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**mageba supports the following organizations:**

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Samuel De Champlain Bridge (Canada)

Project description
The Samuel De Champlain Bridge is located in Montreal, Canada, and replaced the old Champlain bridge over the St. Lawrence River. This crossing is one of the busiest in Canada with over 60 million vehicles and $20 Billion in international trade passing over it on a yearly basis.

The $4.2 billion project consisted of two main bridges – the New Bridge on the St-Lawrence and the Île-des-Soeurs Bridge – fully opened for the traffic on June 2019.

The bridge, 3.5 km long, is a stayed cable bridge designed for a 125 years long service life. This has been possible by taking into consideration the smartest forethoughts and high quality products and materials for a challenging project of a structure subject- ed to approx. 160,000 vehicles every day – sometimes in harsh weather conditions.

mageba scope
mageba provided Structural Health Monitoring service and modular joints for this iconic bridge.

In the course of the project duration, more than 50 embedded and 150 surface sensors are being installed on the bridge, allowing the Government of Canada to monitor displacement, corrosion, movements, temperature, stresses, strain and environmental conditions of the bridge over the next 30 years. This will most certainly optimize the maintenance supporting the owner to keep the structure at his best performances.

Moreover, the ingenious system provides the ability to react instantly to changes and deterioration.

In parallel, the largest expansion supplied will span over 20 meters and cover upwards of 800 mm in movements (10 gaps).

Highlights & Facts
mageba products:
- Type: ROBO®CONTROL permanent Monitoring System
- TENSA®MODULAR expansion joints types LR8, LR9 & LR10

Features: approx. 200 sensors
Installation: 2016–2018

Structure:
- City: Montreal
- Country: Canada
- Type: Cable-stayed bridge
- Completed: Scheduled for 2018
- Owner: Infrastructure Canada
- Contractor: SNC Lavalin, Dragados, Flaticon Canada, TY Lin, MMM Group Preliminary
- Design: Arup

Corrosion Sensor installed on the pier starter reinforcement
Project description
The New Tappan Zee Bridge, also known as the New NY Bridge and officially named the Governor Mario M. Cuomo Bridge after the late former governor Mario Cuomo, is a twin cable-stayed bridge being built to replace the current original Tappan Zee Bridge over New York’s Hudson River. Upon completion in June 2018, the $4.0 billion structure will contain a total of eight lanes for vehicular traffic as well as a shared-use bicycle and pedestrian path.

Additionally, an allowance has been made for the future construction, between the two structures, of a rail line to assist with trans-Hudson public transportation.

The Tappan Zee Bridge is a critically important transportation link in the New York Metropolitan Area, with over 138,000 vehicles crossing it each day.

mageba scope
mageba USA is supplying all 23 of the TENSA®MODULAR (type LR) expansion joints required for the new Tappan Zee Bridge, in fully continuous lengths, the longest of which is 105 feet (32 meters). The largest joints will be type LR18, each with 18 individual movement gaps which accommodate total longitudinal movements of up to 54 inches (1.4 meters).

mageba USA is also supplying 16 RESTON®STU shock transmission units (STU, also known as lock-up devices), with lock-up capacities of 800 kips (3,550 kN) and pressure release valves rated for 1,600 kips (7,100 kN). Each STU will weigh 13,500 lbs (6,150 kg), and will be individually tested to ensure that the performance meets the required design criteria.

Highlights & Facts
mageba products:
Type: 23 TENSA®MODULAR LR expansion joints
16 RESTON®STU shock transmission units
Installation: 2015–2018
Structure:
City: New York
Country: USA
Type: Cable stay Bridge
Completed: 2018
Length: 3.0 miles (4,800 m)
Builder: Fluor Corporation, American Bridge Company, Granite Construction Northeast & Traylor Bros

The Tappan Zee Bridge is located close to New York City
Installation of a TENSA®MODULAR expansion joint type LR8
Installed shock transmission unit
Bayonne Bridge (USA)

Project description
The Bayonne Bridge connects the City of Bayonne, NJ with Staten Island, NY. After its completion in 1931, the Bayonne Bridge was the longest steel arch bridge in the world, but today it sits in fifth place.

