CE

TETRON CD®

Mechanical pot bearings

Design, Build, Maintain

Freyssinet

SUSTAINABLE TECHNOLOGY

CE

Mechanical pot bearings
TETRON CD®

Tetron CD® pot bearings have been developed by Freyssinet since 1960. They are designed to allow or to block movements between two structures and to transfer the induced reactions. They fully satisfy all current international standards.

The Tetron CD® pot bearings designed according to the EN 1337 standard are all CE certified (no. 1777-CPD-0703). This EC certificate of conformity attests that all provisions concerning the attestation of conformity and the performances described in the annex ZA of the standard EN 1337-5 were applied and that Tetron CD® pot bearings fulfil all prescribed requirements.

Field of use: building and civil engineering works.

Types: fixed bearings, guided sliding bearings and free sliding bearings.

Minimum operating temperature: -35°C for sliding types and –40°C for fixed type.

Elastomeric pad: diameter less than or equal to 1500 mm.

Seals: Three types of internal seals are allowed for the Tetron CD® bearings:

- Brass seal for accumulated sliding path of 500 m
- Stainless steel seal for accumulated path of 1000 m
- Carbon filled PTFE seal for accumulated path of 2000 m

Upon request Freyssinet designs special bearings:

- to withstand specific loads: seismic, upflit, etc.,
- or to add options: load monitoring, jackable, etc.

Contents

Function

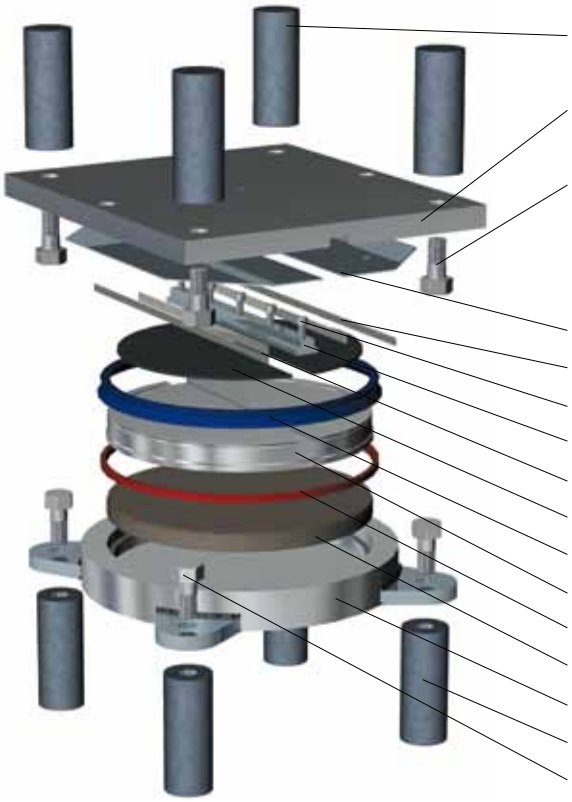
Tetron CD® pot bearings developed by Freyssinet incorporate confined elastomer disks. They form the mechanical connections between a structure and its supports.

These bearings have the following advantages:

- resistance to low to very high vertical loads;
- transmission of high vertical and horizontal forces within small overall dimensions;
- high amplitude movement capacity in one or two horizontal directions with a very low coefficient of friction and without any elastic return force;
- high rotational amplitude along any horizontal axis, with a low resisting moment;
- very high resistance to dynamic loads.

Description

The Tetron CD® pot bearing is composed of an elastomer disk confined in a cylindrical space limited by a hollow base (the pot) and a piston.
The elastomer behaves like an uncompressible liquid. It can thus transmit very high loads and absorb rotations of the structure. If the pot bearing is provided with a sliding plate, it becomes multi-directional and a guide can be added to make it single directional.



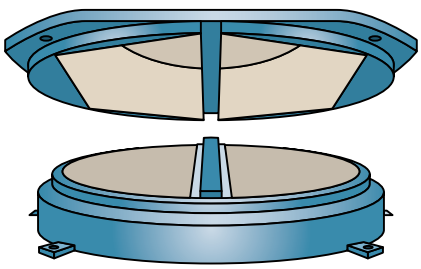
There are three available pot bearing types:

• Tetron CD®/ FX (fixed)

This type consists simply of a pot, a piston and an elastomer disk.
The Tetron CD®/ FX pot bearing behaves like a point hinge and can transmit horizontal forces along any direction either by friction to the structures or by anchor devices.

