

Vibration Isolation and Railway Technology.



**CHRISTIAN
BERNER**

Expect more

Vibration isolation with mass-spring systems

Our solutions provide freedom from disturbances

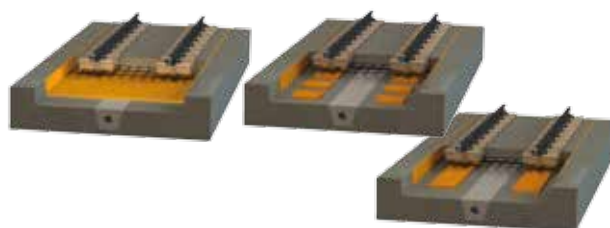
Vibration isolated track systems using Sylomer® and Syldodyn® make it possible to build rail bound traffic below or next to residential and other premises. Mass-spring systems satisfy much higher demands on vibration isolation in a cost efficient manner.

Our solutions provide freedom from disturbances during the complete lifetime of the track.

Maximum isolation at the disturbing source

Rail bound traffic can be planned extremely close to residential areas without a risk of vibration and structure-borne noise levels where we wish for peace and quiet. The mass-spring technology not only means maximum isolation at the disturbance source, but also a railway system with a long life and low maintenance costs.

However, we will not deny it, the design places high demands on the design engineers and supplier, who need to manage a vast number of parameters and have a holistic view, to achieve the objective.



Production methods, characteristics and performance dictate the choice of system

Mass-spring systems with Sylomer® and Syldodyn® can be designed in three different ways. Full surface mats, linear support or discrete bearings.

Examples of implemented projects:

- Tram line - Chalmers tunnel, Södra vägen, Gothenburg
- Tram line & Metro - Berlin, Munich, Augsburg
- Light rail transit system, - Krakow
- Tram line & Metro - Teneriffa, Barcelona, Madrid
- Tram lines - Lyon, Nice, Bordeaux, Marseille
- Railway, ÖBB - Arlberg tunnel, Lainzer tunnel
- Tram line & Metro - Firenze, Bergamo, Milan
- Railway city - Stockholm



Vibration isolation with mass-spring systems



Rail system with Gerb steel spring elements is the most reliable and effective system for vibration and structure-borne noise isolation. They make it possible to build rail bound traffic below or above housing and other premises irrespective of whether the track is laid on the ground, bridges, viaducts or in tunnels. A mass-spring system with Gerb guarantees that you receive the best system available.

Mass spring system with steel springs

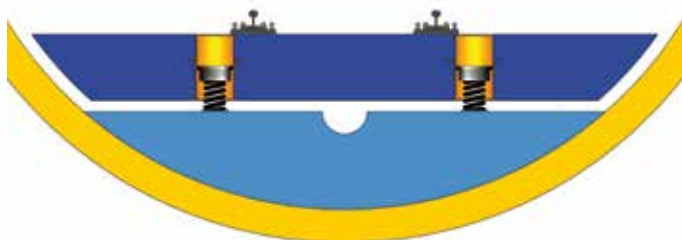
At times rail bound traffic and buildings must share a small area, which places the highest possible demands on the railway system's vibration isolation. Using steel springs the mass-spring system technology is driven to it's ultimate limits for what is possible.

The Gerb system provides maximum isolation at the disturbance source with a long life and low maintenance costs. It is flexible and can be inspected, furthermore the elements are replaceable if something, against all odds, should go wrong. Viscodamper® can also be chosen as an addition, to hone the system yet further, to produce optimum damping system.



Examples of implemented projects:

- Tram line - Wessels plass, Oslo
- Tram line & metro - Heidelberg, Bochum, Stuttgart, Cologne, Frankfurt, Berlin
- Tram line - Basel, Switzerland
- Metro, Docklands Light Railway - London, Lewisham, Woolwich-Arsenal
- Underground - Moscow



Mass-spring systems with Gerb integrated elements where the concrete slab is lifted up afterwards.

Vibration isolation with ballast mats

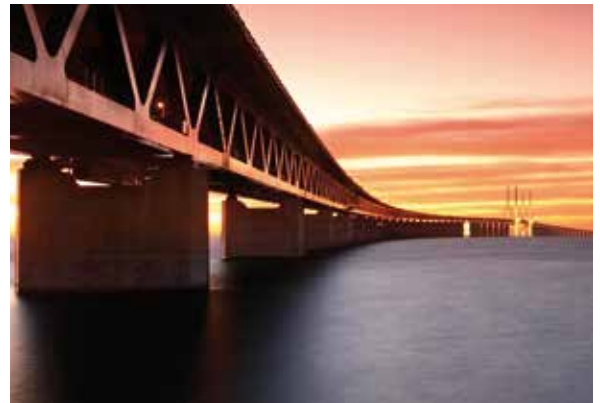
Sylomer® and Sylodyn® mats give the best possible vibration isolation for ballast tracks. Kraiburg ballast mats offer a cost effective solution where only a protective effect is sought. Our wide range of ballast mats represents a cost optimum solution with a documented long life.

Counteracting disturbance demands high elasticity

Railway systems with ballast are built for long life and operating reliability. Demands are frequently made on higher elasticity to successfully counteract disturbances to the surroundings, without foregoing rail quality.

We have long experience in the use of ballast mats for structure-borne noise isolation and know how the material works after 50 years.

Knowledge of the effects of water and frost or extreme strain is particularly important to conform to the demands from the railway authorities. Accordingly, we have successively acquired experience and built-up documentation.