In 2013, prompted by the expansion of the Panama Canal, a $743.3 million project was awarded to raise the bridge deck within the original steel arch in order to accommodate larger post-Panamax class ships.

The significance of this project cannot be overvalued as fully 12% of all US-bound international container ships currently pass under the Bayonne Bridge.

mageba scope
To support the newly raised deck, mageba is supplying 158 RESTON®DISC bearings. All of the approach span bearings are being specially fabricated with the capability to be temporally locked against longitudinal movements during the construction phase, but allowing free movement after construction is completed.

The new bridge deck will also be equipped with 18 TENSA®MODULAR expansion joints, designed with up to 6 gaps to accommodate 17.7 in (450 mm) of movement, and 4 TENSA®FINGER sliding finger joints to accommodate 31.5 in (800 mm) of movement. Additionally, mageba is supplying sliding plate expansion joints for the shared use pedestrian and cycle paths.

Highlights & Facts
mageba products:
Type: TENSA®MODULAR LR expansion joints, TENSA®FINGER GF sliding finger joints, RESTON®DISC bearings
Features: Uplift Bearings
Installation: 2015–2017

Structure:
City: Staten Island, NY
Country: USA
Type: Steel arch
Completed: 1931
Length: 5,780 ft (1,762 m)
Contractor: Skanska Koch-Kiewit JV
Owner: Port Authority of NY and NJ

The bridge is one of three that connect Staten Island, New York to New Jersey
A finished Disc bearing before delivery
Deck movements will be facilitated by modular joints (as shown) and sliding finger joints
Project description

The Ohio River Bridges Project in the Louisville–Southern Indiana region of the United States involves the construction of two bridges across the Ohio River – one in the metropolitan area’s Downtown neighborhood (equipped with mageba bearings), and one eight miles upstream in the area’s growing East End.

With a length of 2,500 feet (762 m), the bridge is just one part of the East End Crossing, which has a total length of 8.5 miles (13.67 km).

The overall project is financed by WVB East End Partners, a consortium involving VINCI Concessions, Walsh Investors and Bilfinger Berger PI International Holdings.

mageba scope

TENSA®MODULAR expansion joints of types LR8 and LR11 (with 8 and 11 gaps respectively) are being supplied by mageba USA, to facilitate deck movements at two bridge axes. At each bridge axis, three separate joints are required – one for each carriageway and one for a footway. The LR11 joints can accommodate longitudinal service movements of up to roughly 33 inches (838 mm), as well as transverse and vertical movements and multi-axial rotations.

The joints were designed and fabricated in accordance with AASHTO LRFD Bridge Construction Specifications, and hot-dip galvanized in accordance with ASTM A123.

Highlights & Facts

mageba products:
Type: TENSA®MODULAR expansion joints of types LR8 and LR11
Movements: Type LR8: 24 inches (610 mm)
           Type LR11: 33 inches (838 mm)
Installation: 2016

Structure:
City: Louisville, KY
Country: USA
Type: Cable-stayed bridge
Completed: 2016 (projected)
Owner: KY DOT
Contractor: Walsh Construction Co.
Engineering: Jacobs Engineering
Ohio River Bridges – Downtown (USA)

Project description
The Ohio River Bridges project involves the construction of two new bridges across the Ohio River between the states of Indiana and Kentucky. The Downtown Crossing will connect the downtown areas of the cities of Louisville in Kentucky and Jeffersonville in Indiana, and the East End Bridge is located eight miles upstream.

The Downtown Crossing project is a cable-stayed bridge with three sets of twin towers. When opened in 2016, it will be tolled to partially refinance its construction.

Mageba scope
Mageba is supplying 20 structural bearings to support the deck of the new bridge. 10 of these are LASTO® BLOCK elastomeric bearings, and 10 are RESTON® DISC disc bearings. A number of the disc bearings will be installed vertically to primarily resist horizontal forces at the pylons.

With a service life of 50 years, the sliding bearings feature ROBO® SLIDE high-grade sliding material instead of the commonly used PTFE, to enhance resistance to wear and abrasion, and therefore maximize overall durability.