• Tetron CD®/ GL (Free Sliding)

This type consists of a fixed pot bearing in which the piston is covered by a polytetrafluoroethylene (P.T.F.E) disk on which the upper sliding plate fixed to the superstructure is free to move. The bearing constructed in this manner is free to slide (it is multi-directional) and follows displacements in all horizontal directions.
The Tetron CD® / GL bearing is not designed to transmit horizontal loads.



• Tetron CD®/ GG (Guided sliding)

This type is a multi-directional bearing provided with a guide. This guided sliding (or unidirectional) bearing only enables movements along the guiding direction. The guidance is achieved either by a central guide fixed on the piston or the sliding plate, or by side stops fixed to the plate.
The Tetron CD® / GG pot bearing can transmit horizontal forces in the direction perpendicular to the line of guidance.

CE

Technical specifications

Tetron CD® pot bearings are designed to satisfy specifications of international standards or more stringent requirements as may be needed for some specific projects.

Materials

The source of materials used to make Tetron CD® pot bearings is certified to technical specifications defined in European standard EN 1337-5 or equivalent.

Protection against corrosion

All metal parts in Tetron CD® bearings are protected against corrosion in accordance with project specifications.
This protection may be provided for example by a paint system that may or may not complement zinc / aluminum or zinc metallization.

Attachments

It may be necessary to fix Tetron CD® bearings to the structures using a removable system, depending on the applied horizontal forces.
This attachment is usually made by sockets embedded in the structures onto which the bearings are bolted.

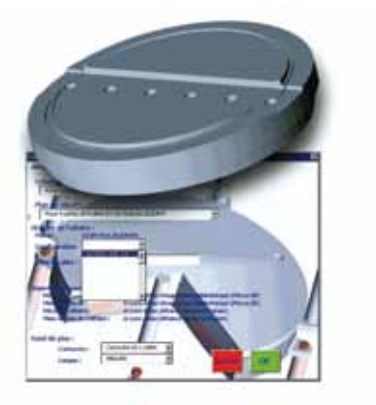
Options

Tetron CD® bearings may be equipped with the following options on request:

- a P.T.F.E. scraper disk protection seal;
- a skirt to provide optimum protection against external aggression;
- plane or skew external distribution plates;
- a movement indicator;
- a vertical load measurement device;
- temporary equipment for launching bridge deck.

There are other options. Please call a Freyssinet local agent for further information.

Sizing



Freyssinet has developed a computer software to design pot bearings taking account of the various applicable international standards (BS, DIN, AASHTO, EN, Austroads, etc.), the immediate environment of pot bearings (structure types, construction methods, etc.) and selected options, and to satisfy each particular case.

This system comprises a calculation software that includes all parameters that have an influence on the dimensions and costs of the components and a CAD link that is capable of automatically plotting drawings of the bearings thus designed.

Apart from information about applicable standards and the environment of bearings, the information necessary for their optimum design is shown in the following table given as an example.

