Case Study

Long-term Protection from Structure-borne Noise in the Centre of Grenoble (FR)

- Protection from vibration immissions caused by the tramway
- Elastic bearing with full-surface mass-spring system made of Sylomer®
- Unchanged high performance after 15 years of use

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Permanent protection from vibration immissions caused by the tramway

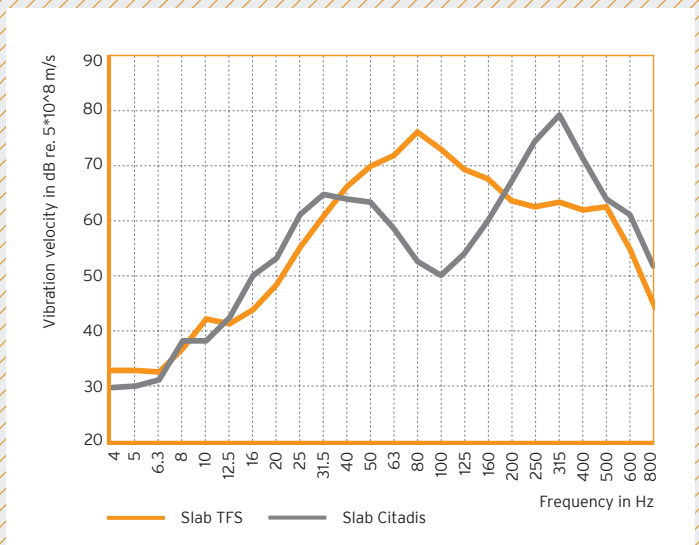
The project

To protect the urban environment from vibrations caused by passing trams, Grenoble relies on mass-spring systems in the city centre. Some sections have been decoupled using Sylomer® solutions from Getzner for more than 30 years without any need for maintenance. Getzner investigated the long-term performance of the system on the section in Avenue de Valmy, which went into operation in 2004.

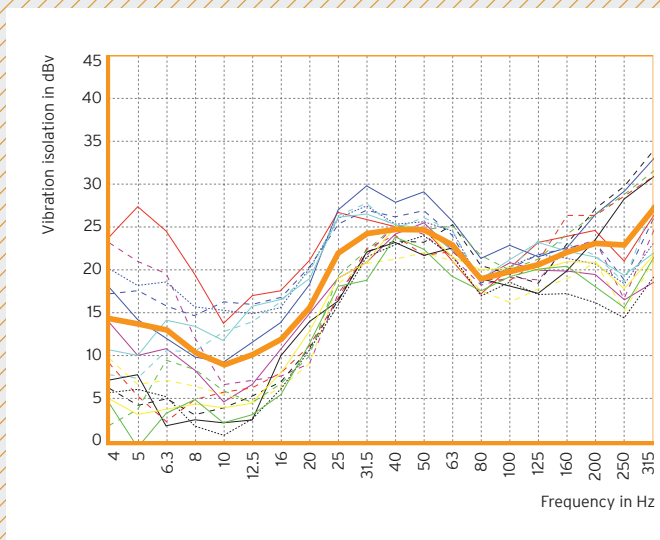
The tramway in Grenoble, originally built at the end of the 19th century stopped operation in 1952, and was finally reintroduced in 1987. Back then, it was the first urban transport system in the world to operate exclusively with low-floor trams.
Today, the tram network extends over 47 km and comprises 81 stations. The lines are built with a standard gauge of 1435 mm. The operator SEMITAG uses two Alstom sets of type TFS and Citadis 402.

Most of the sections in the city centre are elastically supported on mass-spring systems to protect the surrounding area from vibrations. In 2004, SEMITAG started to run trams on the section in Avenue de Valmy, which now carries line C. Here too, the plans included a vibration-attenuating system in order to reduce structure-borne noise. The specifications stated an isolation performance of at least 20 dB at 63 Hz compared to a conventionally built superstructure system.

The TFS and Citadis tram types in use produce significantly different vibration emissions at 63 Hz …



… that are reliably attenuated in both cases by the Getzner mass-spring system with an average of 23 dB.



The structure-borne noise insulation was determined by means of 16 measurements using vibration sensors on the on the elastically Sylomer® supported slab and the isolated pavement.

The Getzner solution

To protect surrounding buildings from vibrations, a Sylomer® LG28 mass-spring system from Getzner was installed. After 15 years of operation, the long-term performance of the Getzner solution in the Avenue de Valmy was measured using a range of tests.

Its effectiveness was measured under real-life conditions. The tests took into account the loads caused by the types of trains running and correctly record the non-linear behaviour of the elastomers. The vibration measurements were carried out simultaneously on the elastically mounted track slab and the isolated pavement.