Highlights & Facts
Mageba products:
- Type: RESTON® DISC disc bearings
- Type: LASTO® BLOCK elastomeric bearings
- Special: 50-year service life

Structure:
- City: Louisville, KY
- Country: USA
- Construction: Cable-stayed bridge
- Type: Highway bridge
- Contractor: Walsh Construction Co.
- Owner: KY DOT

The Ohio River Bridges Downtown Crossing connects Louisville (KY) and Jeffersonville (IN)

A finished RESTON® DISC bearing with adjustable height and presetting

A finished LASTO® BLOCK elastomeric bearing
Verrazano Narrows Bridge (USA)

Project description
The Verrazano Narrows, a body of water which separates the New York boroughs of Brooklyn and Staten Island to the south of Manhattan, is the gateway to New York City’s harbor. The bridge that spans the Narrows creates a vital connection for road traffic, carrying about 200,000 vehicles per day. The double-decked suspension bridge has a central span of 4,260 feet (1,298 m), and was the longest suspension bridge in the world from the time its upper level opened in 1964 until 1981. Currently, it has the longest bridge span in the Americas.

mageba scope
The bridge’s existing finger joints, each accommodating enormous deck movements of 2,700 mm (approx. 9 ft) are to be replaced with new finger joints. Due to the great length of the individual fingers, they will receive intermediate support at midspan. The challenge of designing and supplying these exceptional joints is increased by the need to tailor them to precisely match existing geometry and conditions. Various single gap joints, also tailored to suit the existing structure, are also being supplied to accommodate much smaller movements at other locations.

Highlights & Facts
mageba products:
Type: Sliding finger joints
Features: Enormous movements
Installed: 2015–2016

Structure:
City: New York, NY
Country: USA
Construction: Suspension bridge
Type: Road bridge
Built: 1959–1969
Length: 4,260 feet (1,298 m)
Contractor: Tutor Perini
Owner: City of New York

The bridge spans the Verrazano Narrows – the gateway to New York City’s harbor
The bridge’s sliding finger joints, designed for enormous movements, must be replaced
3D view of a new sliding finger joint, facilitating longitudinal movements of 2,700 mm (approx. 9 ft)
SR 520 Floating Bridge, Washington (USA)

Project description
The Governor Albert D. Rosellini Bridge-Evergreen Point, commonly called the SR 520 Bridge, is the longest floating bridge on the planet. At 7,580 ft. (2,310 m), it carries State Route 520 across Lake Washington from Seattle to Medina.

The four lane toll bridge was opened in 1963 after four years of construction.

Due to its age and deteriorated condition as well as increased traffic, the Evergreen Point Floating Bridge was replaced by a new floating bridge at the same site. The new bridge was opened in April 2016 and carries six lanes as well as a multi-use path for bicyclists and pedestrians. With its length of 7,708.49 feet (2,349.55 m) it is officially certified for the Guinness World Records.

mageba scope
mageba supplied nine TENSA®MODULAR expansion joints for the new bridge. The largest of these expansion joints has 16 gaps and allows 48.4 in (1,230 mm) of longitudinal movement, or 70.4 in (1,790 mm) of extreme limit state movement.

Smaller modular joints, with 2 and 6 gaps, and single gap joints, were also supplied by mageba.

These TENSA®MODULAR expansion joints will accommodate the significant transverse movements as well as the rotations about all axes that can be expected in a floating bridge.

Highlights & Facts
mageba products:
Type: TENSA®MODULAR joints, Types LR16, LR6, LR2; TENSA®GRIP, Type RS-B5
Features: Large rotations
Installed: 2015–2016

Structure:
City: Seattle, WA
Country: USA
Construction: Floating pontoon bridge
Type: Highway bridge
Built: 2013–2015
Length: 7,710 ft (floating)
Contractor: Kiewit/General/Manson
Owner: WSDOT
Macdonald & MacKay Bridges (Canada)

Project description
The Angus L. Macdonald and A. Murray MacKay bridges are critically important structures for the city of Halifax, capital of the Canadian province of Nova Scotia. They were opened to traffic in 1955 and 1970 respectively, and several decades later, it was determined that both structures were in need of significant reconstruction / maintenance work in order to meet the demands of modern traffic for decades to come.

The Angus L. Macdonald Bridge, in fact, is receiving an entire new deck, and computer modelling of the deck, verified by measured data, is playing a key role in the design process.