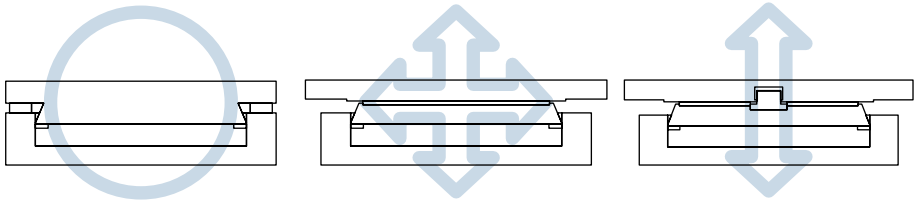
Bearing reference / Location						C0	C0	P1	P1	C2	C2
Bearing identification (FX, GG, GL)						GL	GG	FX	GG	GL	GG
Quantity						1	1	1	1	1	1
Surfaces in contact	Upper surface					Concrete	Concrete	Concrete	Concrete	Mortar	Mortar
	Lower surface					Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
Allowable average contact pressure (MPa)	Upper surface			SLS		23	23	23	23	23	23
				ULS		30	30	30	30	30	30
	Lower surface			SLS		23	23	23	23	23	23
				ULS		30	30	30	30	30	30
Loads (kN)	Serviceability Limit State (SLS)	Vertical		Maximum		5000	5000	20000	20000	5000	5000
				Permanent		4500	4500	18000	18000	4500	4500
				Minimum		2500	2500	10000	10000	2500	2500
		Transverse				0	500	1000	2000	0	500
		Longitudinal				0	0	2000	0	0	0
	Ultimate Limit State (ULS)	Vertical		Maximum		6500	6500	26000	26000	6500	6500
				Minimum		3250	3250	13000	13000	3250	3250
		Transverse				0	650	1300	2600	0	650
		Longitudinal				0	0	2600	0	0	0
	Ultimate Limit State with earthquake (ULSS)	Vertical		Maximum		6500	6500	26000	26000	6500	6500
				Minimum		3250	3250	13000	13000	3250	3250
		Transverse				0	650	1300	2600	0	650
		Longitudinal				0	0	2600	0	0	0
Displacement (mm)	Serviceability Limit State (SLS)	Irreversible		Transverse							
				Longitudinal							
		Reversible		Transverse		10	0		0	10	0
				Longitudinal		50	50		30	50	50
	Ultimate Limit State (ULS)	Irreversible		Transverse							
				Longitudinal							
		Reversible		Transverse		10	0		0	10	0
				Longitudinal		50	50		30	50	50
	Ultimate Limit State with earthquake (ULSS)	Irreversible		Transverse							
				Longitudinal							
		Reversible		Transverse		10	0		0	10	0
				Longitudinal		50	50		30	50	50
Rotation (radians)	Serviceability Limit State (SLS)		Total			0,016	0,016	0,016	0,016	0,016	0,016
	Ultimate Limit State (ULS)		Total			0,022	0,022	0,022	0,022	0,022	0,022
Maximum dimensions (mm)	Pot diameter					800	800	1000	1300	800	800
	Piston diameter (FX)							1000			
	Plate length (GG and GL)					1200	1200		1200	1200	1200
	Plate width (GG and GL)					1100	1100		1100	1100	1100
	Total height					200	200	250	300	200	200
Plate presettings (GG and GL)						20	20		0	20	20

Values given for example

CE

Pot bearing types

We have selected a series of pot bearings for information, to give a rough idea of their dimensions at the preliminary design stage.



Tetron CD®/ FX | Tetron CD®/ GL | Tetron CD®/ GG

Vernègues viaduct, Mediterranean TGV line – France

The dimensions of bearings calculated according to standard EN 1337 are defined in the following tables given for information, for a rotation of 1/100 rad and a maximum concrete stress of 23 N/mm² in the serviceability limit state.

In practice, our bearings are designed individually for each case as a function of standards, particular specifications and actual loads.

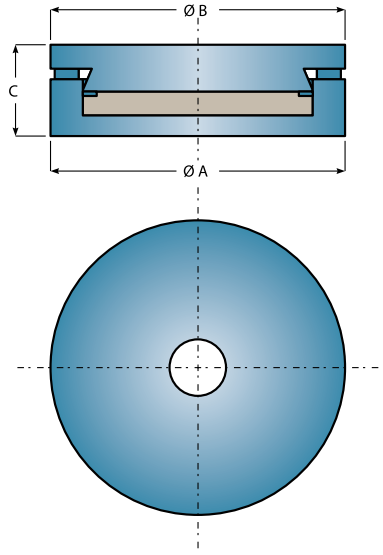
Designation :

FX 12000 - 600

Pot bearing type

Maximum vertical force at serviceability load (kN)

Resultant horizontal force at serviceability load (kN)