Required damping efficiency achieved

The degree of structure-borne noise insulation was evaluated by means of 16 measurements during tram passes in both directions. The results showed insulation performance of 23 dB, easily outperforming the specified insulating value of 20 dB at a frequency of 63 Hz – even after 15 years of operation. "In our opinion, the clean design of the side joints is a key factor in the outstanding long-term performance of the mass-spring system. A well-maintained joint prevents the occurrence of structure-borne noise bridges that reduce the insulation effect," explains Herbert Gehrig, Project Manager at Getzner.

Consistent material properties after 15 years

The natural frequency of the mass-spring system was recorded using impulse excitation in a load-free state. The results showed a frequency of 25.4 Hz – a difference of just 7 % compared to the specified target frequency of 27.2 Hz. This shows that the Getzner mass-spring system is delivering top performance in the isolation of immissions of both tram types in use in Grenoble, even after a period of 15 years.

Advantages for customers

- Criteria for structure-borne noise insulation continue to be fulfilled
- Natural frequency of the system virtually unchanged after 15 years in use
- Reliable, long-lasting elasticity

Feedback

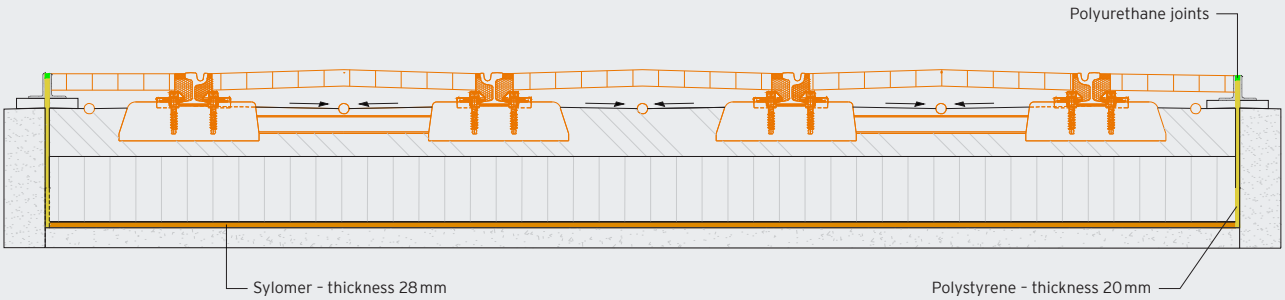
What does the client say about the project?

"Despite the climatically demanding conditions in Grenoble and the intensive use of the system, the Getzner solution isolates vibrations just as effectively now as when it was first installed. Thanks to the results, we can go ahead with the planned adjustments of the track in the centre with peace of mind."

Marc Beaumont
Rail Engineer | Technical Expert
Ingérop

- 14h03-Citadis-AT (max)
- 14h09-Citadis
- 14h11-Citadis-AT
- 14h13-TFS-AT
- 14h16-TFS-AT
- 14h17-TFS
- 14h19-Citadis-AT
- 14h20-Citadis
- 14h26-Citadis
- 14h27-Citadis
- 14h30-TFS (min)
- 14h31-TFS
- 14h33-TFS
- 14h36-Citadis
- 14h42-Citadis
- 14h44-TFS
- Mean

Facts and figures



Operating company:	Société d'Economie Mixte des Transports Publics de l'Agglomération Grenobloise (SEMITAG), Grenoble, France
Implemented:	2004
Solution:	Sylomer® LG28 full-surface mass-spring system, Natural frequency 27.2 Hz
Load:	Approx. 60 million metric tons in 15 years of use (as of 2019)
Getzner	
Project Manager:	Herbert Gehrig
Project support:	Ingérop, Rueil-Malmaison, France

Getzner Werkstoffe GmbH

Founded:	1969 (as a subsidiary of Getzner, Mutter & Cie)
Chief Executive Officer:	Jürgen Rainalter
Employees:	490 (of which 360 in Buers)
Turnover in 2020:	EUR 105.5 million
Business areas:	Railway, construction, industry
Headquarters:	Buers (AT)
Locations:	Peking, Kunshan (CN), Munich, Berlin, Stuttgart (DE), Lyon, Paris (FR), Pune (IN), Amman (JO), Tokyo (JP), Charlotte (US), Melbourne (AU)
Ratio of exports:	91 %

Railway references (extract)

- Graz tramway (AT)
- Paris tramway (FR)
- Budapest tramway (HU)
- Luxembourg tramway (LU)
- Warsaw tramway (PL)
- Bratislava tramway (SK)
- Nottingham tramway (UK)