The A. Murray MacKay Bridge, on the other hand, is retaining its existing deck, but is being subjected to significant renovation work.

Mageba scope
Early in the project, it was determined that a fully automated ROBO®CONTROL structural health monitoring (SHM) system should be used to measure and record the movements and rotations of the bridge decks. The installed system has provided the data needed by the computer modelling of the new deck of one bridge, and assisted in the planning of remedial works of the existing deck of the other, enabling the bridge’s engineers to optimize their designs and minimize the life-cycle costs of the bridges.

In 2015, it was decided to install new TENSA®MODULAR expansion joints with up to seven gaps each (type LR7) at four axes of the Angus L. Macdonald Bridge, replacing the existing joints. These joints were designed for steel connection, and feature noise-reducing “sinus plates” surfacing.

Highlights & Facts
Mageba products:
Type: ROBO®CONTROL automated SHM system
TENSA®MODULAR expansion joints of type LR3 & LR7 LS
Installed: 2012 (SHM), 2015 (joints)

Structure:
City: Halifax
Country: Canada
Type: Suspension bridges
Angus L. MacDonald Bridge
Built: 1955
Length: 4,265 ft (1,300 m)
Main span 1,447 ft (441 m)
A. Murray MacKay Bridge
Built: 1970
Length: 3,937 ft (1,200 m)
Main span 1,398 ft (426 m)

Temporary plates at the point of future installation of the expansion joints
Presentation of measured data (in graphic form) from the applied SHM system
Port Mann Bridge (Canada)

Project description
The Port Mann Bridge is one of British Columbia’s most significant bridge structures, carrying the Trans-Canada Highway (Canada’s Highway 1) across the Fraser River to the west of Vancouver. As part of the major Port Mann Highway 1 project, which also includes the widening and upgrading of 23 miles (37 km) of highway, the bridge has been replaced with a new structure, and was opened to traffic at the end of 2012.

The new bridge is designed for 10 lanes of traffic, and with its main span of 1,542 ft (470 m), it is the second longest cable-stayed span in North America. At 164 ft (50 m) wide, the new bridge is also the widest span bridge of any type in the world.

Mageba scope
Mageba has delivered the modular expansion joints required for the entire bridge including both approaches. The joints have up to 11 movement gaps and thus can facilitate movements of up to 35 inches (880 mm). In noise-sensitive areas, several joints are equipped with noise-reducing “sinus plates” on the surface. Mageba also supplied, in cooperation with R.J. Watson Inc., disc bearings for the bridge. These are designed for loads of up to 19,000 kN and a number feature “double discs” to achieve this load capacity.

Highlights & Facts

Mageba products:
- Type: Modular expansion joints and disc bearings*
- Features: Expansion joints with movements of up to 35 in (880 mm), some featuring “sinus plates”
- Installation: 2012

Structure:
- City: Vancouver
- Country: Canada
- Built: 2008–2012
- Type: Cable stayed bridge
- Length: 1.37 mi (2,200 m)
- Maintained: Transportation Investment Corporation
- Contractor: Kiewit Flatiron General Partnership
* in cooperation with R.J. Watson Inc.
Project references

Audubon Bridge (USA)

Project description
In 2011, The John James Audubon Bridge opened in southern Louisiana. With a 1,581 ft (482 m) main span supported by two 492 ft (150 m) towers, and an overall length of 12,883 ft (3,927 m), the John J. Audubon Bridge became the longest cable stayed bridge in North America. The structure carries four lanes of traffic 65 ft (20 m) above the Mississippi River and replaces the unreliable ferry service. It is the only Mississippi crossing between Natchez and Baton Rouge, a distance of approximately 93 mi (150 km).

mageba scope
TENSA®FINGER sliding finger joints, type GF and type RSFD, were selected to fulfill the requirements of both the client and the designer. Finger joints were preferred by the client for their low maintenance demands, and the specific type of finger joint was determined by the movement demands of the bridge at each joint location. Cantilever finger joints, type RSFD, were chosen to facilitate the smaller movements of 12 in (305 mm) at one bridge axis, while sliding finger joints, type GF, were chosen for the bridge axes requiring movements of 28 in (710 mm) and 49 in (1,240 mm).

