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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 TENSAMODULAR (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 TENSAMODULAR 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 TENSAMODULAR expansion joint type LR8
Installed shock transmission unit
SR 520 West Approach Bridge (Washington)

Project description
The Governor Albert D. Rosellini Bridge-Evergreen Point (commonly called the SR 520 Bridge) carries State Route 520 across Lake Washington from Seattle to Medina. The SR 520 Bridge Replacement development has reached its latest construction phase with the West Approach Bridge North Project. Expected to be completed in the summer of 2017, the new West Approach Bridge North will carry westbound cars, buses and trucks from the new floating bridge to the Montlake area.

mageba scope
The pre-stress girder structure will feature wider lane, shoulders and have a 14-foot-wide bicycle/pedestrian shared path on the north side of the bridge. mageba USA is suppling seven TENSA®MODULAR (type LR) expansion joints for the new West Approach Bridge North. The joints range from 6 to 8 gaps that allows up to 25 in (640 mm) longitudinal service movement. The joints are equipped with noise-reducing “sinus plates”, which provide a smooth driving surface for vehicles, minimizing vibration and noise by up to 80 %. Another feature is the ROBO®MUTE blanket panels, a system of mat layered membrane that reduces noise transmitted from beneath the joint.

Highlights & Facts
mageba products:
- Type: TENSA®MODULAR expansion joints (types LR6, LR7, LR8)
- Features: Noise-reducing “sinus plates” on surface, ROBO®MUTE Sliding Panels
- Installation: January – June 2017

Structure:
- City: Seattle, WA
- Country: USA
- Type: Highway bridge
- Built: 2014–2017
Transbay Transit Center (California)

**Project description**

The new Transbay Transit Center will replace the former Transbay Terminal that was built in 1939 in downtown San Francisco. This modern transit hub will serve 11 transportation systems. It contains more than one million square feet. The highlights are a 5.4-acre (22,000 square meters) rooftop public park, Grade Hall, dramatic Light Column, and stay cable pedestrian bridge. The construction is expected to be complete in late 2017.

**mageba scope**

mageba USA is working on different sections of this landmark project. On one side, mageba is supplying eight RESTON®PENDULUM Mono Types A and B with vertical capacities of 2,500 kips (11,120 kN) and 2,000 kips (8,900 kN), respectively for the terminal superstructure; eight RESTON®SPHERICAL Type Free sliding able to withstand blast forces of 171 kips and with 41.5” of max. sliding capacity for the glass roof structure.

On the other side, mageba is also supplying two TENSA®MODULAR expansion joints designed with 8 and 11 gaps to accommodate 24 in and 33 in of movement respectively at the bus storage facility ramp.

**Highlights & Facts**

**mageba products:**

- **Type:** RESTON®PENDULUM Mono bearings
  - RESTON®SPHERICAL bearings
  - TENSA®MODULAR expansion joints of type LR8 and LR11

- **Features:** Table hysteretic behavior

- **Installation:** 2016–2018

**Structure:**

- **City:** San Francisco, CA
- **Country:** USA
- **Type:** Transit Center
- **Owner:** TJPA
- **Builder:** Shimmick, Greenlite, MCM
Bayonne Bridge (New York)

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 TENSAMODULAR expansion joints, designed with up to 6 gaps to accommodate 17.7 in (450 mm) of movement, and 4 TENSEFINGER 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: TENSAMODULAR LR expansion joints, TENSEFINGER 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
Ohio River Bridges – Downtown (Kentucky)

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
LASTO®BLOCK elastomeric bearings
Special: 50-year service life

Structure:
City: Louisville, KY
Country: USA
Construction: Cable-stayed bridge
Type: Highway bridge
Built: 2013–2016
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 (New York)

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 mid-span. 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)

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
Project description

Interstate traffic across the St. Croix River, between the states of Minneapolis and Wisconsin, has been served for over 80 years by the Stillwater Lift Bridge – a structure which is now in a poor state of repair, functionally obsolete and over capacity. The new St. Croix Crossing, when opened in 2016, will enable the old bridge to be closed to vehicular traffic. The new structure will be an extradosed bridge – a combination of a box girder and cable-stayed structure. The resulting low profile will minimize visual and environmental impacts.

mageba scope

mageba is supplying 68 RESTON®DISC bearings to support the deck of the new bridge. The key component of a disc bearing is the disc at its centre, which carries the load of the structure above and allows rotations about any horizontal axis. The disc is moulded from high-strength Polyether Urethane (PU), an aromatic thermoplastic with excellent mechanical properties. The allowable compressive stress on the disc is as high as 35 MPa, and it does not require confinement, as does, for example, the elastomeric pad at the heart of a pot bearing. The disc is also highly resistant to environmental impacts, and remains effective at a very wide range of temperatures, from –94 °F to 249 °F (–70 °C to +121 °C).

