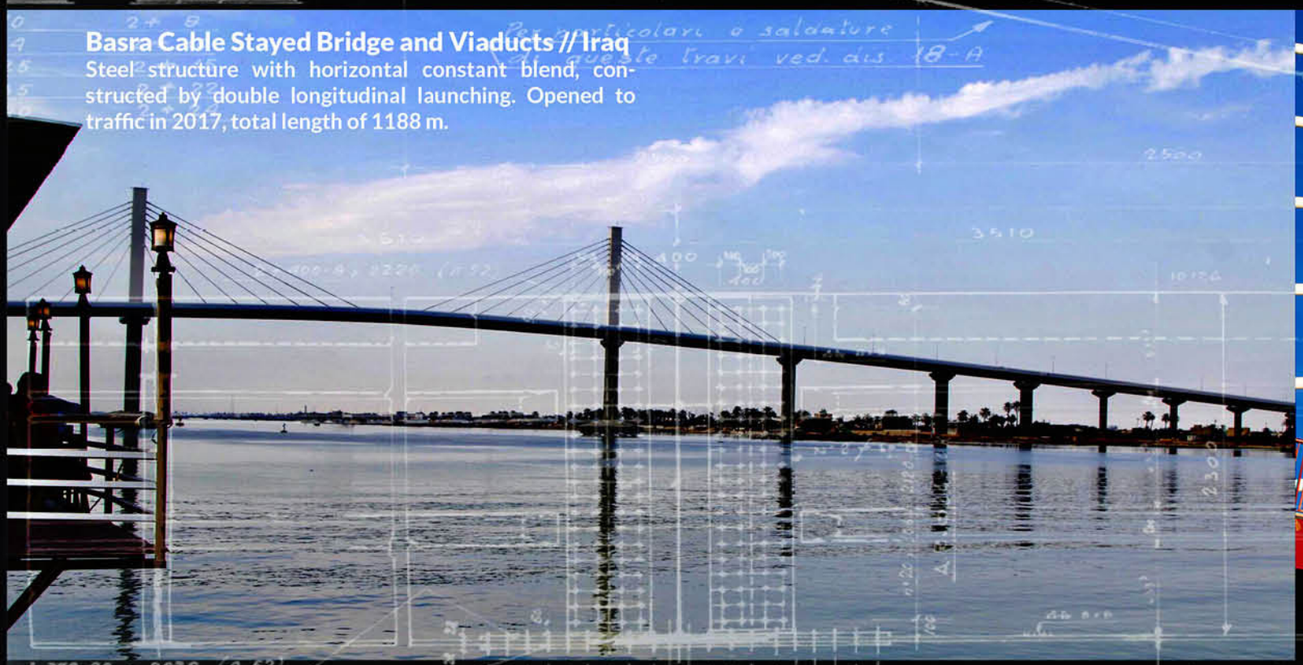


Storstrom Bridge // Denmark Road and high speed railway Viaducts and Cable Stayed Bridge with total length of 3832 m. Design and Construction International Tender awarded in 2018, end of construction expected in 2022.

Stadano Suspension Bridge // Italy
Road suspension bridge with steel structure deck and three concrete towers; the two main cables converge in one mast, and all the deck hangers are inclined. Constructed in 2017.

Ponte del Mare Pescara // Italy
Pedestrian cable stayed bridge with inclined mast, double curved deck, steel structure. 2009.

Watermark image: Hand drawn cross section of Rande Cable Stayed Bridge, 1977

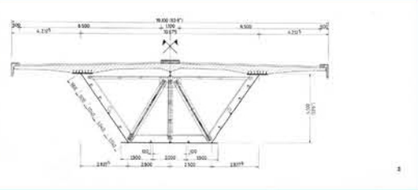


Basra Cable Stayed Bridge and Viaducts // Iraq
Steel structure with horizontal constant blend, constructed by double longitudinal launching. Opened to traffic in 2017, total length of 1188 m.