Fixed pot bearing: TETRON CD®/ FX

Designation	Ø A (mm)	Ø B (mm)	C (mm)	Weight (kg)
FX 500 - 50	180	200	69	15
FX 1000 - 100	255	265	69	25
FX 1500 - 150	295	320	78	40
FX 2000 - 200	345	365	88	60
FX 2500 - 250	385	415	93	75
FX 3000 - 300	420	450	97	95
FX 3500 - 350	460	490	97	110
FX 4000 - 400	480	520	107	135
FX 4500 - 450	510	560	117	170
FX 5000 - 500	570	600	106	205
FX 6000 - 500	580	640	136	255
FX 7000 - 500	620	670	145	305
FX 8000 - 500	660	710	145	340
FX 9000 - 500	690	750	164	430
FX 10000 - 500	730	795	163	470
FX 12000 - 600	835	865	162	565
FX 14000 - 700	905	935	170	685
FX 16000 - 800	945	997	190	865
FX 18000 - 900	1000	1055	209	1085
FX 20000 - 1000	1095	1125	197	1135
FX 24000 - 1200	1190	1220	216	1475
FX 28000 - 1400	1260	1320	285	2400
FX 30000 - 1500	1305	1375	294	2670
FX 35000 - 1750	1415	1475	312	3280
FX 40000 - 2000	1515	1585	321	3865
FX 45000 - 2250	1610	1680	330	4415
FX 50000 - 2500	1700	1770	368	5620

Values given for information only

Designation :

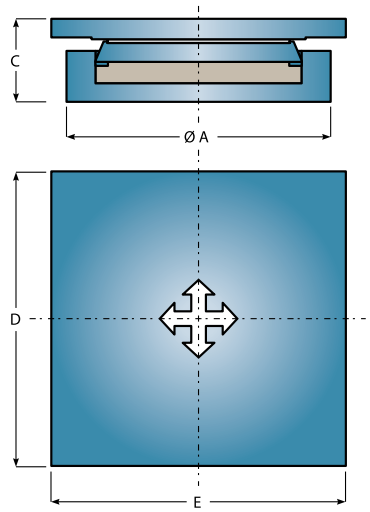
GL 12000 - 50 - 20

Pot bearing type

Maximum vertical force at serviceability load (kN)

Total longitudinal displacement at serviceability load (mm)

Total transverse displacement at serviceability load (mm)



Multidirectional pot bearing: TETRON CD®/ GL

Designation	Ø A (mm)	D (mm)	E (mm)	C (mm)	Weight (kg)
GL 500 - 50 - 20	170	245	225	90	25
GL 1000 - 50 - 20	225	290	175	90	35
GL 1500 - 50 - 20	270	330	315	94	45
GL 2000 - 50 - 20	310	370	355	99	60
GL 2500 - 50 - 20	345	410	395	99	75
GL 3000 - 50 - 20	375	435	430	108	95
GL 3500 - 50 - 20	405	460	465	108	110
GL 4000 - 50 - 20	435	500	495	108	125
GL 4500 - 50 - 20	465	525	530	118	155
GL 5000 - 50 - 20	495	555	550	112	175
GL 6000 - 50 - 20	545	610	605	122	215
GL 7000 - 50 - 20	590	655	655	142	290
GL 8000 - 50 - 20	635	695	695	157	275
GL 9000 - 50 - 20	680	745	740	156	425
GL 10000 - 50 - 20	720	785	785	170	520
GL 12000 - 50 - 20	795	855	860	169	595
GL 14000 - 50 - 20	860	920	920	208	925
GL 16000 - 50 - 20	925	985	985	232	1185
GL 18000 - 50 - 20	985	1045	1045	244	1405
GL 20000 - 50 - 20	1040	1100	1100	250	1610
GL 24000 - 50 - 20	1145	1205	1205	274	2135
GL 28000 - 50 - 20	1240	1300	1300	293	2685
GL 30000 - 50 - 20	1285	1345	1345	317	3095
GL 35000 - 50 - 20	1395	1455	1455	327	3765
GL 40000 - 50 - 20	1495	1555	1555	356	4715
GL 45000 - 50 - 20	1590	1650	1650	365	5455
GL 50000 - 50 - 20	1680	1740	1740	389	6490

Values given for information only

Designation :

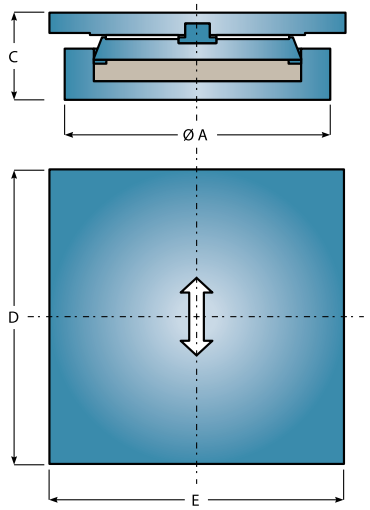
GG 12000 - 600 - 50

Pot bearing type

Maximum vertical force at serviceability load (kN)

