

Freyssinet solutions for structural accessories



D E S I G N , B U I L D , M A I N T A I N



FREYSSINET
SUSTAINABLE TECHNOLOGY

The Freyssinet Group

Freyssinet brings together **an unrivalled set of skills in the specialist civil engineering sector**. It implements solutions with high added value in two major fields: construction and repairs.

Freyssinet is involved in numerous projects across five continents, making it the world leader in its specialist areas of:

- Prestressing
- Construction methods
- Cable-stayed structures
- Structural accessories
- Repairs
- Structural reinforcement and maintenance

Freyssinet is highly involved in sustainable development issues, and has set up a number of initiatives, particularly to reduce the environmental impact of its projects and enhance its social responsibility policy.

Freyssinet is a subsidiary of the Soletanche Freyssinet Group, a world leader in the soils, structures and nuclear sectors.

*Cover photo:
Hassan II Bridge (Morocco)*

Structural accessories are systems that link together two structures and fully determine the relative movements and forces that each structure transmits to the other under the influence of external stresses.

Structural accessories can be categorized into three families based on their main function:

- **Bearings**, which transfer major vertical loads, such as between a deck and its piers.
- **Expansion joints**, which ensure a continuous road surface, such as between a main deck and its end spans.
- **Earthquake protection devices**, which reduce the transmission of inertial forces, such as between a deck and its piers during a seismic event.

Each device actually follows a complex constitutive equation that associates its resistance, stiffness and internal damping.

Perfect control over the structure's operation

Freyssinet ensures that the devices implemented correspond perfectly to the models used in the structure's static and dynamic analyses, thereby providing complete control over the structure's actual operation and guaranteeing its resistance, stability and durability.

The guarantee of an integrated service offering

Freyssinet delivers end-to-end project support, from design through to completion:

- Assistance with defining the structure's functional diagram.
- Assistance with dynamic design (non-linear time series analysis).
- Structural accessory design and sizing in accordance with the requirements of applicable standards.
- Controlled manufacturing in Freyssinet's production centres.
- Factory acceptance testing.
- On-site installation and fine-tuning according to actual temperature conditions.





DYNAMIC PROTECTION DEVICES



8

FREYSSINET PRODUCTS COMPANY



10

- 1 - Bearings beneath a metal deck
- 2 - FVD damper
- 3 - Fitting an expansion joint

STRUCTURAL BEARINGS

Freyssinet offers an end-to-end range of bearings designed to meet the working constraints of each structure.

