R-MAX SPHERICAL BEARINGS

AGOM INTERNATIONAL S.R.L.
Via Mesero, 12 – 20010 Ossona (MI) – Italy - www.agom.it
PH.: +39 02 9029111 – FAX: +39 02 9010201 – agom@agom.it

R-Max bearings

Agom R-Max bearings are designed to carry combinations of vertical loads, horizontal loads, longitudinal and transversal movements and rotations and they are used in steel and concrete road and railway bridges.

The bearing is composed by steel elements coupled with PTFE surfaces to allow movement and rotations. One side of the internal median plate is machined as a spherical surface to allow tilting movement (rotation) whilst on the other side a flat sliding surface is obtained to allow displacements.
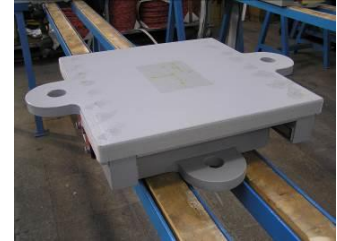
Depending on whether the bearing is fixed, guided sliding or a free sliding, Agom R-Max bearings accommodate vertical loads and corresponding horizontal forces, as well as movements in longitudinal or transversal directions

Load Combinations

Agom R-Max bearings can carry very high loads, over 100.000 kN

The bearings are designed for combined maximum vertical and horizontal loads. The standard range of Agom bearing is designed to have an horizontal load ≤ 15% of the maximum vertical load with a maximum rotation of ± 0.02 rad (other load and rotation combinations are provided on request).In order to define the correct bearing, our engineers take into account the designed load effects, rotations, displacements and type of fixings.

Fixed R-Max AGSF

Due to the combination of vertical and horizontal loads, the R-Max bearings can be designed in two different arrangements: the two steel plates configuration and the three steel plates configuration.

The "two steel plates configuration" R-Max bearings are given by the combination of a convex and concave steel plates machined as a spherical surface to realize the hinge for rotation around every axis; the rotational surface is obtained coupling a virgin PTFE curved sheet and a spherical low roughness sliding surface (according to EN1337-2 code) to minimize friction and maximizing PTFE service life. In this "two plates R-Max spherical bearing configuration", the horizontal load is transmitted through the spherical surface to the base plate, according to design codes (as EN1337-7).

The "three plates configuration bearings" are made up by adding an external steel plate to the "two plates configuration bearings"; in this arrangement the horizontal load is transmitted by the direct contact between the bearing upper steel and the base plate whilst the spherical and PTFE surfaces carry only the vertical loads allowing rotations. The "three plates configuration" allows to transmit higher horizontal loads respect to the two plates bearings.
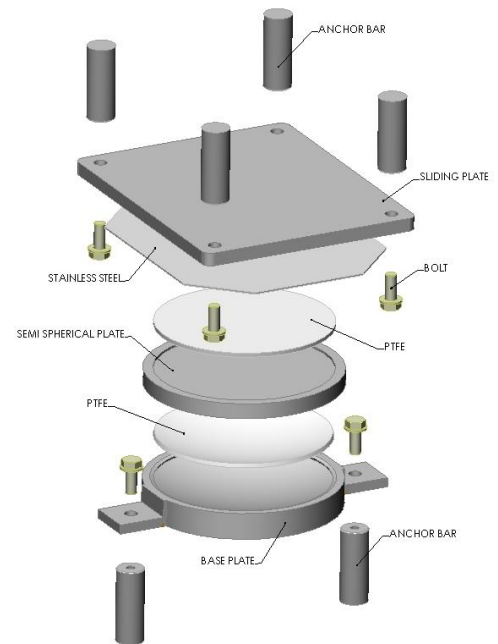
Agom R-Max bearings enable rotation in any direction while at the same time the structure is constrained horizontally. The bearing external steel plates is designed to fix the bearing to the structure.

Free sliding R-Max AGSM

Identical in construction to the fixed bearings, these multi-directional bearings have three plates and two PTFE surfaces one for rotation the other for sliding; the upper PTFE sheet is in direct contact with an austenitic stainless steel plate, enabling the bearing to slide in all directions.

Guided sliding R-Max AGSL- AGST

Identical in construction to the free sliding bearings these guided sliding devices are fitted with one or more guides to constrain the bearing's movement in only one direction. Also in these devices the horizontal load can be hold either by the shape of the spherical surface or by the direct contact between upper steel plates and base steel plate.

International standards

Agom R-Max   bearings are designed and manufactured in accordance with the requirements of a wide range of international standards (European EN1337.7, British BS 5400, Italian CNR 10018, German DIN 4141, French SETRA B.T.4. and American AASHTO). Every single component is mechanically worked and assembled by fully qualified and trained workers at the Agom factory under strict ISO 9001:2008 accredited quality control standards.

Quality of the materials

Austenitic steel sheet

The austenitic steel used for sliding surfaces is X5CrNiMo17-12-2 in accordance with EN 10088-2 1.4401 with a minimum thickness of 1.5 mm

The roughness is Ry5i ≤ 1 μm

The hardness ≥ 150 HV1 and ≤ 220 HV1

PTFE

Agom uses only virgin PTFE without regenerated or filler materials.

The minimum thickness of PTFE is 4.5 mm and varies in according with the bearings size.

Characteristics	Test method	Requirements
Tensile strength (MPa)	ISO 527-1/3	≥ 29
Elongation at break (%)	ISO 527-1/3	≥ 300
Hardness	EN ISO 2039-1	H132/60=23 to 33 MPa

Friction of the bearings

The reaction of the bearing to the movement can be mathematically calculated by considering friction coefficient between stainless steel and PTFE, the design friction values are in according to EN 1337-2 section 6.7.

Ferrous material for structural elements:

The convex plate, the concave plate and if applicable the sliding plate are manufactured from ferrous material in accordance with EN 10025 standard.

Concrete pressure

According to EN 1337-7 the allowable concrete pressure depends on the relative dimensions of the bearing structure interface to the total support area and the characteristic strength of the concrete

Fixing types

Usually all the R-Max bearings are equipped with suitable anchor bars for anchoring purpose to lower and upper structure.

In case of pre-cast concrete beam the bearings can be provided with upper pin and top subsidiary plate; in case of steel beams the bearings shall be provided with upper pin and/or connecting bolts.

To adjust the angle of inclination of the superstructure, the bearing's top plate can be manufactured tapered or a wedge plate can be fixed at the top of the bearing.