The GF joints feature sliding support for the ends of the finger plates which span across the bridge gap, and a downward pre-tensioning of the finger plates to ensure that they remain in contact with the sliding surface below.

Weighing 24 tons each, the joints, which allow 49 in (1,240 mm) of movement, are the largest sliding finger joints of their type ever manufactured.

Highlights & Facts
mageba products:
Type: TENSA®FINGER joints of type GF (sliding) and type RSFD (cantilever)
Installation: 2010
Structure:
City: New Roads, LA
Country: USA
Built: 2007–2011
Type: Cable stayed bridge
Length: 2.44 mi (3,927 m)
Main span 1,581 ft (482 m)
Contractor: Audubon Bridge Constructors (Flatiron and others)
Owner: LA DOT
Project References – Latin America
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<td>Oil Refinery Seismic Isolation</td>
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Atlantic Bridge (Panama)

Project description
The world’s busiest waterway – the Panama Canal – is currently being widened and deepened to allow for a second lane of traffic for larger containerships: the new “Panamax ships”.

Within the expansion project of this key conduit for international maritime trade, a new bridge is planned on the Atlantic side: the Atlantic Bridge (Spanish: Puente Atlántico).

The new third crossing across the canal will span 579 yards (530 m) and will have a clearance of 82 yards (75 m) to allow the largest container ships in the world to navigate beneath, connecting the Pacific and Atlantic Oceans through this man-made 48 mile (77 km) waterway.

mageba scope
mageba will deliver 16 RESTON®SPHERICAL bearings featuring uplift claws and designed according to AASHTO. Moreover, the contract comprises four LASTO®BLOCK lateral tower bearings at the tower level.

All bearings face very large displacements up to +/-40 inches (+/-1025 mm) as the bridge is seismically isolated. Therefore, all bearings use mageba’s patented ROBO®SLIDE sliding surface tested for more than 31 miles (50 km) of displacement without abrasion.

ULS uplift loads will be resisted with mageba’s uplift claw design and for two piers that feature an innovative external uplift device solution designed for up to 3,500 kN (ULS).

Mageba products:
Type: RESTON®SPHERICAL Uplift devices
LASTO®BLOCK elastomeric bearings
Features: ROBO®SLIDE high-grade sliding material According to AASHTO
Installation: 2016–2017

Structure:
City: Colon
Country: Panama
Type: Cable-stayed concrete bridge
Completed: 2018
Owner: Autoridad Del Canal de Panamá (ACP)
Contractor: VINCI Construction

Highlights & Facts

 mageba products:
Type: RESTON®SPHERICAL Uplift devices
LASTO®BLOCK elastomeric bearings
Features: ROBO®SLIDE high-grade sliding material According to AASHTO
Installation: 2016–2017

Structure:
City: Colon
Country: Panama
Type: Cable-stayed concrete bridge
Completed: 2018
Owner: Autoridad Del Canal de Panamá (ACP)
Contractor: VINCI Construction

The Atlantic Bridge is located just 1.8 miles (3 km) from the Gatun Locks in Colon, Panama

Lateral bearing with ROBO®SLIDE and adjustable shim plates to be installed between the tower and the deck

Spherical bearing being tested according to AASHTO
Glass Melting Plant (Costa Rica)

Project description
The glass melting plant is located in Cartago, Costa Rica, and is one of the most significant glass melting furnaces in Central America. Costa Rica is located in one of the most active areas in terms of earthquakes since it is surrounded by the boundaries of four tectonic plates.

In order to protect the melting furnace against earthquakes, its structure has been redesigned to consider the installation of seismic isolators at the base of the furnace. These devices will prevent seismic damage and hence avoid service interruption.

mageba scope
The solution chosen by the structural designer is based on the installation of 28 mageba LASTO®LRB (lead rubber bearing isolators) which support the furnace in order to isolate movements generated by earthquakes.

This project considers seismic isolators of 400 mm of diameter, with maximum displacement of 60 mm and vertical load capacity of up to 1,100 kN.

This bearing consists of internal layers of elastomeric material and vulcanized reinforcement steel plates, but features a lead core. The lead core deforms plastically under shear deformations while dissipating energy through heat.