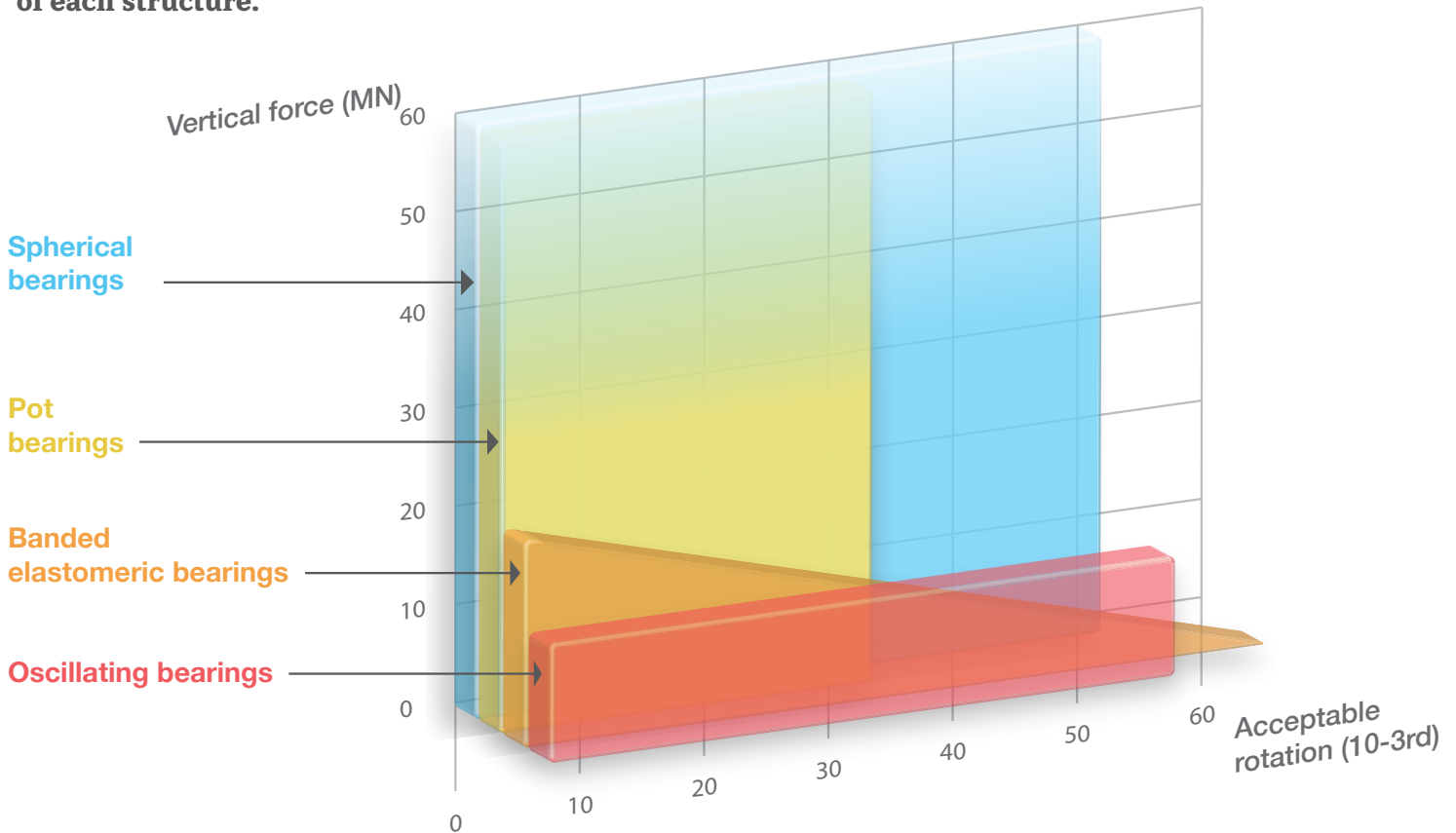


Chart:
The choice of bearing depends on a number of parameters, including a combination of vertical load and acceptable rotation.



Banded elastomeric bearings

Banded elastomeric bearings absorb moderate loads, while allowing significant rotational movement. They are supplied in conformity with international standards, such as European standard EN 1337, and feature the CE marking. They are made from either neoprene or natural rubber.

Options

- Instrumented bearings for reading the load.
- Jacking bearings for weighing or jacking the superstructure.

TETRON CD pot bearings

Pot bearings absorb heavy loads, while allowing moderate rotational movement. They feature a highly compact design. They are supplied in conformity with international standards, such as European standard EN 1337, and feature the CE marking.

Options

- Anti-lift: absorption of occasional lifting forces.
- Instrumented: for reading the load.
- Injectable: for jacking or weighing the superstructure.
- For incrementally launched bridges: fitted with an auxiliary slider for building the deck using the launching method.

TETRON SB spherical bearings

Spherical bearings transfer heavy loads, while allowing significant rotational movement. They are supplied in conformity with international standards, such as European standard EN 1337.

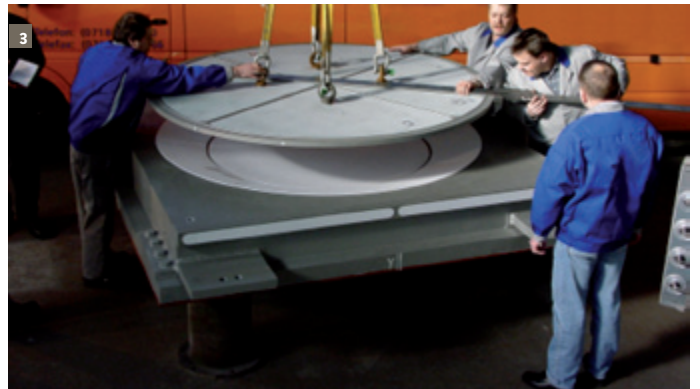
Options

- Instrumented: for reading the load.

Special bearings

Special bearings come in two categories:

- Shear keys, which are used to create high-capacity abutments. This type of bearing only absorbs horizontal loads and may be fixed (type GT) or guided / sliding (type GF).
- Oscillating bearings.