In case of horizontal loads < 20% of the simultaneous vertical load, if there is sufficient friction between the bearing and the sub or superstructure, the anchor bolts can be left out and the bearing can be connected to the structure by means of cementitius or epoxy resin (if the local code allow it).

To improve the R-Max bearings replacement with minimal up-lift of the structure, suitable Agom interconnecting quick devices QD are provided, as shown in the pictures.

Manufacturing and Quality

Agom R-Max bearings are designed and manufactured in accordance with the requirements of the new European standard EN 1337-7. Agom can also supply bearings complying with other standards. Every single component is mechanically worked and assembled by fully qualified and trained workers at the Agom factory with regular external inspections according to EN 1337 and under strict ISO 9001:2008 quality control standards.
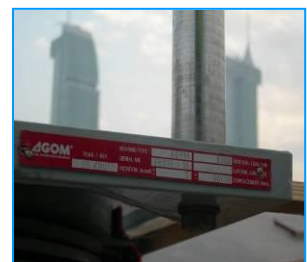
Comprehensive Labelling

All the bearings are provided with a metal label detailing the proprieties of the bearings:

- bearing type
- maximum vertical and horizontal loads
- rotation
- order number
- date of manufacture

The top face of the bearing gives information on the type of the bearing, the direction of the axis of the bridge, the presetting (if any), the position.

Agom R-Max Bearings accessories

Movement indicator

The movement indicator allows the monitoring of the sliding bearing displacement by using a reference arrow fixed to the bearing base and a graduate indicator moving with the sliding plate. The movement indicator allow to check the initial presetting of the bearing (if required) and to verify the bearing motion during the future inspections.

Reference surfaces

According to EN1337 code the bearing can be provided with "reference surfaces" to ensure the perfect horizontal position during bearing installation. The lower reference surface is parallel to the bearing base and the upper one to the upper plate. In this way is possible to check the horizontal alignment of the two reference surfaces by means of suitable water levels and to obtain the perfect horizontal position of the bearing during installation.

Dust protection

The dust protection around the sliding plate ensure the cleaning of the sliding surfaces to minimize the friction during sliding and guarantee the durability of the PTFE sliding material.

Corrosion protection

Steel components exposed to the elements are protected against corrosion. Agom adapts the corrosion protection in accordance to the aggressiveness of the environment in which the bearings are to be installed and to each customer's requirements.

The standard corrosion protection according EN 1337-9 is as follows:

- sandblasting SA2.5 grade
- two components high thickness epoxy zinc paint:
  250 µm

The high resistant corrosion protection (metallization) is as follow:

- sandblasting SA 2.5 grade
- metal spraying to 85 µm with Zn/Al 85/15
- sealing: Epoxy sealer 20-25 µm
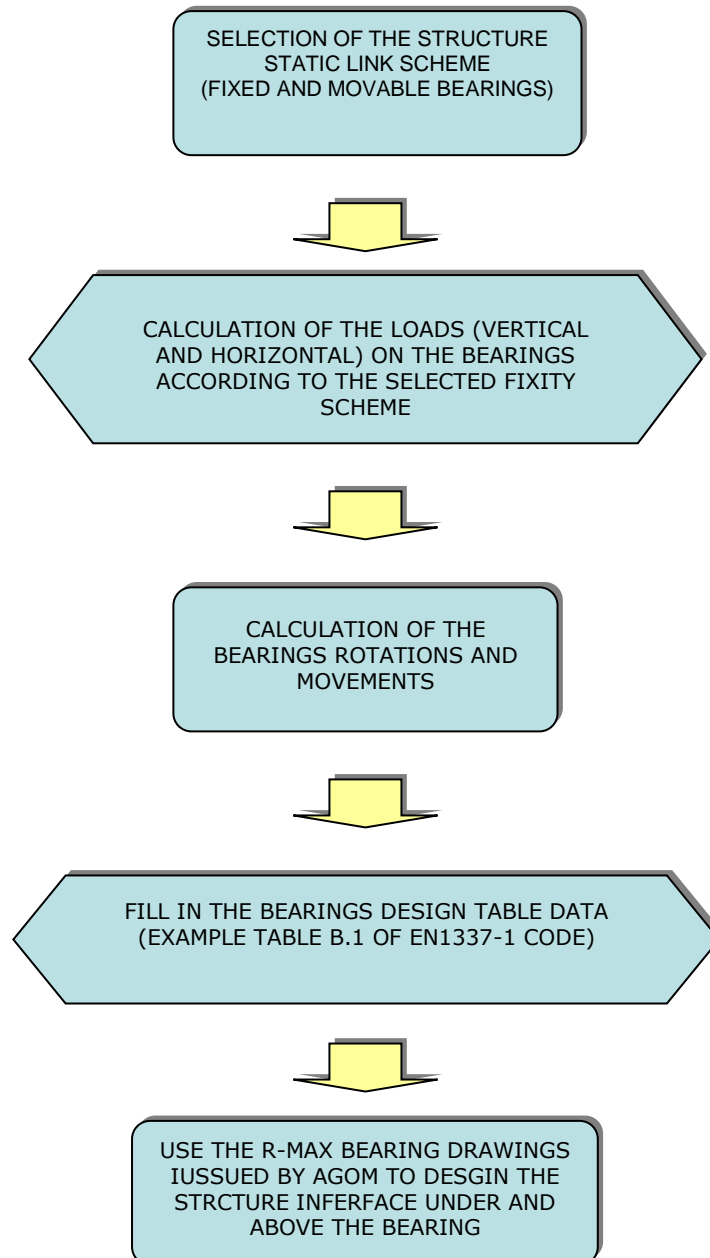- top coat: Polyurethane paint 100 µm

Guidelines for the design of a structure with Agom R-Max bearings

In this section a simple guideline for the design of a structure equipped with Agom bearing is presented, the design procedure is summarized in the following steps:

1. Selection of the structure static link scheme (fixed and movable support bearings)

2. Calculation of the loads (vertical and horizontal) on the bearings according to the fixity scheme

3. Calculation of the bearing rotations and movements

4. Insert all the bearing design data in to the bearing design table (example table B.1 of the EN1337-1 code attached at the end of the document)

5. Using the bearing drawings provided by Agom design the interface parts between structure and bearings as: bearing lower plinth with adequate position for installing the bearing anchor bars, level of the plinth to fit the vertical space between lower and upper structure to place the bearing and the upper structure interface where the bearing upper plate will be positioned

6. By using the spherical bearings the slope of the bridge deck can be easily taken without any compensator normally required by other type of bearings. By spherical bearing the rotation capacity can be increased to reach the required values due deck slope plus the additional structure permanent and live rotation. With standard R-Max bearings normally a permanent slope of 0.01 rad can be directly compensated by the bearing rotation, in any case the value can be increased according to the requirements.