Highlights & facts
mageba products:
Type: LASTO®LRB seismic isolators
Features: 28 units
Installation: 2016

Structure:
City: Cartago
Country: Costa Rica
Completed: 2016

Owner: Vidriera Centroamericana S.A. (Vicesa)
Contractor: Hulera Costarricense Ltda
Sky Building, Guayaquil (Ecuador)

Project description
The Sky Building in Guayaquil Ecuador will be part of a commercial complex called Aerocity located near the Guayaquil International Airport. This 15-floor building consists of 4 parking levels and 11 office floors. Sky Building has been designed with the latest advances in terms of seismic protection by the leading structural engineering company in Ecuador. The structure has been conceived to withstand severe earthquake without suffering damages that could jeopardize the serviceability of the building at any time.

Mageba scope
The seismic protection strategy chosen for this building is based on the seismic isolation principle. 64 Mageba LASTO®LRB (Lead Rubber Bearings) will be installed on top of the parking levels in order to isolate the severe movement at the ground level, this will provide a comfortable movement on the structure, and most importantly the protection against any seismic damage during the earthquake.

There were considered three different types of seismic isolator for different loading conditions. Additionally, 44 sliders will also contribute with the isolation system.

Highlights & facts
Mageba products:
Type: LASTO®LRB Lead Rubber Bearings (Isolators)
RESTON®SPHERICAL structural bearings (seismic sliders)

Structure:
City: Guayaquil
Country: Ecuador
Completed: 2014
Engineer: Consulsismica
Contractor: Construdipro S.A.

The building is located in Guayaquil, Ecuador
3D-View of one of the LASTO®LRB (seismic isolators) to be installed in the Sky Building
Full-Scale Sample LASTO®LRB prepared to be tested under actual seismic conditions in Italy
Project descriptions

**Petrobras FPSO units (Brazil)**

A Floating Production Storage and Offloading (FPSO) unit is a floating vessel used by the offshore oil and gas industry for the processing of hydrocarbons and storage of oil. An FPSO vessel is designed to receive hydrocarbons from nearby platforms or subsea templates, process them, and store oil until it can be offloaded onto a tanker or, less frequently, transported through a pipeline. Petrobras, Brazil’s semi-public Brazilian multinational energy corporation, is the largest company in the Southern Hemisphere by market capitalization and a major user of FPSOs around the world.

**mageba scope**

Two Petrobras FPSO units, designated P66 and P69, are currently being fitted with new topside modules which require structural bearings to support and fix them in place while accommodating specified movements and rotations. A large number of mageba bearings are being used for this, including 384 LASTO®BLOCK elastomeric bearings, many with ROBO®SLIDE sliding material, and 128 RESTON®POT HP bearings, some of them designed to resist uplift as well as downward forces. RESTON®POT HP bearings are the new “High Performance” version of the well-proven RESTON®POT bearing.

**Highlights & facts**

**mageba products:**
- Type: RESTON®POT HP and LASTO®BLOCK bearings
- Features: ROBO®SLIDE high-grade sliding material, Special internal seals

**Structure:**
- Country: Brazil offshore industry
- Completed: 2015
- Type: FPSO units
- Client: Lindel PTE Ltd
- Owner: Petrobras

The Chilina Bridge in the Peruvian city of Arequipa, opening 2014, is a segmental continuous pre-stressed concrete viaduct. With an overall length of 562 m, it is the longest urban bridge in the country, with spans of up to 157 m. Its two 11.3 m-wide decks are box girders with variable depths. These were constructed by the balanced cantilever method with 5.1 m-long insitu segments built using form travellers. It is in a highly seismic area, requiring large seismic movements to be allowed for in the design.

**mageba scope**

The bridge is equipped with 4 TENSA®MODULAR expansion joints - two at each end, one per structure. These are of type LR7 (with 7 individual movement gaps), allowing service movements of up to 560 mm (80 mm per gap). The joints feature Fuse-Box seismic protection, designed to ensure that the expansion joint will break free of the deck in a controlled manner during an earthquake, avoiding serious damage to the deck or the joint itself. This will enable the bridge to be used in the immediate aftermath of an earthquake, when it might be needed most for emergency purposes.

