Internal Elastomeric Damper

- Invisible
- Damping from low amplitude
- Long endurance
- Maintenance friendly

Stay cable dampers

Technical Sheet Reference: FT En C I 1 16

FREYSSINET
SUSTAINABLE TECHNOLOGY

Introduction

Stay cables are key elements of cable stayed structures.
Under some conditions, stay cables can accumulate energy and oscillate with high amplitudes, particularly when they are subject to periodic excitations. There are two main causes of these vibrations:

- Displacement of the anchors under the effect of traffic or wind loads
- The effect of wind acting on the cables directly

These oscillations rarely endanger the structure, but they can make users feel uncomfortable and they can damage the stay cables if they are not controlled.
Since stay cables have a fairly low intrinsic damping, FREYSSINET has developed a range of dampers to increase the damping of stay cables and thus limit or eliminate vibrations.
For aesthetics and practical considerations, when possible, the dampers are located inside a guide tube which is linked to the formwork tube to be invisible from the outside. Such dampers are called internal. Their efficiency is optimized according to the configuration of each project.
The IED, Internal Elastomeric Damper, is the less powerful device among the internal dampers range of FREYSSINET.

Description

The damper is placed around the bundle of strands and inside a metallic tube called the guide tube.
The latter is fixed rigidly to the structure through a bolted connection that enables inspection and eccentricity correction.
The Internal Elastomeric Damper has a diabolo shape that has been designed to maximize the sheared area when the cable moves in any direction.
Shearing in high damping rubber dissipates the vibration energy.

Applications

The IED technology is equally applicable to new structures and existing structures. It can be adapted to all types of stay cable systems (stay cables with parallel wires, stay cables with parallel strands, locked coil cables, etc.) and all types of cable stayed structures (bridges, roofs, etc.)

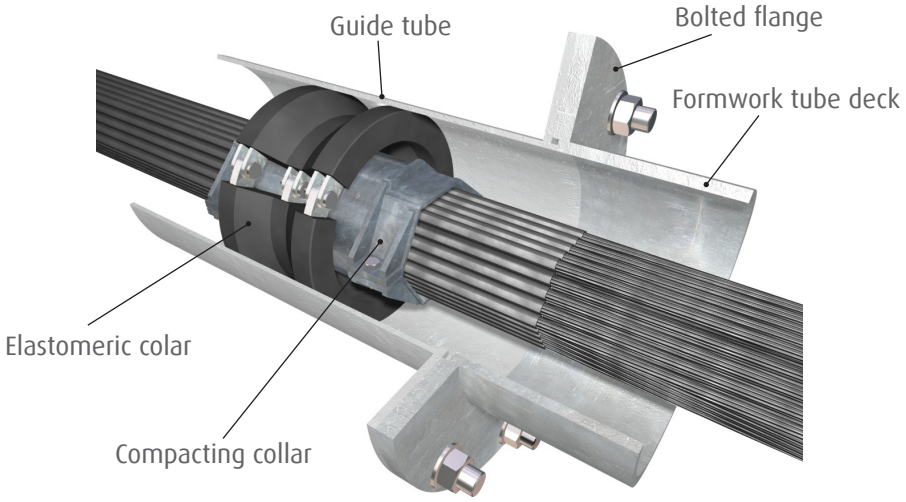
Materials & Corrosion Protection

Materials

Tubes & steel components:	S355 (EN 10025)
Screws:	Class 8.8 (NF E 25-112)
Bolts:	Class 10.9 (NF E 27-701)
Elastomeric collar:	High damping rubber

Corrosion protection

Tubes & collars:	Hot dip galvanised (ISO 1461) or Thermally sprayed zinc
Threaded parts:	Zinc + Bichromate (EN 12339)
Bolts & screws:	Galvanised or zinc bichromated



Performances

Damping

The damping of a cable is characterised by its damping ratio to critical ξ or its logarithmic decrement δ. The latter is preferred here as it is linked to the physical behaviour of the cable:

$$\delta = \ln\left(\frac{a_n}{a_{n+1}}\right),$$

where a_{n+1} and a_n are the vibration amplitudes of the free length of the stay cable in the $(n + 1)^{th}$ and n^{th} cycles respectively, for any two consecutive cycles.

Note that: $\delta = 2\pi\xi$

Damping performance depends on the cable length L, the distance x from the cable anchorage to the damper, and the stiffness of the damper support. Freyssinet Technical Department has developed proprietary software to design the damping solution that is optimal for each given project.

- Maximum theoretical efficiency: $\delta_{max} = \pi \frac{X}{L}$,
- Endurance: 100 km of pulsation

Internal Elastomeric Damper

FREYSSINET
SUSTAINABLE TECHNOLOGY

Advantages

IED dampers have many advantages:

- Unseen since the damper is inside a guide tube
- No exposed metallic part
- No mechanical part in motion, hence hardly any maintenance,
- Removable and replaceable.

Installation

The IED damper is assembled in our factory so that all alignments are checked before installation.
The dampers can be installed after erection and final stressing of the stay cables. The installation requires access to the bottom of the cable at the guide tube location.
On site, collars, pistons, screws and washers must be prepared and placed closely to the stay cable.
The damper is installed through an access window according to the required sequence:

- Place compacting collar and tighten it
- Install the elastomeric collar and conned it
- Lower the guide tube and adjust it
- Tighten the bolts (torque)
- Lower the duct and the anti-vandalism tube.

The IED installation requires mechanical means only. Several control points ensure an accurate positioning of each element.

IED installation on Moscow ice rink cables

Tests

Freyssinet has carried out laboratory tests to demonstrate the efficiency of IED, including:

- test of resistance,
- dynamic characteristics of IED,
- fatigue resistance of IED.

In situ damping measurements were also made on different bridges throughout the world in order to confirm the theoretical efficiency of these devices.

Geometrical dimensions

The IED is usually proposed for short stay cable (length < 80 m)

- Stay eccentric adjustment: +/- 20 mm
- Effective damper stroke: +/- 10 mm
- Recommended position: x = 0.010 L (L = Stay cabe length / x = distance from anchorage)

Unit	Outer diameter	Length
19	276	500
27	298	500
31/37	328	500
55/61	388	500

Serebryany Bor (Russia)

References

- Rao II bridge (Vietnam) - 2011 - 20 units on service
- Serebriany Bor bridge (Russia) - 2007 - 20 units on service
- Millau bridge (France) - 2004 - 42 units on service
- Charles River bridge (USA) - 2002 - 116 units on service
- M0 (hongaria) - 2008 - 8 units on service
- Moscow Ice Rink roof (Russia) - 2004 - 19 units on service
- Plock bridge (Poland) - 2004 - 52 units on service
- Vasco Da Gama bridge (Portugal) - 1998 - 64 units on service

Millau viaduct (France)

Fabrication and distribution

FPC
Zone d'activité du Monay
Saint Eusèbe – BP18
71210 Montchanin
Tel.: +33 (0)3 85 73 69 00
Fax: +33 (0)3 85 73 69 01

COMMERCIAL CONTACT
Philippe GUGGEMOS
Tel.: + 33 (0)1 46 01 84 63
philippe.guggemos@freyssinet.com

TECHNICAL CONTACT
Maté BORBAS
Technical Department
Tel.: + 33 (0)1 46 01 85 10
mate.borbas@freyssinet.com

Local commercial contact