DESIGN OF A STRCTURE WITH R-Max BEARINGS

SELECTION OF THE STRUCTURE
STATIC LINK SCHEME
(FIXED AND MOVABLE BEARINGS)

↓

CALCULATION OF THE LOADS (VERTICAL
AND HORIZONTAL) ON THE BEARINGS
ACCORDING TO THE SELECTED FIXITY
SCHEME

↓

CALCULATION OF THE
BEARINGS ROTATIONS AND
MOVEMENTS

↓

FILL IN THE BEARINGS DESIGN TABLE DATA
(EXAMPLE TABLE B.1 OF EN1337-1 CODE)

↓

USE THE R-MAX BEARING DRAWINGS
IUSSUED BY AGOM TO DESGIN THE
STRCTURE INFERFACE UNDER AND
ABOVE THE BEARING

Comparison of bearings performances

	V-MAX **pot** bearing	**R-MAX** **spherical** bearing	**E-LINK** **rubber** bearings
Vertical load	High	High	Medium
Horizontal displacement	No Limits	No Limits	Medium
Rotation	Medium	High	Low-Medium
Dimension	Small-Medium	Small-Medium	High

Advantages of using Agom R-Max bearings

The Agom R-Max bearings fulfil the following requirements:

a. Transmit the vertical loads due to permanent and accidental effects; it is possible to cover a **wide range of loads about up from 500 to 100000 kN**

b. Transmit the horizontal loads with in practise no limitation of the design load

c. Allow rotation as per a spherical hinge. The standard design rotation

(± 0.02 rad) can be easily increased to compensate structure slopes

d. No limitation for **of horizontal displacement**

e. Suitable for all structures steel and concrete bridges and buildings

f. **High durability and easy maintenance**

$N_{ed, max}$
UP TO
100000 kN

NO LIMITS
HORIZONTAL
LOADS

NO LIMITS
HORIZONTAL
DISPLACEMENT

HIGH
DURABILITY
NO
MAINTAINANCE

R-Max features

All the structural parts of the bearing are made of S355JR steel with yield strength of steel 355 Mpa according to EN10025 code. If required other structural steel can be used for design and manufacturing. The sliding surfaces are obtained by coupling PTFE and stainless steel according to EN1337-2 code.

Handling and storage installation and maintenance

This manual gives the main list of the most important operations to correctly install the AGOM bridge bearings.

Under control of the Engineer who designed the bridge, bearings must be installed by expert workers, with precision to meet the bridge and bearing design criteria.

Inappropriate handling, storage and installation will have an adverse effect on the bearing life, usually estimated in more than 50 years providing right maintenance.

AGOM structural bearings are manufactured to close tolerances by skilled technicians working in clean conditions.

To obtain the requisite performance from bearings it is imperative that they are properly handled at the work site and installed with the same care as when they were assembled in the factory.

AGOM bearings are clearly identified and marked on the top plate to ensure correct installation. The typeface on the cover or sliding plate gives information on the type, size and number of the bearing. Moreover, arrows indicate the movement axis and the presetting direction (if applicable).

Every bearing is provided with a steel identification label with all the most important bearing information

Handling and storage

Care should be taken in storage to prevent contamination and damage to the working surfaces. AGOM bearings should be stored in a controlled environment where they are protected from contamination, misuse and excessive moisture.

Robust transportation devices are fitted to all bearings to ensure that the components are maintained in they correct relative positions before and during installation.
The devices are normally finished in red paint.
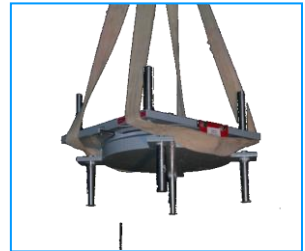
Unless special devices have been specified, they should not be used for slinging or suspending the bearings beneath beams.
Due to unpredictable conditions, which may occur during transportation or handling on site, the alignment and presetting (if applicable) of the assembled bearing should be checked against the drawing.
Do not try to rectify any discrepancies on site.
Bearing too heavy to be lifted by hand should be properly slung using lifting equipment.

Presetting

If bearing are required to preset eg. where once only large movements may occur during stressing operations, this should be specified as a requirement and should only be carried out in AGOM prior to despatch.
Do not attempt this operation on site.

Installation

The installation procedure of the bearings generally depends on the structure type. The main steps are:

1. Check before installation.
In order to avoid placements mistakes of the bearings, all the technical and description data, printed on the label, shall be checked and compared with the ones showed in the shop drawings.
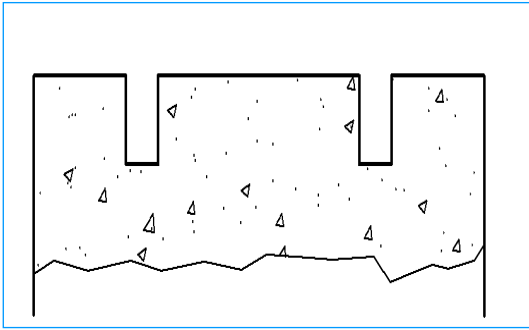
2. Casting of the substructures.
Substructures shall reach a level about 30 mm lower then the final level.

In order to install the bearings suitable voids spaces must be provided to insert the bearing lower anchor bars.
An easy way to leave the voids is to use corrugated steel pipes grouted into the concrete with a diameter at least double compared with the diameter of the anchor bars.

Bearing positioning
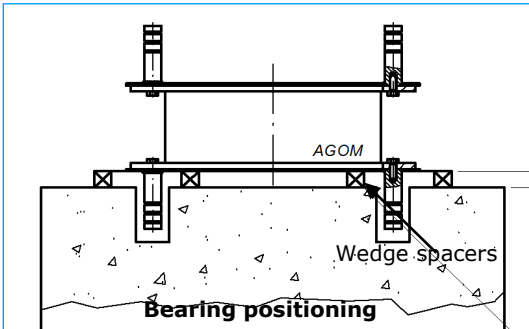
3. Bearing positioning and substructure casting.
The bearings are placed at the final exact level supporting it by temporary wedge spacers; the maximum deviation from the horizontal plan does not exceed 0.001 radians.

In order to fix the bearings and anchor bars a formwork around the lower base plate must be provided (normally a wood or steel formwork is used).

To grout the bearing a high strength non-shrink, quick setting cement mortar with compression strength > 45 Mpa has to be used; if the thickness of the mortar exceeds 40 mm a suitable reinforcement shall be provided.