Maximum transverse force at serviceability load (kN)

Total longitudinal displacement at serviceability load (mm)



Unidirectional pot bearing: TETRON CD®/ GG

Designation	Ø A (mm)	D (mm)	E (mm)	C (mm)	Weight (kg)
GG 500 - 50 - 50	205	270	235	100	30
GG 1000 - 100 - 50	270	325	290	104	45
GG 1500 - 150 - 50	325	365	330	104	60
GG 2000 - 200 - 50	355	390	380	109	80
GG 2500 - 250 - 50	400	425	415	113	100
GG 3000 - 300 - 50	430	445	440	118	120
GG 3500 - 350 - 50	460	475	470	123	145
GG 4000 - 400 - 50	490	505	505	123	160
GG 4500 - 450 - 50	520	535	535	137	200
GG 5000 - 500 - 50	550	565	565	142	230
GG 6000 - 500 - 50	590	615	615	162	295
GG 7000 - 500 - 50	620	660	660	162	350
GG 8000 - 500 - 50	660	705	705	167	415
GG 9000 - 500 - 50	690	745	745	181	500
GG 10000 - 500 - 50	730	785	785	185	560
GG 12000 - 600 - 50	820	860	860	184	675
GG 14000 - 700 - 50	870	930	930	213	930
GG 16000 - 800 - 50	935	995	995	242	1245
GG 18000 - 900 - 50	1000	1055	1055	246	1400
GG 20000 - 1000 - 50	1050	1110	1110	265	1710
GG 24000 - 1200 - 50	1160	1215	1215	284	2200
GG 28000 - 1400 - 50	1255	1315	1315	327	2970
GG 30000 - 1500 - 50	1300	1360	1360	336	3300
GG 35000 - 1750 - 50	1410	1470	1470	365	4240
GG 40000 - 2000 - 50	1510	1570	1570	363	4780
GG 45000 - 2250 - 50	1605	1665	1665	382	5690
GG 50000 - 2500 - 50	1695	1755	1755	410	6800

Values given for information only

CE

Quality assurance

Tetron CD® bearings are made using procedures defined in the Freyssinet Quality Assurance Plan according to ISO 9002. This guarantees that they are conform with contractual requirements.

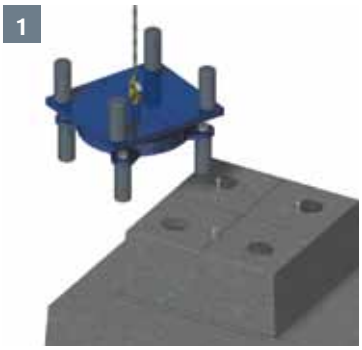
Test benches

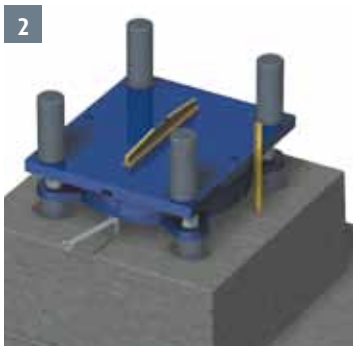
The quality and operation of Tetron CD® pot bearings are regularly checked by tests according to the different applicable standards (AAHSTO, BS, EN 1337, DIN, etc.) such as:

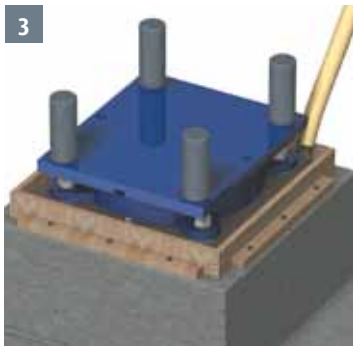
- vertical load;
- combined vertical and horizontal loads;
- operation with rotation;
- wear and friction.