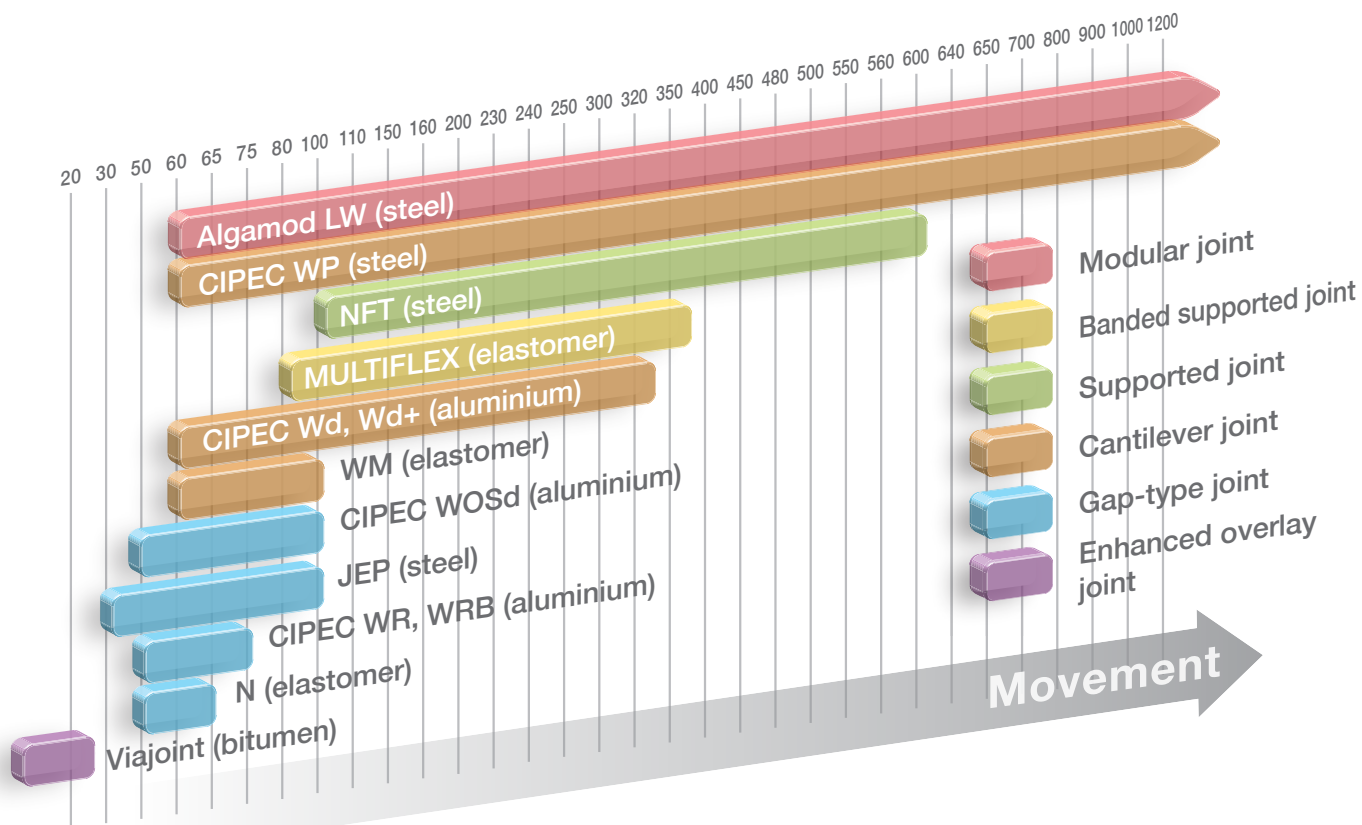


- 1 - Ronda de Malaga (Spain)
- 2 - Rio Saramo viaduct (Spain)
- 3 - Mounting a Tetron SB bearing
- 4 - GF bearings

EXPANSION JOINTS

Freyssinet's expansion joints are designed to allow for continuous traffic between two structures by accommodating any movements in the structures caused by creep, shrinkage, temperature variations and deformation during service.

Freyssinet offers an extensive range of small and large-movement, bituminous, metal, elastomeric and modular expansion joints for road and railway structures.



Viajoint bituminous expansion joint

The Viajoint is a small-movement expansion joint (± 15 mm) achieved by filling a chase with a polymer and aggregate-modified viscoelastic mixture containing a bituminous binder.

CIPEC metal expansion joints

The CIPEC range of metal expansion joints offers an effective solution, irrespective of the movement (from 30 to 1,000 mm), the structure being fitted, and the implementation and operating conditions.