Substructure casting
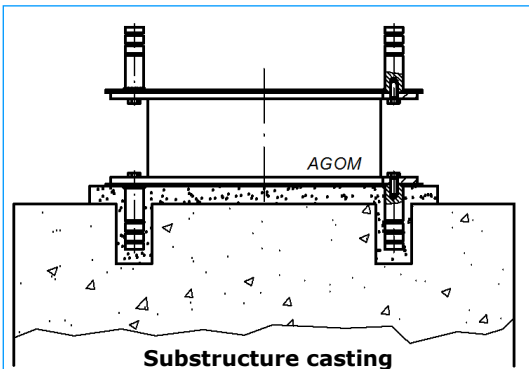
The temporary wedges used to keep the bearing in right position shall be removed after mortar hardening and remaining voids shall be filled by the same mortar.

The level of the cement mortar shall not exceed bottom level of the bearings steel lower plate to avoid bearings embedding compromising the eventual future bearing replacement.

4. Casting of the superstructure – cast-in-situ superstructure

Superstructure formwork must be arranged around the bearing upper steel plate and sealed with adhesive tape or foam to avoid concrete leakage during casting.

The formwork must be arranged in a suitable way to avoid embedding of the bearing upper plate into concrete to avoid bearing embedding compromising the eventual future replacement. The formwork must be supported at the design level during concrete pouring.

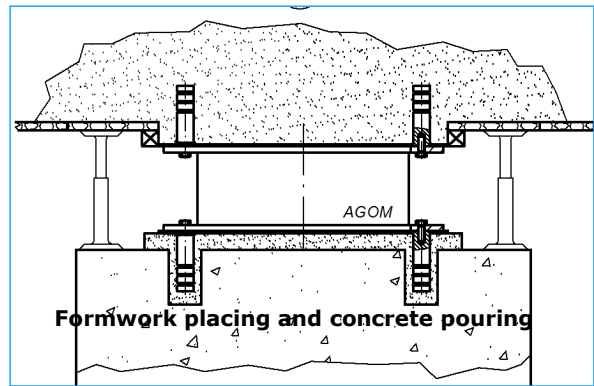When the concrete has reached adequate resistance the supports and formwork have to be removed. At the end of the construction the bearings must be cleaned and the painting of the steel plates repaired if some damages occurred during construction.

Formwork placing and concrete pouring

Formwork removal
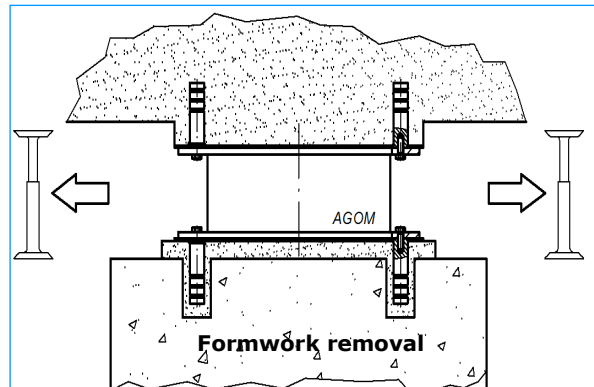
5. Casting of the superstructure - prefabricated superstructure

The bearings normally have upper anchorages that must be inserted into the suitable voids of the prefabricated structure.

After the prefabricated beam has been placed in the final position (the beam must be supported on temporary supports), the bearing upper plate must be surrounded by a seal (normally rubber seal with suitable injection and leakage pipes).
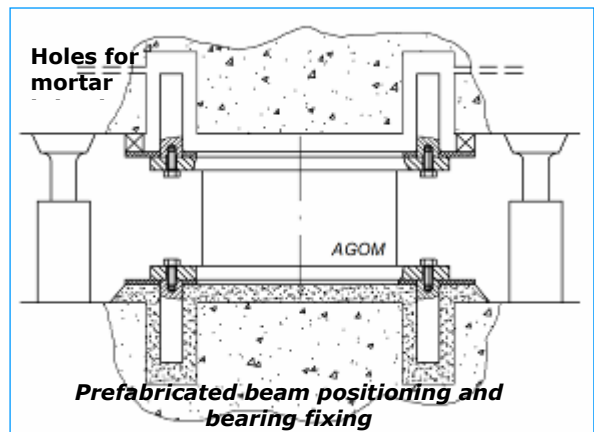
The gap and anchorages voids between plate and beam have to be filled by high strength mortar.

When the mortar has achieved sufficient strength to transmit the weight of the bearings; the temporary supports shall then be removed.

At the end of the construction the bearings must be cleaned and the painting of the steel plates repaired if some damages occurred during construction.

Holes for mortar

Prefabricated beam positioning and bearing fixing

Temporarily support removal
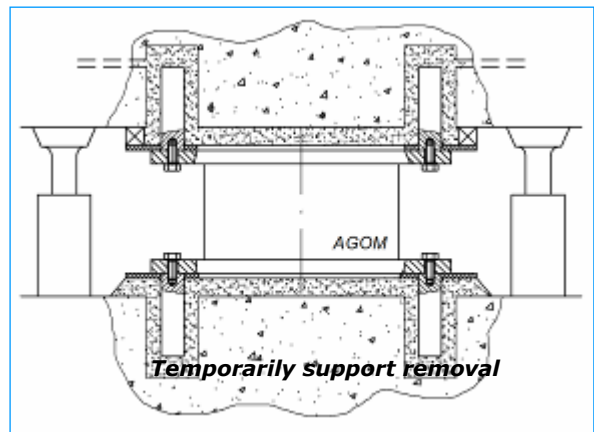
Removal of transport devices

The transport devices, normally painted red should only be removed when the bearing is properly installed and ready for operation.

Any tapped holes exposed after removal of transportation brackets etc (coloured red) should be sealed with self-vulcanizing silicon sealant.

Maintenance of Bearings

The service life of a   bearing is usually estimated in more than 50 years.
The most important thing to assure such a long life time is a correct and careful maintenance of the bearing, that is usually installed in a severe environment.

The requested bearing inspection and maintenance program that could be adapted and improved by the bridge designer to the specific service conditions of the bridge is fully described in the "Inspection and warranty manual" that can be download from Agom web site www.agom.it .