Curitiba Cable Stayed Viaduct // Brasil
Steel-concrete composite structure, central plane of stays, built in 2014 with longitudinal launching of the deck and vertical rotation of the mast.

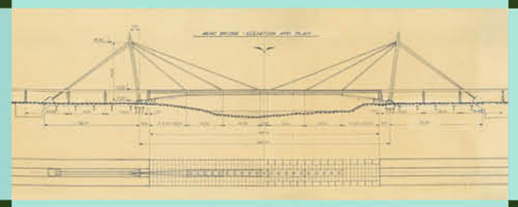
Innovation is

Forefront Structural Systems



• First use of **High Performance Steel** in bridge construction in Italy occurred in 1970, for the construction of the one kilometre long Entella Bridge, where high strength steel, 690 MPa class, T1A type, was adopted in highly stressed sections, realizing a forerunner Hybrid Girder Bridge.

• **Steel-concrete composite structures** is today a well consolidated technique, but in the 60s the standard was or steel or concrete. The introduction of this system in Italy, for road and railway bridge, was carried on by F. de Miranda; first composite bridge was the Chiese Bridge in 1955, and many other followed up



• The Indiano Bridge, in Florence, first steel cable stayed bridge in Italy, also has two other interesting primacies: it was the **first earth-anchored** and the **first twin-deck cable stayed bridge** in the world.

• In Europe the first steel bridges seismically isolated by elastic restraints were the Slizza and Vallone viaducts, designed in 1986. And the **first public building seismically base isolated** was the Civic Centre of Monte d'Ago near Ancona.

• The main concepts of modern long span cable stayed bridge, were introduced in 1969 by Fabrizio de Miranda in the **Messina Bridge Design** for the International Competition: closely spaced and fan-shaped stay cables, stiffening transverse cables, slender and streamlined box girder, A-shaped pylons. The same concepts were adopted by the same author in the design of the Zarate–Brazo Largo Bridges in 1970, in Argentina, first long span railway cable stayed bridge, and in the Rande Bridge in Spain in 1973, the longest cable stayed bridge at the moment of its construction.

• The **elevated Helideck in Turin**, over the Lingotto building was an innovative large slender structure, placed over the rooftop test track of the ancient FIAT car factory and received the ECCS award in 1997.

• The **first** and **largest cable stayed bridge** in the **Caribbean**, in a strongly seismic area, prone the frequent hurricanes was the Higuamo Bridge, Dominican Republic, designed by Mario de Miranda with tuned differentiated materials: reinforced concrete heavy side spans, and aerodynamic steel-concrete main span. Concrete legs and steel head were designed for the pylon.

• **First long span self launching trusses**, and self launching formworks were designed in 1985 by Fabrizio and Mario de Miranda; by means of these special forerunner equipment, the construction of many segmental and span by span concrete long viaducts, was made easy and quick.

• The **first large cable stayed bridge in Brazil**, over the river Guamà in Amazon area, opened the way for a series of modern Brazilian cable stayed bridges: over the Sergipe river in Aracajù, in Natal on the mouth of Potengi river into the Atlantic Ocean; and crossing the Oiapoque river, so joining Brazil with French Guyana, ideally linking South America and Europe.

The company has been involved in the innovation of many different aspects of bridge design over the years...