It consists of:

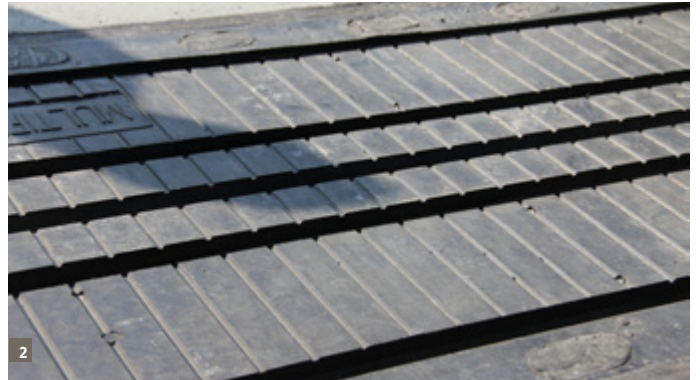
- Small-movement expansion joints (JEP, WR and WOSd).
- Medium-movement comb-type expansion joints (Wd).
- Large-movement comb-type expansion joints (WP).

Elastomeric expansion joints

The range of elastomeric expansion joints is the ideal solution for small and medium movements (from 30 to 350 mm). These expansion joints offer increased driver comfort and low noise pollution.

The range includes:

- Small-movement expansion joints (N, WM).
- Medium-movement expansion joints with bridging (Multiflex).
- Medium-movement comb-type supporting expansion joints (NFT).



Modular expansion joints

Modular expansion joints can be used to create small, medium and large-movement joints by adding basic modules with a movement of 65 mm. Boasting a rugged long-life design, these joints also ensure a highly impervious surface thanks to their elastomeric sections.



TRANSPEC 4-18 joints for rail-based crash barriers

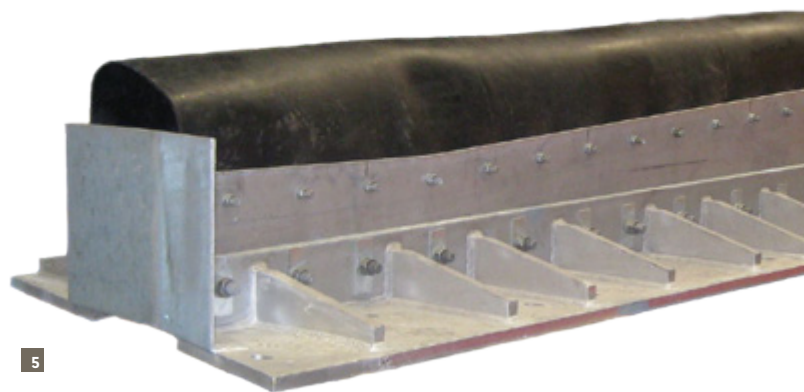
The rail-based crash barrier joint (type BN4) is a system that allows rail ends to move freely and which locks in case of an impact (vehicle collision) to form a rigid and robust link enabling the barrier to fully perform its role as a safety barrier.



Railway expansion joints

The ballast-guard joint is an expansion joint used for significantly long railway structures, where the variation in movement between the deck ends and the retaining wall is such that a break is required in the ballast.

In contrast, the sub-ballast joint is designed for structures, where the variation in movement between the deck ends and the retaining wall is such that no break is required in the ballast.



1 - CIPEC WD joint

2 - Multiflex joint

3 - Algamod joint

4 - Transpec 4-18

5 - Ballast-guard expansion joint

DYNAMIC PROTECTION DEVICES

Dynamic protection devices are used to protect structures against earthquakes (high acceleration and low cycle number) or vibrations, such as caused by the wind (low acceleration and large cycle number).



Freyssinet has pioneered an end-to-end range of so-called active protection devices. They do not interfere with the structure's static operation and allow for free movement between structures with less effort. However, during a fast movement associated with a seismic event, they create highly specific connections that can be characterized by the way in which they transfer energy.

There are three different types of energy transfer:

- Rigid connections: total energy transfer.
- Connections with high internal damping: energy transfer through dissipation.
- Dynamic isolation between two structures: energy transfer partly through potential energy.

TRANSPEC STU units (Shock Transmission Units)

Shock transmission units increase a structure's hyperstatic performance by distributing the inertial force from a seismic event between a larger number of resisting elements. Fluid viscous dampers can be used as compact high-capacity connectors offering effective performance over a stroke of a few millimetres, thereby transferring the force as soon as the first movements occur.

Options

- TRANSPEC STU - Fuse: shock transmission unit fitted with a force limiter.
- TRANSPEC STU - Bearing: shock transmission unit combined with a TETRON CD pot bearing for an even greater space-saving design.