INSTALLATION

AFTER
INSTALLATION
INSPECTION

AFTER
1 YEAR

PRINCIPAL
INSPECTION

MAX EVERY
5 YEARS

REGULAR
INSPECTION

REGULAR
INSPECTION

PRINCIPAL
INSPECTION
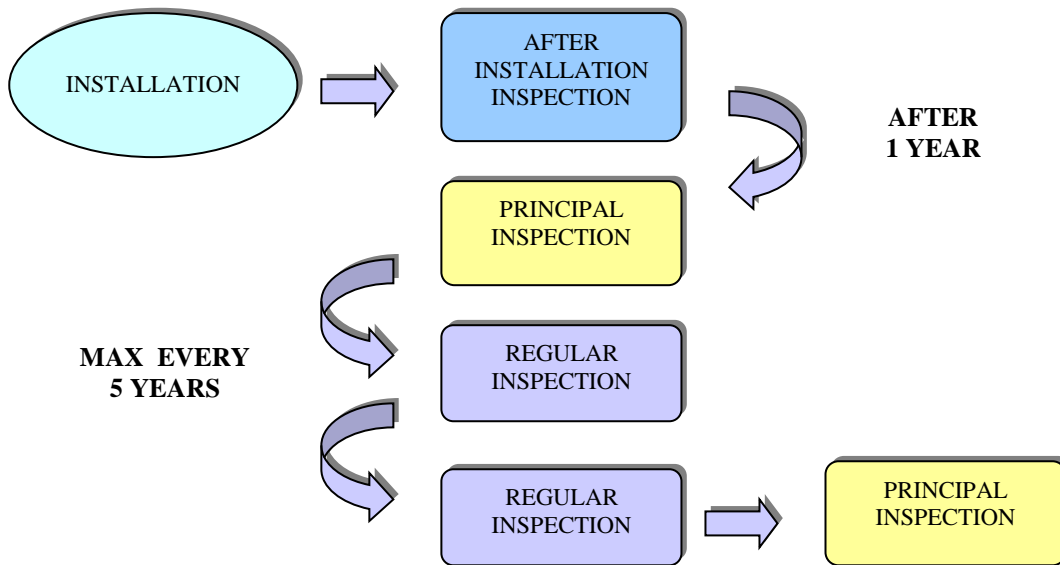
A typical complete routine check of the bearing installed should be comprehensive of the following activities.

Paint and other specified protective coatings must be maintained in good and efficient condition and free from scratches or chips. Any areas of the protective coating showing damage or distress must be rectified as soon as it is seen

Area surrounding the bearings must be kept clean and dry and free from the adverse effects of external influences such as airborne debris or water/salt (for example flow out from leaking joints)

The wearing surfaces of the bearing must be checked to ensure that they are continuing to operate efficiently. Where possible seals should be checked to ensure that they are undamaged

Fixing bolts must be checked for tightness.
Any bedding material showing signs of distress or ineffectiveness must be replaced and the reason for its failure investigated and corrected

Routine inspections shall include a check that translational and rotational capacities of the bearing have not been exceeded and show no sign of being likely to exceeded the requirements specified at the design stage.

PTFE discs should be within limits of their design movement and have at least 1 mm thickness of material visible. Excess movement will be evident if the PTFE disc have moved outside the limits of the stainless steel slider plate

Agom R-Max bearing with special devices

The Agom R-Max bearings can be combined with special devices as:

- hydraulic devices

- antilifting system

- vertical load measurement tool

- elastic devices

Agom R-Max bearing combined with hydraulic devices

The hydraulic devices that can be combined with Agom R-Max bearing are of two types:

- Hydraulic device type shock transmitter (ST).
It allows the slow movement (velocity < 0.1 mm/sec) due to service conditions (thermal, shrinkage, fluage) while it blocks in case of fast motion (seismic etc..) and transmits the horizontal load along the device axis.

- Hydraulic device type viscous damper (VD).
It allows the slow movement (velocity < 0.1 mm/sec) due to service conditions (thermal, shrinkage, fluage) while it reacts in case of fast motion (seismic etc..); it reaches the design load and allows the motion dissipating energy. It works as a viscous damper with very high damping capacity (higher than 50% of the critical damping); the response cycles in term of force-displacement and force-velocity can be adjusted according to the structural designer requirements.

The Agom R-Max bearings combined with hydraulic devices are available of two types:

- longitudinal guided bearings with hydraulic shock transmitter AGSL ST; it allows rotations of a spherical hinge and the horizontal displacement in the longitudinal direction for slow motion; it carries the vertical load ,the horizontal load along the transversal direction and the longitudinal one due to dynamic actions
- free sliding bearing with hydraulic shock transmitter AGSM ST; it allows rotations of a spherical hinge and the horizontal displacement along each direction of the horizontal plane for slow motions; it carries the vertical load and the longitudinal one due to dynamic actions
- longitudinal guided bearings with hydraulic shock transmitter AGSL VD; it allows rotations of a spherical hinge and the horizontal displacement in the longitudinal direction for slow motion; it carries the vertical load ,the horizontal load along the transversal direction and the longitudinal one due to dynamic actions with very high energy dissipation
- free sliding bearing with hydraulic shock transmitter AGSM VT; it allows rotations of a spherical hinge and the horizontal displacement along each direction of the horizontal plane for slow motions; it carries the vertical load and the longitudinal horizontal one due to dynamic actions with very high energy dissipation

Agom R-Max bearing combined with antilifting system

The Agom R-Max bearing can be equipped with antilifting tool in order to absorb the negative tensile vertical forces. The antilifting tools can be applied to all the R-Max bearings (fixed, guided and free sliding) with different systems depending on the bearing type, tensile load value and required rotation.
It is possible to cover a very wide range of tensile loads by suitable design of antilifting tools.
An example of R-Max bearing combined with antilifting tools is shown in the following figure:

Agom R-Max bearing with vertical load measurement

The Agom R-Max bearing can be equipped with a system to measure the vertical load acting on the bearing. It can be useful to verify the effect of transient loads on bearings (example traffic on bearings) or to check the structure behaviour in case of foundations settlements. The load measurement can be registered near the bearing or by remote acquisition depending of the adopted data acquisition system.

![AGOM - IDEAS, ENGINEERING AND MANUFACTURE]

Agom R-Max design parameters

Normally the required input parameters that the structural designer has to provide to Agom engineers for device design and constructions are the one of the bearing design table for example the table B.1 of EN1337-1 code (attached at the end of this document):

| Maximum vertical load and horizontal loads (when allowed) | ⟹ | $N_{Sd,max}$ V_{Sd} |

| Minimum vertical load | ⟹ | $N_{Sd,min}$ |

| Bearing design rotation (seismic, thermal, irreversible movements) | ⟹ | α_d |

| Bearing design displacement (seismic, thermal, irreversible movements) | ⟹ | $v_{,d}$ |

| Bearing lower and upper interface surface with the structure (available space for bearing installation, material and design resistance) | ⟹ | $\sigma_c,$ A,B |

Agom R-Max standard range

The Agom R-Max bearings can cover a very wide range of loads and displacements, they can be designed according to many international standards (European code EN 1337 relevant parts, American AASHTO LRFD, British BS5400, etc..).