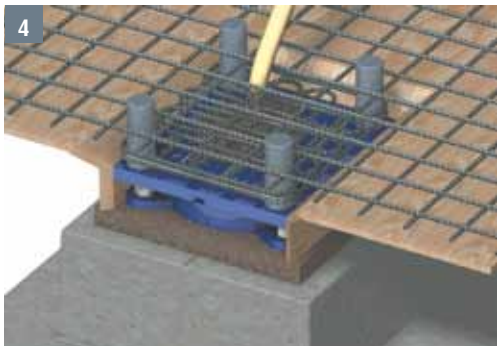
Installation

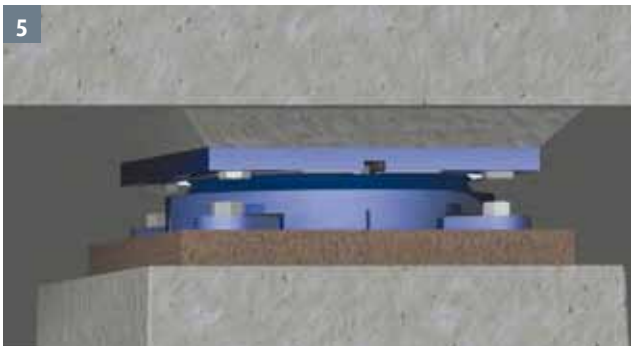
Correct installation of Tetron CD® pot bearings is a difficult operation and decisive for durability. Lack of precision or any mistake in the various installation steps can introduce forces that damage the pot bearings, or even jeopardize the integrity of the structures.
There is a specific installation procedure for every project.
The following sketches illustrates the installation of a Tetron CD® pot bearing for a cast in situ structure.











1/ Place the bearing on its support
2/ Adjust the bearing
3/ Grout the base
4/ Formwork, reinforcement and pour concrete of the superstructure
5/ Release temporary attachments.

Anti-Seismic Tetron CD® pot bearings

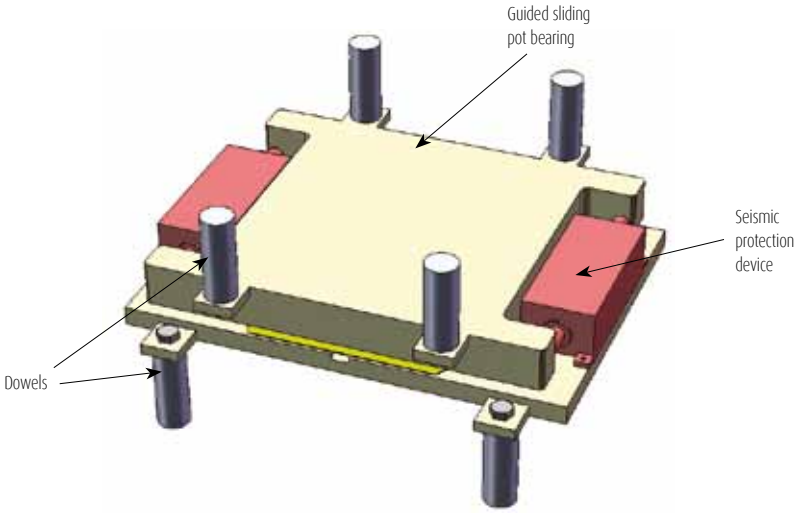
Tetron CD® pot bearings are also specifically designed to withstand the large forces and movements induced by seismic events. Fixed and guided bearings may be calculated to resist horizontal forces which are sometimes of the same magnitude as the vertical reaction.

C380 Viaduct – Taiwan: pot bearings for very high horizontal seismic loads

Sungai Prai – Malaysia:
pot bearing resistant to uplift

Under extreme seismic events, bearings may be required to resist uplift forces, to prevent for example a deck from overturning.

Guided sliding Tetron CD® pot bearings can be also combined with seismic protection devices, shock transmission units or dampers. They will allow the free displacement of the superstructure except during seismic events.



CE

Monitored and jackable Tetron CD® pot bearings

During the fabrication process Tetron CD® pot bearings can be fitted with internal load gauges to monitor the bearing reaction after installation.

When the superstructure is required to be lifted several millimetres during the lifetime of the bridge, then Tetron CD® pot bearings can be designed to be injected after installation. Liquid Silicon Rubber is injected at high pressure and will polymerize.

Weighable pot bearing Prébois viaduct – Switzerland

Jackable bearings can also be designed by combining a Tetron CD® pot bearing and a Freyssinet flat jack. The stroke of the flat jack allows to lift a few centimetres.

Bridge over the Some – Switzerland: pot bearing installed on flat jack.