The bearings supplied by mageba include all three types (fixed, free sliding, and guided bearings) with vertical load capacity of up to 6,584 kips (29,300 kN), and horizontal load capacity of up to 1,310 kips (5,830 kN).

Highlights & Facts

mageba products:
Type: RESTON®DISC bearings
Installation: 2015

Structure:
City: Oak Park Heights (MN)
Country: USA
Construction: Extradosed bridge
Type: Highway bridge
Built: 2013–2016
Builder: Lunda/Ames JV

The bridge will connect Oak Park Heights (MN) and St. Joseph (WI) across the Ohio River

3D render of a mageba Disc bearing

A finished Guided Disc bearing ready for delivery
Project description
The Goldsboro Bypass is a 20-mile bypass of the city of Goldsboro, North Carolina. Also known as Highway 44 (NC 44), it will connect to US Highway 70 (US 70), one of the major east-west corridors traversing eastern North Carolina. Construction started in 2008, and the first phase opened in December 2011. The bypass includes a number of structures to cross roads, rivers and streams.

mageba scope
A total of 32 expansion joints are being supplied by mageba to accommodate the movement demands of six highway bridges. With longitudinal movements limited to just 2.8 inches (70 mm), single gap joints were preferred in order to maximize durability and minimize maintenance and renewal requirements. The TENSA®FORCE RG10 type joints were selected to meet the specific needs of the North Carolina DOT. These joints are commonly being used in the area to replace existing compression seal joints which have shown major deterioration over the years.

Highlights & Facts
mageba products:
Type: TENSA®FORCE expansion joints, 2.8” movements
Installation: 2014

Structure:
City: Goldsboro, NC
Country: USA
Completed: 2014 (Proj.)
Type: Simple Span
Length: 1,385 ft (422 m) (longest bridge)
Contractor: S. T. Wooten
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. Canti-lever 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

The bridge spans the Mississippi River in Louisiana, upriver from New Orleans
Project References – Canada
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**mageba supports the following organizations:**

- International Joints & Bearings Research Council
- International Association for Bridge Maintenance and Safety
- Canadian Welding Bureau
- International Association for Bridge and Structural Engineers
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, Flathiron Canada, TY Lin, MMM Group Preliminary Design: Arup

Corrosion Sensor installed on the pier starter reinforcement
Nipigon River Bridge (Ontario)

Project description
Upon completion in 2017, the $106-million Nipigon River Bridge will be the first cable-stayed bridge of its kind on the Ontario highway system. The 252 meters (827 feet) bridge will consist of three towers with cables supporting the bridge deck and a separate sidewalk for pedestrians. Nipigon River is renowned for its brook trout and the bridge is located directly in a spawning area, presenting environmental challenges.

mageba scope
Mageba will deliver all expansion joints for this bridge. This includes a 37 meter long TENSA®FINGER GF sliding finger joint accommodating both vertical (20 mm) and longitudinal (160 mm) displacements.
Mageba will also provide a TENSA®FINGER RSFD cantilever finger joint which will allow a 160 mm longitudinal displacements.

Highlights & Facts
Mageba products:
Type: TENSA®FINGER joints of Type GF (sliding) and Type RSFD (cantilever)
Features: Vertical movements allowed
Installation: 2017

Structure:
City: Town of Nipigon, Ontario
Country: Canada
Completed: 2017
Type: Cable stayed bridge
Length: 252 meters (827 feet)
Builder: Bot Ferrovial Nipigon Joint
4 The Kingsway Condo (Canada)

Project description
4 The Kingsway Condominium is a new luxurious apartment complex located at 2800 Bloor Street West, Toronto. The 34 unit condo will stand 8 storeys high, and are surrounded by historic homes, parkland and shopping facilities.

As the northern part of the building sits adjacent to the underground TTC rail line, vibration isolation was a main criteria and issue for the structure. Hence, mageba supplied a complete solution for the building’s isolation to support the foundation walls, slab walls and columns.

mageba scope
mageba supplied 421 vibration isolation elastomeric bearings of type VIBRAX®BLOCK B & B/C with a design load ranging between 90 kN to 900 kN.

The VIBRAX®BLOCK B bearings are designed to absorb vibrations from the surrounding environment, and hence provide an upscale comfort to all residents.

The material used for this isolation bearings is natural rubber with hardness of 50 Shore A +/- 5. It demonstrates very high tensile strength, elasticity and cold flexibility.