The bearings dimensions shown in the following tables have been designed according to European codes with the following criteria:

- EN 1337 part 1 and relevant European codes for load and displacements calculation. Note that the bearing design loads (shown in the tables) are ultimate limit state loads (ULS) according to European codes
- EN 1337 part 7 and 2 for sliding surface
- Standard rotation 0.02 rad
- Displacement 100 mm ($\pm$50 mm)
- Horizontal load equal to 15% of the maximum vertical one
- Concrete stress calculated according to EC2 - EN1992-1-1 standard with concrete class C30/37, levelling mortar with minimum compression resistance f_c = 45 N/mm2 and plinth size at least 100 mm greater that bearing plate

In any case the dimension can be adjusted to fit the available space on the structure and/or to verify the contact stress on the interface surface (example different concrete class respect to the one used for the bearing standard design, etc..)
In the following the overall dimension for fixed, guided and free sliding bearings are presented.

Since the bearings checks depends on the combination of multiple inputs (load, displacement and rotation) the Agom engineers can assist the structural designer for design optimisation.

In the following the overall dimension of a wide range of the Agom R-Max bearings are shown. In the table the fixed bearing with three plates and the guided one with external steel plates are presented.

![AGOM logo - IDEAS, ENGINEERING AND MANUFACTURE]

Agom R-Max Fixed Bearings

Fixed bearing type AGSF (*Vertical load - Horizontal longitudinal load - Horizontal transversal load*).
For example *AGSF 500-75-75* means: Vertical load $N_{,Rd}$ = 500 kN, Horizontal longitudinal load $V_{x,Rd}$ = 75 kN, Horizontal transversal load $V_{y,Rd}$ = 75 kN.

Bearing type	Bearing Dimensions						Weight
	ØB	H	nZ	ØZ	LZ	A	W
	[mm]	[mm]		[mm]	[mm]	[mm]	[kg]
R-Max AGSF 1000-150-150	250	72	2	30	122	330	30
R-Max AGSF 2000-300-300	330	73	2	40	140	430	52
R-Max AGSF 3000-450-450	400	76	4	40	140	500	75
R-Max AGSF 4000-600-600	450	88	4	40	140	550	116
R-Max AGSF 5000-750-750	500	106	4	50	188	620	184
R-Max AGSF 6000-900-900	550	106	4	50	188	670	212
R-Max AGSF 7000-1050-1050	590	113	4	60	235	730	275
R-Max AGSF 8000-1200-1200	620	122	4	60	235	760	326
R-Max AGSF 9000-1350-1350	670	131	4	60	235	810	387
R-Max AGSF 10000-1500-1500	700	131	4	60	235	840	410
R-Max AGSF 11000-1650-1650	730	148	4	70	282	890	532
R-Max AGSF 12000-1800-1800	770	147	4	70	282	930	574
R-Max AGSF 13000-1950-1950	800	146	4	80	330	980	658
R-Max AGSF 14000-2100-2100	840	155	4	80	330	1020	739
R-Max AGSF 15000-2250-2250	870	154	4	80	330	1050	778
R-Max AGSF 16000-2400-2400	880	164	4	80	330	1060	840
R-Max AGSF 17000-2550-2550	910	163	4	80	330	1090	877
R-Max AGSF 18000-2700-2700	940	162	4	80	330	1120	916
R-Max AGSF 19000-2850-2850	980	170	4	90	375	1180	1090
R-Max AGSF 20000-3000-3000	1000	177	4	90	375	1200	1178
R-Max AGSF 22000-3300-3300	1030	193	4	90	375	1230	1329
R-Max AGSF 24000-3600-3600	1090	193	4	100	420	1310	1546
R-Max AGSF 26000-3900-3900	1120	192	4	100	420	1340	1608
R-Max AGSF 28000-4200-4200	1170	191	6	90	375	1370	1738
R-Max AGSF 30000-4500-4500	1220	208	6	90	375	1420	1993
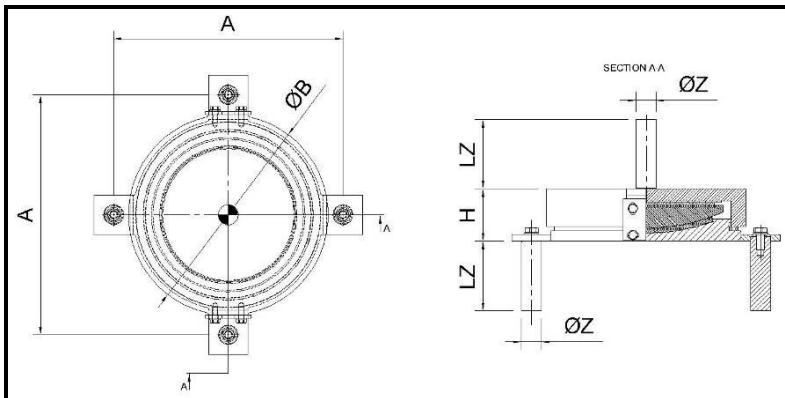
Agom R-Max Guided Bearings

Guided bearing type AGSL (*Vertical load / Horizontal longitudinal movement - Horizontal transversal load*).
For example: *AGSL 500/100-75* means: Vertical load $N_{,Rd}$ = 500 kN, horizontal longitudinal movement
$V_{x,d}$ = 100 (±50) mm, horizontal transversal load $V_{y,Rd}$ = 75 kN. In case of AGST bearings, the
movement is along transversal axis and the horizontal load along the longitudinal one.