Some References

1/ Venezuela, Orenoque Bridge
2/ France, Tours Palais des Congrès
3/ United Kingdom, London Saint Pancras Station
4/ France, Ventabren viaduct, railways bridge
5/ France, Allone bridge
6/ France, Euralille

More than 60 offices worldwide

AMERICAS

- **Argentina**
  Freyssinet - Tierra Armada S.A.
- **Brazil**
  Freyssinet Brazil Ltda
- **Canada**
  Freyssinet Canada Ltée
- **Chile**
  Freyssinet Tierra Armada Chile S.A
- **Colombia**
  Freyssinet Colombie
- **El Salvador**
  Fessic S.A De C.V.
- **Mexico**
  Freyssinet de Mexico - Tierra Armada S.A.
- **Panama**
  Freyssinet
- **United States**
  Freyssinet Inc.
- **Venezuela**
  Freyssinet - Tierra Armada CA

EUROPE

- **Belgium**
  Freyssinet Belgium N.V.
- **Bulgaria**
  Freyssinet
- **Danemark**
  A/S Skandinavisk Spaendbeton
- **Estonia**
  Latvijas Tilti
- **France**
  Freyssinet France
  Freyssinet International & Cie
- **Hungary**
  Pannon Freyssinet Kft
- **Iceland**
  A/S Skandinavisk Spaendbeton
- **Ireland**
  Freyssinet Ireland
- **Latvia**
  Latvijas Tilti
- **Lithuania**
  Latvijas Tilti
- **Macedonia**
  Freyssinet Balkans
- **Netherlands**
  Freyssinet Nederland B.V.
- **Norway**
  A/S Skandinavisk Spaendbeton
- **Poland**
  Freyssinet Polska Sp. z.o.o
- **Portugal**
  Freyssinet - Terra Armada S.A
- **Romania**
  Freyrom
- **Russia**
  Freyssinet
- **Serbia**
  Freyssinet
- **Slovenia**
  Freyssinet Adria SI d.o.o.
- **Spain**
  Freyssinet S.A.
- **Sweden**
  A/S Skandinavisk Spaendbeton
- **Switzerland**
  Freyssinet S.A.
- **Turkey**
  Freysas
- **United Kingdom**
  Freyssinet Ltd

AFRICA AND MIDDLE EAST

- **Abu Dhabi**
  Freyssinet Middle East LLC
- **Algeria**
  Freyssinet Algérie
- **Dubai**
  Freyssinet Gulf LLC
- **Egypt**
  Freyssinet Menard Egypt SAE
- **Jordan**
  Freyssinet Jordan LLC
- **Koweit**
  Freyssinet Koweit
- **Morocco**
  Freyssima
- **Oman**
  Freyssinet Arabian Sea LLC
- **Qatar**
  Freyssinet Menard Qatar WLL
- **Saudi Arabia**
  Freyssinet Menard Saudi Arabia Ltd.
- **Sharja**
  Freyssinet Menard
  Northern Emirates LLC
- **South Africa**
  Freyssinet Posten (Pty) Ltd
- **Tunisia**
  Freyssinet

ASIA

- **Hong Kong**
  Freyssinet Hong Kong Ltd
  Freyssinet Insight Sewer Services Ltd
- **India**
  Freyssinet Menard INDIA Pvt Ltd
- **Indonesia**
  PT Freyssinet Total Technology
- **Japan**
  Freyssinet KK Japon
- **Macau**
  Freyssinet Macau Ltd
- **Malaysia**
  Freyssinet PSC (M) SDN BHD
- **Pakistan**
  Freypak Ltd
- **Singapore**
  PSC Freyssinet (S) Pte. Ltd
- **South Korea**
  Freyssinet Korea Co. Ltd
- **Taiwan**
  Freyssinet Taiwan Engineering
- **Thailand**
  Freyssinet Thailand Ltd
- **Vietnam**
  Freyssinet Vietnam

OCEANIA

- **Australia**
  Freyssinet Australia Pty Ltd
- **New Zealand**
  Freyssinet New Zealand Ltd

FREYSSINET
SUSTAINABLE TECHNOLOGY

1 bis, rue du Petit Clamart 78140 Vélizy-Villacoublay - France
Tel: +33 1 46 01 84 84 - Fax: +33 1 46 01 85 85
www.freyssinet.com

April 2010