Highlights & Facts
mageba Products:
Type: VIBRAX®BLOCK B & B/C
Feature: Vibration isolation
Installation: 2017

Structure:
City: Toronto
Country: Canada
Type: Building
Built: 2017–2018
Owner: North Drive
Contractor: Accel
Architect: Richard Wengle

The condo is located in Etobicoke district, western part of Toronto

Installed VIBRAX®BLOCK B elastomeric bearings

 mageba scope
mageba Supplied 421 vibration isolation elastomeric bearings of type VIBRAX®BLOCK B & B/C with a design load ranging between 90 kN to 900 kN.

The VIBRAX®BLOCK B bearings are designed to absorb vibrations from the surrounding environment, and hence provide an upscale comfort to all residents.

The material used for this isolation bearings is natural rubber with hardness of 50 Shore A +/- 5. It demonstrates very high tensile strength, elasticity and cold flexibility.

mageba Products:
Type: VIBRAX®BLOCK B & B/C
Feature: Vibration isolation
Installation: 2017

Structure:
City: Toronto
Country: Canada
Type: Building
Built: 2017–2018
Owner: North Drive
Contractor: Accel
Architect: Richard Wengle
St. Lawrence Seaway Bridge (Canada)

Project description
Linking Lake Ontario to Lake Erie, The Welland Canal cuts 42 km across Canada’s Niagara Peninsula from Port Colborne to Port Weller. A series of eight locks lift and lower vessels 100 meters and enables maritime commerce to bypass Niagara Falls. Located adjacent to Lock 2, the St. Lawrence Seaway Bridge is also named as route 83 or Carlton Street. The length of the structure is 80 meter and it is supported by a total of five spans.

mageba scope
The flexible plug expansion joint system, POLYFLEX®ADVANCED PU, is a complete new development based on elastic polymers and a further development of the traditional asphaltic plug joint, whereby disadvantages of the traditional bituminous plug joint (e. g. debonding, plastic deformation, rutting, overload due to standing traffic, etc.) can be eliminated and increasing the durability greatly.

Highlights & Facts
mageba products:
Type: POLYFLEX®ADVANCED PA30
Features: +20/–10 mm movement  Support ribs
Installation: 2017

Structure:
City: St. Catharines
Country: Canada
Type: CIP Concrete
Length: 80 m
Built: 2017
Owner: St. Lawrence Seaway
Contractor: Rankin Construction

The Welland Canal links Lake Ontario to Lake Erie near the Niagara Falls

Typical joint section detail, a total of four joints will be replaced in this project

Installation of the POLYFLEX®ADVANCED PA30 expansion joint and support ribs
Highway A20/A73 Interchange (Quebec)

Project description
A new highway viaduct was constructed in 2013, serving the city of Levis in Quebec, Canada. The viaduct, at an interchange between Highways 20 and 73, was constructed adjacent to an existing structure in order to increase highway capacity.

The viaduct has steel girder deck and six spans which range between 131 ft (40 m) and 197 ft (60 m), and has a total length of 984 ft (300 m). With a horizontal radius of 886 ft (270 m), the structure exhibits a prominent curve which increases the risk of serious damage during an earthquake and thus increases the need for its deck to be seismically isolated from its supports.

A planning phase lasting several years was needed to identify the best solution for integrating the new bridge into the protected and sensitive local environment with minimal impact. The new 5.7 mi (9.3 km) bypass shortened the old route by 7.9 mi (12.8 km).

mageba scope
While the end spans of the deck are supported by conventional pot bearings, the central spans, which are more prone to damage from movements, are supported by mageba LASTO®LRB Lead Rubber Bearings (LRB). These LRBs will protect the structure during an earthquake by isolating it from destructive ground movements.

Each interior pier carries six LRBs, one supporting each of the deck’s main girders. Each LRB has a vertical load capacity of approximately 3,200 kN. Due to the structure’s location, the LRBs were designed for extreme temperatures from 104 °F (40 °C) to −22 °F (−30 °C).

Highlights & Facts
mageba products:
Type: LRB seismic isolators
Features: For temperatures as low as −30 °C (−22 °F)
Installed: 2013

Structure:
City: Levis, Quebec
Country: Canada
Built: 2013
Type: Steel girder deck
Length: 317 m

Lead rubber bearing installed in the bridge – guided type, allowing longitudinal movements

Lead rubber bearing installed in the bridge – multi-directional type, allowing all movements
Infrastructure products

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

Location of the bridges in Halifax, Nova Scotia, Canada

Presentation of measured data (in graphic form) from the applied SHM system
Highway Interchange A40/A73 (Quebec)

Project description

Just north of Quebec City this project was a strategic redevelopment of highways Félix-Leclerc (40) and Laurentienne (73) interchange.

The interchange is located in the St-Lawrence Lowland part of a rift valley making it one of the rare regions prone to seismic events in the eastern part of Canada. In addition to seismic activity, the climate in Quebec City is known to vary over 40 °C from −17 °C during the winter and over 25 °C during the summer.