| Bearing type | Dimensions de l'appui | | | | | | | | | | | | Weight |
| | B | H | nZ | ØZ | LZ | A | C | D | nU | ØU | LU | E | W |
	[mm]	[mm]		[mm]	[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg]
R-Max AGSL 1000/100-150	230	83	2	30	122	310	330	380	2	30	122	410	57
R-Max AGSL 2000/100-300	300	92	2	40	140	400	410	450	2	40	140	510	99
R-Max AGSL 3000/100-450	360	102	4	40	140	460	510	510	4	40	140	610	165
R-Max AGSL 4000/100-600	400	107	4	40	140	500	550	550	4	40	140	650	205
R-Max AGSL 5000/100-750	450	128	4	50	188	570	600	600	4	50	188	720	303
R-Max AGSL 6000/100-900	490	130	4	50	188	610	640	640	4	50	188	760	355
R-Max AGSL 7000/100-1050	520	138	4	60	235	660	680	670	4	60	235	820	453
R-Max AGSL 8000/100-1200	550	143	4	60	235	690	720	700	4	60	235	860	506
R-Max AGSL 9000/100-1350	580	151	4	60	235	720	750	730	4	60	235	890	570
R-Max AGSL 10000/100-1500	610	159	4	60	235	750	780	760	4	60	235	920	654
R-Max AGSL 11000/100-1650	640	166	4	70	282	800	830	790	4	70	282	990	786
R-Max AGSL 12000/100-1800	670	164	4	70	282	830	860	820	4	70	282	1020	834
R-Max AGSL 13000/100-1950	690	182	4	70	282	850	880	840	4	70	282	1040	961
R-Max AGSL 14000/100-2100	720	181	4	80	330	900	910	870	4	80	330	1090	1078
R-Max AGSL 15000/100-2250	740	179	4	80	330	920	930	890	4	80	330	1110	1116
R-Max AGSL 16000/100-2400	760	186	4	80	330	940	950	910	4	80	330	1130	1192
R-Max AGSL 17000/100-2550	780	203	4	80	330	960	980	930	4	80	330	1160	1355
R-Max AGSL 18000/100-2700	800	202	4	80	330	980	1010	950	4	80	330	1190	1422
R-Max AGSL 19000/100-2850	830	210	4	90	375	1030	1050	980	4	90	375	1250	1626
R-Max AGSL 20000/100-3000	850	208	4	90	375	1050	1070	1000	4	90	375	1270	1676
R-Max AGSL 22000/100-3300	890	225	4	90	375	1090	1130	1040	4	90	375	1330	1958
R-Max AGSL 24000/100-3600	930	232	4	100	420	1150	1170	1080	4	100	420	1390	2237
R-Max AGSL 26000/100-3900	960	248	4	100	420	1180	1200	1140	4	100	420	1420	2493
R-Max AGSL 28000/100-4200	1000	255	6	90	375	1200	1270	1160	6	90	375	1470	2790
R-Max AGSL 30000/100-4500	1040	262	6	90	375	1240	1310	1190	6	90	375	1510	3018
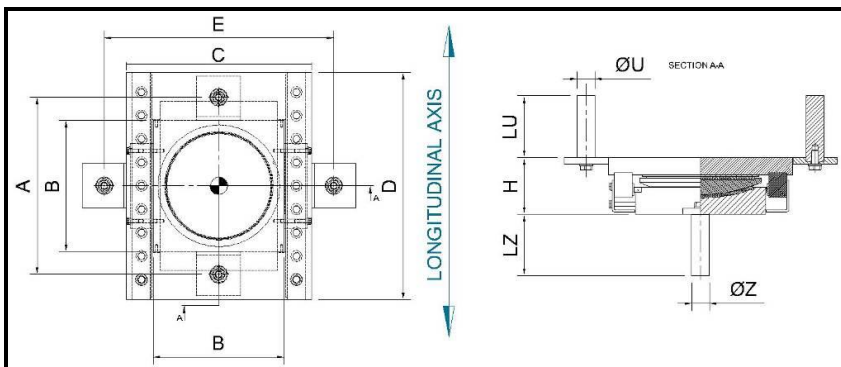
Agom R-Max Free Sliding Bearings

Free sliding bearing type AGSM (*Vertical load / Horizontal longitudinal movement / Horizontal transversal movement*).

For example: AGSM 500/100/20 means: Vertical load N_{rRd} = 500 kN, Horizontal longitudinal movement $V_{x,d}$ = 100 (±50) mm , Horizontal transversal movement $V_{y,d}$ = 20 (±10) mm.

Bearing type	Bearing Dimensions													Weight
	ØB	H	nZ	ØZ	LZ	A	C	D	nU	ØU	LU	E	F	W
	[mm]	[mm]		[mm]	[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[mm]	[kg]
R-Max AGSM 1000/100/20	220	69	2	30	122	300	250	340	4	30	122	190	280	31
R-Max AGSM 2000/100/20	290	79	2	30	122	370	320	410	4	30	122	260	350	55
R-Max AGSM 3000/100/20	340	87	2	30	122	420	380	470	4	30	122	320	410	82
R-Max AGSM 4000/100/20	390	93	2	30	122	470	420	510	4	30	122	360	450	106
R-Max AGSM 5000/100/20	430	108	2	30	122	510	460	560	4	30	122	400	500	148
R-Max AGSM 6000/100/20	470	116	2	40	140	570	500	590	4	30	122	440	530	188
R-Max AGSM 7000/100/20	500	118	2	40	140	600	530	630	4	30	122	470	570	219
R-Max AGSM 8000/100/20	530	134	2	40	140	630	560	660	4	30	122	500	600	271
R-Max AGSM 9000/100/20	570	132	2	40	140	670	590	690	4	30	122	530	630	301
R-Max AGSM 10000/100/20	600	135	2	40	140	700	620	720	4	30	122	560	660	344
R-Max AGSM 11000/100/20	630	142	2	50	188	750	650	750	4	40	140	570	670	401
R-Max AGSM 12000/100/20	660	141	2	50	188	780	680	780	4	40	140	600	700	435
R-Max AGSM 13000/100/20	690	153	2	50	188	810	700	800	4	40	140	620	720	508
R-Max AGSM 14000/100/20	710	152	2	50	188	830	730	830	4	40	140	650	750	538
R-Max AGSM 15000/100/20	740	150	2	50	188	860	750	850	4	40	140	670	770	569
R-Max AGSM 16000/100/20	770	166	2	50	188	890	770	870	4	40	140	690	790	650
R-Max AGSM 17000/100/20	790	165	4	40	140	890	790	900	4	40	140	710	820	697
R-Max AGSM 18000/100/20	810	172	4	40	140	910	810	920	4	40	140	730	840	773
R-Max AGSM 19000/100/20	830	181	4	40	140	930	830	940	4	40	140	750	860	849
R-Max AGSM 20000/100/20	850	180	4	40	140	950	850	960	4	40	140	770	880	886
R-Max AGSM 22000/100/20	900	186	4	50	188	1020	900	1000	4	50	188	800	900	1023
R-Max AGSM 24000/100/20	940	202	4	50	188	1060	940	1030	4	50	188	840	930	1220
R-Max AGSM 26000/100/20	980	218	4	50	188	1100	980	1070	4	50	188	880	970	1409
R-Max AGSM 28000/100/20	1010	216	4	50	188	1130	1010	1100	4	50	188	910	1000	1484
R-Max AGSM 30000/100/20	1050	232	4	50	188	1170	1050	1140	4	50	188	950	1040	1732
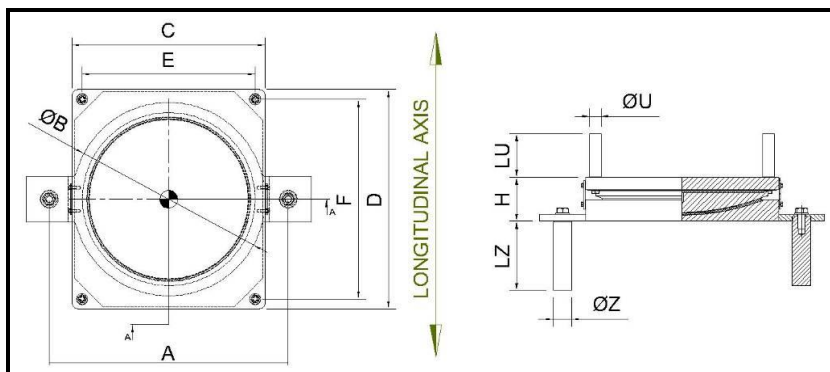
Bearing design table according to EN1337-1 code