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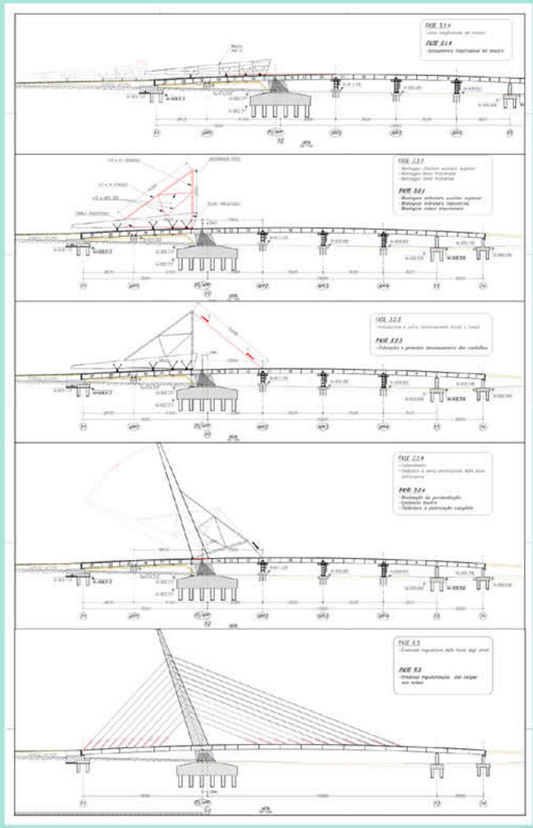
Our Tradition

Construction Methods



• **Autogenous vertical rotation**, without the aid of cranes, was conceived by Studio de Miranda Associati for the assembly of the pylon of the **cable-stayed viaduct of Curitiba** (Brasil) in 2013 and for the two pylons of Basra bridge (Iraq) in 2016.

• First **large longitudinal launching of long span girders** in Italy were accomplished for the Vallone and Slizza bridges, with 80 m long spans, curved in plan.

• **Prestressing of steel structures** by using **internal disconnections** was and still is an innovative construction system. It allows tuning and optimizing the girder bending moments without jacking, but simply by releasing some joints. The Mallero Bridge, as well as many motorway overpasses were designed by Fabrizio de Miranda by using his patented method.

• Innovative and differentiated systems were conceived for the erection of many large bridges:
  – horizontal **quick rotation of two half-decks** over a motorway: the Lavis bridge;
  – the **erection by running on the deck**, rotating, shifting and lowering, of entire large segments, in Higuamo Bridge, Dominican Republic;
  – the automatized replacement of old railway truss girders with new ones on the Merano-Malles railway, in Alto Adige (Italy);
  – macro active-structures and **macro segments installation devices** for the erection of **Delhi Signature Bridge**;
  – the quick erection of the **200 m deck of a Suspension Bridge in 20 days**, in the Stadano Bridge;
  – the designed erection of **macro pre-stressing concrete girders** without mega-cranes, in the **Storström Bridge;**

• Original and innovative methods were used for the construction of the **Storebaelt Suspension Bridge in Denmark**: progressive prestressing of steel viaducts, special lowering frames, special temporary joints between segments, vibration control systems. All these methods were specifically designed and successfully used within the **Construction Engineering** task.

... ad in the conception of other systems making smart and simple many complex projects.