**Highlights & facts**

**mageba products:**
- Type: TENSA®MODULAR expansion joints (LR7)
- Features: Fuse-Box (seismic)
- Installation: 2014

**Structure:**
- City: Arequipa
- Country: Peru
- Completed: 2014
- Type: Concrete viaduct
- Length: 562 m
- Contractor: Consorcio Constructor Puente Chilina
Chilina Bridge (Peru)

Project description
The Chilina Bridge in the Peruvian city of Arequipa, opening 2014, is a segmental continuous pre-stressed concrete viaduct. With an overall length of 562 m, it is the longest urban bridge in the country, with spans of up to 157 m. Its two 11.3 m-wide decks are box girders with variable depths. These were constructed by the balanced cantilever method with 5.1 m-long insitu segments built using form travellers. It is in a highly seismic area, requiring large seismic movements to be allowed for in the design.

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Highlights & facts
mageba products:
Type: TENSA®MODULAR expansion joints (LR7)
Features: Fuse-Box (seismic)
Installation: 2014
Structure:
City: Arequipa
Country: Peru
Completed: 2014
Type: Concrete viaduct
Length: 562 m
Contractor: Consorcio Constructor Puente Chilina

Arequipa is Peru’s second most populous city, with a population 10% that of the capital, Lima

Sectional view of a TENSA®MODULAR expansion joint with 5 gaps (Type LR5)

The joints feature Fuse-Boxes, enabling them to break free from the deck during an earthquake
**Project description**

The highway connecting the cities of Morelia and Lázaro Cárdenas in Michoacán state in southern Mexico was subjected to significant maintenance works in 2013 – 2014, with many bridge structures along its length being renovated. A number of the bridges required new expansion joints at each end of their decks, to provide a suitable driving surface for traffic while protecting the deck ends and preventing the passage of water through the deck’s movement gap.

**mageba scope**

Mageba supplied 70 expansion joints for a large number of bridge structures on the highway: 36 Tensa®Grip Type RS-B single gap joints (accommodating 110 mm of movement) and 34 Tensa®RSFD cantilever finger joints (allowing 160 mm of movement). The cantilever finger joints, in addition to facilitating greater movements, also minimize noise from traffic crossing the movement gap by providing continuous support to a vehicle’s wheels and thus avoiding the impacts that can result in noise.

**Highlights & facts**

**mageba products:**

- Type: Tensa®Grip Type RS-B single gap joints and Tensa®RSFD cantilever finger joints

**Structure:**

- State: Michoacán
- Country: Mexico
- Type: Various highway bridges
- Client: Grupo Concesa S.A. de C.V.
Project description
Panama City’s Tocumen International Airport is currently being extended with the addition of a new terminal. Designed by Foster & Partners, it will increase floor space by over 800,000 square feet, with 20 new boarding gates, a duty free area, a new control tower and a third runway.
Access to the new terminal from the Corredor Sur highway that bypasses the airport is provided by a four-lane road, part of which is elevated. The non-continuous elevated structure of each carriageway is supported by ten piers, requiring a bearing solution.

mageba scope
To support the structures’ decks, mageba supplied 80 RESTON®POT HP bearings with uplift resistance. These bearings are based on the standard RESTON®POT bearing which has been a most popular bearing in mageba’s range for many years, having proven its worth in countless applications. The recently developed version of the bearing, with “HP” standing for “High Performance”, represents a major advance in the bearing’s technology. Durability is much increased, thanks to the use of improved materials, and the increased strength enabled the bearings to be made small enough to suit the main structure’s design.