Based on these unique conditions, the Ministry of Transport of Quebec opted to seismically isolate this highway overpass increasing safety.

mageba scope

mageba supplied 18 Lead Rubber Bearings (LRB) seismic isolators. However, prior to production two full size prototypes had to go through a very stringent testing protocol, based on CAN/CSA S6-06, S6-14 and AASH-TO LRFD.

The protocol included cooling of the two LRB prototypes at −30 °C for 72 hours prior to testing followed by additional testing after another 72 hours of cooling at −8 °C. Making this an unprecedented accomplishment.

Each guided LRB have a vertical load capacity of approximately 3,200 kN.

Highlights & Facts

mageba products:

<table>
<thead>
<tr>
<th>Type:</th>
<th>LASTO®LRB lead rubber bearings of type S-550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation:</td>
<td>2015</td>
</tr>
</tbody>
</table>

Structure:

| City:      | Quebec                        |
| Country:   | Canada                        |
| Type:      | Highway Interchange           |
| Completed: | 2016                          |
| Length:    | 80 m                          |
| Builder:   | EBC                           |
| Owner:     | Ministère des Transports du Québec (MTQ) |

The structure is located in Levis, Quebec, Canada

The bearing after 72 hours of cooling at −30 °C

Prototype testing
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.
Deh Cho Bridge (Northwest Territories)

Project description

The Deh Cho Bridge, located in Canada’s Northwest Territories, was completed in the fall of 2012. The $202 million cable stayed bridge spans the Mackenzie River near Fort Providence, replacing an existing ferry service in the summer, and an ice crossing route in the winter. The Deh Cho Bridge is the only permanent crossing of the Mackenzie River. The structure ensures that the region to the north will not be cut off from southern Canada for an annual 8 week period, when forming or melting ice, not strong enough to carry the ice road, prevents the passage of the ferry. The new 0.68 mi (1.1 km) long bridge has nine spans of lengths ranging between 294 ft (90 m) and 624 ft (190 m).

mageba scope

mageba was awarded the contract to design and manufacture the modular expansion joints required at each end of the Deh Cho Bridge. mageba provided an 11 gap TENSA®MODULAR expansion joint at one abutment, and an 8 gap modular expansion joint at the other. These modular expansion joints, reliable in the most extreme conditions of northern Canada, are able to facilitate movements of up to 35 in (889 mm). In addition, they are also exceptionally flexible, allowing movements in every direction as well as limited rotations about every axis.

Highlights & Facts

mageba products:
Type: TENSA®MODULAR LR expansion joints of types LR8 and LR11
Installation: 2010–2012

Structure:
Location: Northwest Territories, Canada
Completed: 2012
Type: Cable stayed bridge
Length: 3,642 ft (1,100 m)
Contractor: Ruskin

Location of the Deh Cho Bridge in northern Canada
A modular expansion joint of the type required by the new bridge
View of a modular expansion joint from beneath, showing its control mechanisms
Project description
The Golden Ears Bridge, near Vancouver, British Columbia, creates an important new transportation link across the Fraser River. The bridge, with three main spans each 242 m (795 ft) long, features an unusual hybrid cable-stayed system designed to ensure a specified performance in the case of defined earthquake events. The bearings and expansion joints for the bridge are also subjected to such demands, making their design and fabrication an interesting challenge.

mageba scope
Main Span Bearings:
mageba supplied four custom-designed uplift bearings, precompressed for frequent load reversal. Each bearing weighs a massive 17 tons and can accommodate a wide range of loads from 4,170 kN to −2,790 kN (uplift), longitudinal movements of 3,100 mm (122 in), transverse movements of 50 mm (2 in) and rotations of 0.039 radians about the x-axis and 0.010 radians about the y-axis.

Expansion Joints:
In addition to the bearings, 12 TENSA®MODULAR LR expansion joints were supplied by mageba. The largest, type LR17 with 17 individual gaps, will allow longitudinal movements of 1,350 mm (53 in). The joints are also equipped with ‘Fuse-Box’ earthquake protection devices which prevent serious damage to the joint, and the connecting bridge structure, in the event of an earthquake. The ‘Fuse-Box’ also enables the modular expansion joint to continue to allow passage of emergency vehicles after a seismic event.

Highlights & Facts
mageba products:
Type: 12 TENSA®MODULAR expansion joints, with up to 17 gaps, and 4 special uplift bearings
Features: Uplift bearings
Installation: 2009

Structure:
City: Vancouver
Country: Canada
Type: Hybrid cable stay design
Completed: 2009
Length: 2,410 m 1.45 mi with 3 main spans each 242 m (794 ft) long
Contractor: GCCJV (Bilfinger Berger and others)
Owner: TransLink