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100 SIGNIFICANT PROJECTS

• 1968 n. 240 Overpasses on the Bologna-Padova, Napoli-Bari, Rimini-Ancona, Pescara-Vasto motorways. • 1968 Road and railway bridge of the Sangritana Railway near Lanciano. • 1969 Viaduct over the Entella valley in Chiavari on the Genova-Sestri Levante motorway. Total lenght: 601 m. • 1969 Roadway bridge over Rio Colcabamba (Perù). • 1969 Pedestrian and pipeline bridge near Robilante. • 1970 Bridge in Val Clusaz on the Gran S. Bernardo roadway. • 1971 n. 44 Viaducts on the Messina-Catania motorway. • 1971 Rago Viaduct on the Reggio Calabria-Salerno motorway. -Advisory- • 1972 Viaduct over the S. Lorenzo railway in Rome. Total lenght: 2000 m. • 1970 Arch pipeline bridge in Marghera harbour -Advisory- Span: 220 m. • 1970 Road and railway bridge near Cornigliano. • 1970 Bridge over the Natisone torrent. • 1972 n.220 Highway overpasses IRI 70. • 1976 Road and railway cable-stayed bridges over the Rio Paranà-Guazù. (Argentina) Spans: (110+330+110) m. • 1976 Road and railway cable-stayed bridges over the Rio Paranà-Las Palmas. (Argentina) Spans (110+330+110) m. • 1976 Roadway bridge at the Villarosa Dam. • 1971 4 spans Viaduct near Enna. • 1971 Curved overpass in Torino. • 1971 Rebuilding of the road and railway Langer type bridge over the Chiaravagna torrent. • 1972 Bridge in Varlungo near Florence. Total length 360m. • 1973 Cable-stayed canal bridge over Neto torrent near Crotone. • 1977 Cable-stayed bridge over the Rande Strait near Vigo (Spain). Spans: (148 + 400 + 148) m. • 1978 Cable-stayed bridge over the Arno river in Florence: the Indiano Bridge. Central Span: 206 m. • 1978 Approach viaducts of the Indiano bridge. Total lenght: 1000 m. • 1981 Pedestrian cable-stayed bridge over the Mugnone torrent near Florence. • 1982 Vela viaduct in Trento. Total lenght: 525m. • 1982 Road and railway cable-stayed bridge over Rio Paranà between Posadas and Encarnaccion (Paraguay). –Advisory- Spans: (110+330+110) m. • 1982 Cable-stayed bridge over the Rio Magdalena in Betania (Colombia). • 1983 Pipeline bridge over the Sokoto river near Bakolori (Nigeria) Length: 540 m. • 1984 Overpass bridge on the A11 motorway in Prato. • 1984 Overpass bridge on the A11 motorway in Pistoia. • 1985 n.2 viaducts "Slizza 3" on the Udine-Tarvisio motorway. • 1985 n.2 viaducts "Vallone" on the Udine-Tarvisio highway. • 1988 Cable-stayed bridge over Rio Paraiba do Sul (Brasil). -Preliminary design- • 1988 Pipeline bridge over the Aidda canal, near Taranto. • 1989 Widening of the San Lorenzo viaduct in Rome. • 1991 Medoina and Valletta viaducts in Val di Fiemme. • 1993 Roadway bridge over the Sarca river near Ponte Arche. • 1993 n. 2 Viaducts over County Road n°188 on the Chishang-Kao-Hsung motorway (Taiwan). • 1993 Roadway Langer type bridge over the Noce torrent near Commezzadura. • 1993 Yen Chao highway bridge (Taiwan). • 1994 Jupia cable-stayed bridge (Brasil) Advisory. • 1994 The elevated Helideck in Turin over the Lingotto Fiat building.• 1995 Approach Viaducts of the Storebaelt East Bridge in Denmark. (Construction Engineering). Spans: 24x193 m. • 1995 Road and railway arch bridge over Adda river between Paderno and Calusco (Winning Design). Spans: (52+256+52) m. • 1996 Cable-stayed bridge over the Po river -Advisory- Spans: (104+192+104) m. • 1996 Railway viaducts for Milan-Bologna High Speed Line. (Detailed and construction design of the composite decks). • 1997 C392 Kaoshiung Ring Rd 2nd freeway (Taiwan). • 1998 Storebaelt Suspension Bridge in Denmark. (Construction Engineering) Spans: (535+1624+535) m. • 