TRANSPEC FVD dampers (Fluid Viscous Dampers)

Dampers are used to dissipate part of the energy transmitted to a structure during an earthquake and thereby minimize the forces acting on the structure.

Fluid viscous dampers are used to produce devices that satisfy the most stringent laws of energy dissipation and are especially recommended for high-force and low-stroke applications.

Options

- TRANSPEC PDS: damper combined with a prestressed hydraulic spring.
- TRANSPEC FVD - Bearing: damper combined with a TETRON CD pot bearing for an even greater space-saving design.

Dampers help to significantly reduce a structure's TCO and allow the structure to keep functioning after an earthquake, such as a hospital where continuous service is essential. Furthermore, they can provide effective protection for existing structures that do not feature built-in protection.

TRANSPEC SFD vibration dampers (Seal Free Dampers)

Vibration dampers reduce the excitation energy in structures through dissipation. They are designed to withstand a large number of stress cycles.

Freyssinet's fluid viscous and seal free dampers can be used to create effective devices over just a few millimetres with high built-in resistance to fatigue. They are especially suitable for stabilizing very high towers, stadium roofs, and so on.

Dynamic isolation bearings

Isolation bearings are banded elastomeric bearings featuring calibrated horizontal flexibility, which allow for large movements. They are made from elastomeric bands which, through deformation, give the device its horizontal flexibility. Lead-core elastomeric bearings offer a high level of internal damping by using a work-hardened lead core, but their deformation capacity is limited.

Elastomeric bearings with high internal damping due to the intrinsic properties of the elastomer maintain a high deformation capacity.



- 1 - FVD damper
- 2 - Transpec dampers
- 3 - PDS prestressed damper
- 4 - SFD damper, Heron Tower (London, Great Britain)
- 5 - Dynamic isolation bearings - R/JH nuclear research centre (Cadarache, France)

FREYSSINET PRODUCTS COMPANY



We guarantee all our customers around the world the same level of excellence in our products and services by designing and manufacturing our own structural accessories. We can draw on our expertise across the product and system lifecycle to gear our solutions towards a broad array of applications and extreme operating conditions.

Products designed and manufactured by Freyssinet

All of Freyssinet's structural accessories are conceived and designed by an in-house technical department that fine-tunes the accessories in conformity with applicable standards and project specifications. Coordination between the design, the manufacturing solutions and the choice of materials is critical for producing solutions offering peak performance and providing reliable and durable products.

Our in-house mechanical testing centre with its broad array of specific materials carries out full-scale testing on most of our products during both the product development phase and the approval stage.

Certified products

Recognition of Freyssinet's expertise and high-quality processes is reflected in a number of certifications in a wide range of fields. Our structural accessories have been accepted around the world by such organizations as: SETRA (France), TZUS (Czech Republic), AREVA (Nuclear), TNSISS (Russia), ASME (Nuclear), EDF (Nuclear, Hydroelectric), SNCF (France), AECL (Canada), DNV SUBSEA 7 (Offshore), INTRATEC (Nuclear, China), IBDIM (Poland), Politecnico Di Milano (CE marking) and AFAQ-AFNOR (ISO certification).

The CE marking is gradually becoming mandatory for structural accessories when marketed in an EU country. Freyssinet already affixes the CE marking to its banded elastomeric bearings, pot bearings, spherical bearings and specific earthquake protection devices. The CE marking means that the product conforms to the essential requirements of the Construction Products Directive defined by the European Commission and that the product is fit for its intended purpose.



1 - Transpec testing

2 - Tetron CD testing for CE certification

Expertise and industrial know-how

Based in France, our FPC Industrial Division (Freyssinet Products Company) acts as a focal point for all of Freyssinet's expertise in materials, manufacturing, production engineering, control and logistics. It coordinates all of our production activities on a global scale. A large contingent of experts in smelting, elastomers, mechanical engineering and quality travels the length and breadth of the five continents in a bid to define and control the manufacturing processes and guarantee the same level of product quality, irrespective of the production site's location.



Guaranteed quality

The sprawling network of FPC-managed production sites requires daily involvement from the quality control department, which guarantees the quality and conformity of the products supplied. All products are checked by FPC in France at a given moment in time, using its array of cutting-edge measuring instruments.

All checkpoints are defined internally, and FPC issues a certificate of conformity for each product supplied.



3 - Manufacturing TETRON CD bearings

4 - Forging a pot bearing

5 - FPC team of experts

6 - Inspecting the dimensions of a WP expansion joint

7 - Ultrasonic inspection

8 - Inspecting the sphericity of a TETRON SB bearing



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