Highlights & facts
mageba products:
Type: RESTON®POT HP (high performance) bearings
Features: Uplift resistance
Installation: 2014
Structure:
City: Panama City
Country: Panama
Completed: 2014
Type: Airport access viaduct
Contractor: Construtora Norberto Odebrecht

The new viaduct provides access to Tocumen International Airport, Panama City, Panama
Exploed view of a typical RESTON®POT bearing, showing elastomeric pad at its core
A typical RESTON®POT bearing featuring uplift resisting clamps at sides, as fabricated
Lerma Building – Telmex (Mexico)

Project description
Telmex, the largest telephone company in Mexico, owns several buildings in Mexico City. One of these buildings is currently obsolete due to the new seismic specifications in the city. The Lerma Building is a 17-floor structure including 4 parking levels, 12 office floors and 1 penthouse. The building’s dimensions is 25 m x 15.3 m with an area per floor plan of 393 m². The high risk of damaged in a highly likely earthquake, motivated the development of a retrofitting plan. After a detailed evaluation of the options, it was decided to add dampers in different levels in order to improve the dynamic response.

mageba scope
To improve the seismic response of the building, the engineers in charge of the seismic retrofitting studied multiple configurations of dampers, evaluating variations of loads, displacements and number of devices. After a detailed analysis of several configurations, it was decided to install 76 mageba RESTON®SA Shock Absorbers in strategic location along the building. Two types of SA were chosen, one for 800 kN of maximum load (50 units), and another one for 600 kN (26 units). The displacement capacity of both types is 50 mm.

Highlights & facts
mageba products:
Type: RESTON®SA Shock Absorber (800 and 600 kN)
Installation: 2014
Structure:
City: Mexico City
Country: Mexico
Completed: 2014
Type: Office Building
Contractor: CTBR SA de CV (Telmex)
Oil refinery seismic isolation (Venezuela)

**Project description**

In the process of making an oil refinery in a seismically active part of Venezuela safe from the destructive effects of earthquakes, heat exchange tanks were seismically isolated from ground movements in 2012. The ongoing operation of such refineries is of great importance to the Venezuelan economy, with revenue from petroleum exports accounting for over 50% of the country’s GDP and roughly 95% of total exports. Venezuela has the world’s largest proven oil reserves (20% of global reserves), and is one of the top four suppliers of foreign oil to the United States.

**magesa scope**

mageba supplied six LASTO®LRB lead rubber bearings with a diameter of 220 mm and height of 165 mm including 20 mm steel connection plates. Each bearing is designed for a vertical service load of 780 kN and to allow seismic displacements of up to 100 mm. The lead core at the bearing’s vertical axis has a diameter of 44 mm and provides dissipation of seismic energy, while the natural rubber (NR) elastomer around it provides the desired re-centering after the earthquake. To ensure proper installation and functioning, mageba also supervised the installation.

**Highlights & facts**

**mageba products:**
- Type: LASTO®LRB isolators
- Installation: 2012
- Supervision: Installation supervised by mageba

**Structure:**
- Location: Falcón State
- Country: Venezuela
- Type: Oil refinery
- Client: PDVSA

The refinery is located in Falcón State, one of Venezuela’s 23 states, in northern Venezuela. A LASTO®LRB lead rubber bearing of the type supplied – with 220 mm diameter. The LASTO®LRBs protect heat exchange tanks from ground vibrations during earthquakes.
East-West Corridor (Trinidad and Tobago)

Project description
The Ministry of Works and Infrastructure (MOWI) of Trinidad and Tobago undertook a project to alleviate traffic congestion at one of the country's most important highway intersections between the Churchill Roosevelt Highway (CRH) and the Uriah Butler Highway (UBH).

The project included an 18 m high, 600 m long bridge over the CRH/UBH intersection, connecting the San Juan River Bridge to Grand Bazaar.

By providing a separate route across the junction, the new bridge reduces the amount of traffic using the junction, and thus the congestion at this key point on the two major highways.

mageba scope
Six expansion joints were required for a total of three new bridges constructed. Considering especially the relatively high transverse movements to be accommodated, mageba modular expansion joints were selected, due to their exceptional flexibility.

The two joints of the main bridge are of type LR4 (with four gaps), accommodating longitudinal movements of +/-160 mm and transverse movements of +/- 83 mm, while the four joints required by the other two structures facilitate longitudinal and transverse movements of +/-100 mm and +/-68 mm respectively.

Highlights & Facts
mageba products:
Type: TENSA® MODULAR LR expansion joints
Installation: 2009 + 2012

Structure:
City: Aranguez
Country: Trinidad and Tobago
Type: Highway

Infrastructure project at one of the country's most important highway intersections
Construction of one of the new bridges
Installation of a mageba TENSA-MODULAR LR2 expansion joint