1998 Bridge over S.S. n. 513 Val d'Enza. • 1997 Cable-stayed bridge on Adige river for Highway A31 Valdastico. -Preliminary design-. • 1998 Cable-stayed bridge for a carrier belt at Cimenterie de Hamma Bouziane (Algeria). • 1998 Trecho Santo Amaro cable-stayed bridge over Rio Pinheiros (Brasil). –Advisory- • 1999 Pedestrian arch bridges over Polcevera torrent. • 1999 Pedestrian cable-stayed bridge over Chiese River in Storo, Trento. • 2000 Gaggio and Bosisio Overpass bridges on SS.36. • 2001 Steel truss bridges for the Merano Malles Railway. • 2002 Cable-stayed bridge over the Rio Guamà (Brasil). Spans: (131+320+131) m. • 2003 n° 8 Viaducts in Albiano, Trento. Total lenght: 1735 m. • 2002 Cable-stayed bridge over Kwanza river in Angola. -Design of cables replacement- Central span: 260 m. • 2001 Pedestrian railway overpass in Lecco. Lenght: 180 m. • 2002 Arch bridge over S.Bernardino River in Verbania. • 2002 Cable-stayed bridge on the S.P. 51 near Meduna. • 2002 Cable-stayed bridge over Higuamo River in Santo Domingo. Total Lenght: 600 m Central span: 390 m. • 2002 n°4 Arch bridges in Albiano. • 2003 Cable-stayed bridge over rio Itajaì Mirim in Brusque (Brasil). • 2003 Arch bridge over Brembo river near Bergamo. • 2003 Arch-frame bridge over Rio Fontana near Verbania. • 2004 Cable-stayed bridge over Commercial Harbour in Venice. • 2004 Cable-stayed bridge over Tieté river (Brasil). • 2004 Pedestrian bridge along S.S.36 between Abbadia Lariana and Pradello. Total lenght: 2928 m. • 2004 Cable-stayed bridge over Adige river near Trento. • 2005 Cable-stayed bridges over Rio Sergipe in Aracajù (Brasil) Spans: (82+202+82) m. • 2005 Cable-stayed bridge Forte Redinha in Natal (Brasil). Spans: (94+212+94) m. • 2005 New arch-bridge over Passirio torrent in Merano. • 2005 n° 2 cable-stayed bridges "Jornalista Roberto Marinho" in Sao Paulo (Brasil). -Design Checking- • 2005 Viaduct over Cavone torrent near Matera. • 2005 Cable-stayed bridge in Vitória (Brasil). • 2007 Cable-stayed bridge in Campina Grande (Brasil). • 2007 Arch bridge over railway station in Souk Ahras (Algeria). • 2008 Cable-stayed Bridge over Mincio river in Valeggio. • 2008 Cable-stayed bridge over Poty river in Teresina (Brasil). -Design Checking- • 2008 Cable-stayed viaduct Padre Adelino in San Paolo (Brasil). -Design Checking- • 2008 Bridge over A22 Highway near Lavis. • 2009 Cable-stayed bridge over rio Negro in Manaus (Brasil). -Design Checking- • 2009 Pedestrian Cable-stayed bridge "Ponte del Mare" in Pescara. Spans: (2x172) m. • 2009 Cable-stayed bridge over Oiapoque river in Amapà (Brasil). Spans: (65+245+65) m. • 2011 Cable-stayed bridge over Juruà River in Acre (Brasil). Spans: (110+115) m. • 2012 Cable-stayed bridge in Nizza Monferrato. Spans: (100+100) m. • 2013 Cable-stayed bridge in Avenida Ayrton Senna – Rio de Janeiro (Brasil). Spans: (39+130+39) m. • 2014 Cable-stayed viaduct in Curitiba (Brasil). Spans: (100+129+26) m. • 2017 Cable-stayed bridge over Shatt al-Arab in Bassora (Iraq). Total Length: 1188 m. • 2017 Cable-stayed bridge in Val di Pai. Span: 118 m. • 2017 Pedestrian Suspension Bridge in Val Tartano. Span: 222 m. • 2018 Signature Cable-stayed bridge in New Dehli (India). Total Length: 685 m -Construction Engineering- • 2018 Suspension Bridge in Stadano. Total Length: 295 m. • 2018 Suspension Bridge in Mulazzo. Total Length: 124 m. • 2018 Suspension Bridge in Castagnetoli. Total Length: 68 m. • 2018 Polavaram Multispan Cable-stayed bridge in West Godavari (India). Total Length: 1040 m. • 2018 Storstrom Cable-Stayed Bridge and Viaduct (Denmark) Total Length: 3832 m.