The purpose of this bridge bearing schedule is to list the information normally required for the design of the bearings for a particular structure. This information should ensure that bearings are designed and manufactured so that, under the influence of all possible actions, unfavourable effects of the bearing on the structure are avoided. A drawing should accompany the schedule showing the layout of the bearings with identification marks, including a typical cross section of the bridge and particular of any special locating requirements. Bearing function should be indicated on the drawing by appropriate symbols.

Every item listed in the "bearing design table" should be considered, but some may not be applicable to a particular bearing. Only relevant information should be given and when an item in the schedule is not applicable this should be stated. Additional information should be added when special conditions exist.

Here above you can find a short explanation of each item listed in the "bearing design table"

BEARING IDENTIFICATION MARK	Bearing with different function or load carrying requirements should be distinguished by a unique reference mark
NUMBER OFF	The required number for each item
SEATING MATERIAL	The materials on which each outer bearing plate bears should be stated as it may affect the design and finish of these plates
AVERAGE DESIGN CONTACT PRESSURE	The pressure of the effective contact area
DESIGN LOAD AFFECTS	The structure designer should give the worst individual values of the design load effects in the schedule. The most adverse combination of these values is usually sufficient for a satisfactory design of bearing. Only in special cases would greater economy be achieved by considering the actual coexistent values of load effects, in which case these should be given in detail.

DISPLACEMENT	Displacement of the structure at a bearing should be determined and factored. Allowance should be made for any movement of the supporting structures. Transverse and longitudinal movements are normally in a direction perpendicular and parallel to the longitudinal axis of a bridge span, respectively. Where there is any likelihood of ambiguity directions of movement should be clearly indicated on the accompanying drawing.
ROTATION	The irreversible and reversible rotations at the serviceability limit state (SLS), which the bearing is required to accommodate, should be given in radians. In the case of elastomeric bearings the maximum rate should be given.: 100x(rotation [rad]/coexisting design vertical load [kN])
MAXIMUM BEARING DIMENSIONS	The maximum sizes of the bearing that can be accommodated should be stated
TOLERABLE MOVEMENT OF BEARING UNDER TRANSIENT LOADS	The movement that can be tolerated at the bearing under transient loads, in directions in which the bearing is meant to provide restraint
ALLOWABLE RESISTANCE TO TRASLATION UNDER SLS [kN.] (if relevant)	In the design of the structure, reaction to displacement movements may be of significance, in which case the acceptable horizontal force generated by the bearing should be given for the serviceability limit state (SLS). The values to be given are those for slowly applied movements at normal temperatures (any necessary extra allowance for low temperatures and rapidly applied movements should be made by the designer of the structure).
ALLOWABLE RESISTANCE TO ROTATION UNDER SLS [kN*m] (if relevant)	In the design of the structure, reaction to rotation may be of significance in which case the acceptable moment of reaction generated by the bearing, when subjected to the critical design load effects, should be given for the serviceability design state.
TYPE OF FIXING REQUIRED	Various means of fixing the bearing to the superstructure and substructure are available, appropriate to different type of bearing. Particular requirements, such as friction, bolts, dowels, keys or other devices, should be stated.

Bearing Design Table

Reference:……………………………………….. **Date:**…………………………………….

Bridge Name: ………………………………….. **Table:** ……………. of ………………..

BEARING IDENTIFICATION MARK						
NUMBER OFF						
SEATING MATERIAL (e.g. cement, mortar, epoxy mortar, in situ concrete, precast concrete, steel, timber.)	Upper surface					
	Lower surface					
AVERAGE DESIGN CONTACT PRESSURE [N/mm^2]	Upper face	SLS				
		ULS				
	Lower face	SLS				
		ULS				
DESIGN LOAD AFFECTS [kN]	ULS	vertical	Max			
			Permanent			
			Min.			
		Transverse				
		Longitudinal				
	SLS	Vertical				
		Transverse				
		Longitudinal				
DISPLACEMENT [mm]	ULS	Transverse				
		Longitudinal				
	SLS	Transverse				
		Longitudinal				
ROTATION	ULS	Transverse				
		Longitudinal				
MAXIMUM BEARING DIMENSIONS [mm]		Transverse				
		Longitudinal				
		Overall Height				
TOLERABLE MOVEMENT OF BEARING UNDER TRANSIENT LOADS [mm] (If relevant)		Vertical				
		Transverse				
		Longitudinal				
ALLOWABLE RESISTANCE TO TRASLATION UNDER SLS [kN.m] (if relevant)		Transverse				
		Longitudinal				
ALLOWABLE RESISTANCE TO ROTATION UNDER SLS [kN.m] (if relevant)		Transverse				
		Longitudinal				
TYPE OF FIXING REQUIRED		Upper face				
		Lower face				

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- Shock absorber
- Rubber dampers

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- Elastomeric joints
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- Finger joints
- Buried joints
- Railway joints

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- Design
- Consulting
- On site assistance
- Installations
- Tests
- Inspection

BRIDGES

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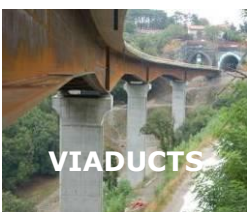
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