Examples of implemented projects:

- Railway, Öresund bridge - Banverket
- Railway, Tröingeberg tunnel - Banverket
- Railway, Asker-Skøyen - Jernbaneverket
- Railway, Fruäng line - SL, Stockholm
- Railway, Uppsala travel centre - Banverket
- Tram line, Stigbergsliden - Trafikkontoret, Göteborg
- Tram line, Metro line - Oslo Sporveier, Oslo
- Railway, Årsta project - Banverket
- Railway, Stäket tunnel - Banverket
- Metro/S-Ban, Farum line - BaneDanmark
- Railway, Lysaker station - Jernbaneverket

Vibration isolation with Under Sleeper Pads



USP (Under Sleeper Pads) of Sylomer® and Syldyn® offer the best possible vibration isolation at the lowest possible cost where requirements on structure-borne noise isolation are lower, or where only a protective effect is sought. Sylomer® is probably the most documented elastomer on the market.

Our wide range represents a cost optimum solution with a documented long life.

USP - a strong alternative to ballastmats

Under Sleeper Pads are a cost efficient option to ballast mats when demands are lower. It is a very compelling option when performing measures on existing track and renovating as you only need to excavate a minimum of track ballast. USP can be used together with both wooden and concrete sleepers and installation instructions are available for most production methods.

Of course the solutions are optimised through the traffic, tracks and the required properties control the choice of USP. We therefore have over fifteen different standard models to cover all requirements.

Examples of implemented projects:

- Railway, City tunnel - Banverket
- Railway, Öresund link - Banverket
- Railway, Furet Halmstad - Banverket
- Underground, Points - SL, Stockholm
- Tram line, Kolsås line - Oslo sporveier, Oslo
- Tram line, Grønland-Tøyen - Oslo sporveier, Oslo
- Railway, Brynsbakken - Jernbaneverket
- Metro, Line east - Metro Amsterdam, Amsterdam



Noisetrap[®] - a smart sound screen

A silent noise screen with acoustic advantages

The design of the screen parts allow shaping the screen based on the environment. Sweeping shapes follow variations in elevation without "step" effects.

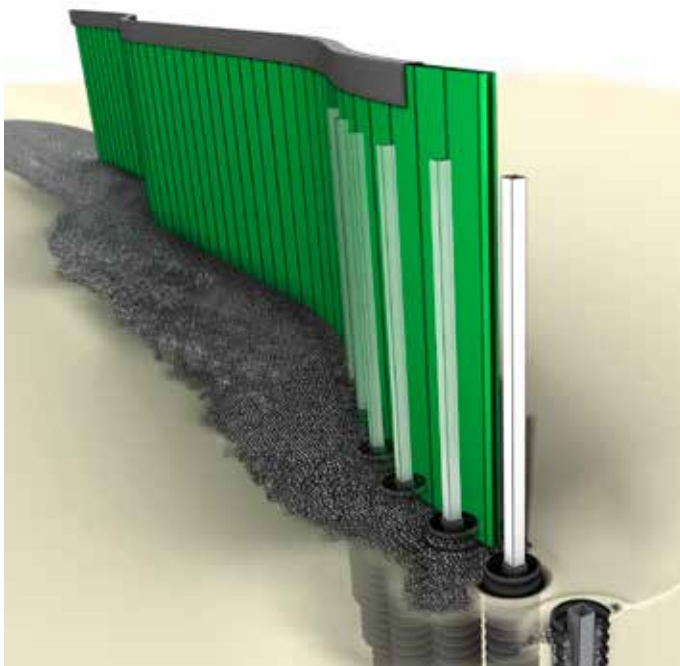
The material, high density polyethylene HDPE, is known for its durability and is environmentally friendly, 100% inorganic and virtually unaffected by weather and environmental effects.

Very low life cycle cost due to low maintenance need. Noisetrap can be washed with high pressure water without chemicals.



A smart noise screen with many advantages

- Three acoustic functions: Screening, insulation, absorption
- Double wall construction
- Technology from room acoustics: tuned Helmholtz resonators



- Sound insulation 33 dB (class B3)
- Absorption class 19-21 dB (class A4) (tuned against disturbing frequencies typical for rail applications)
- Patented connection between wall parts allows for flowing shapes (reduces reflections)
- Two types available: NoiseTrap[®] H (with Helmholtz resonators) and NoiseTrap[®] S (standard, without Helmholtz resonators)

And more advantages

- Long service life (calculated to >150 years in soil conditions)
- Does not crack, resistant to noise leaks
- Rain and weather proof
- Anchored to the ground ensuring no noise leakage
- Maintenance-free and washable
- UV proof
- Unpaintable – graffiti can be washed off with high pressure water. No "shadows" are left after removing graffiti

STRAILastic Embedded Rail Systems



STRAILastic systems for street rail

STRAILastic offers a wide range of products to reduce structure- and air-borne noise due to urban rail and tram networks. The systems have long life expectancy and are maintenance-free. The vertical elasticity, controlling vibration isolation, can be tailored to meet project specific requirements on noise and vibration levels with respect to axle loads and safety requirements.

As the materials are vulcanized at high pressure and temperature the materials are UV proof, does not absorb water, are extremely temperature-stable.



STRAILastic_S TOR

The optimised STRAILastic Chamber Filling Systems consists of a high-quality new rubber rail foot profile in combination with chamber filling elements that reach up to the top of the rail. The system is installed in standard tracks or in tracks with sleeper constructions and can be combined with mass spring systems to meet even higher requirements of vibration isolation.

Due to their special geometries, the profiles can be installed easily and quickly without the need for adhesives, reducing construction time considerably. As the chamber filler covers the rail from foot to top and has a strong surface designed to handle heavy loads there is no need for elastic joints between rail and asphalt, reducing the maintenance of the track significantly.



System benefits

- Vulcanized rubber, UV and ozone resistance and colour stable
- Stray current insulation according to DIN EN 50122-2
- Quick easy installation
- Environmentally friendly (100% recyclable)

Image 1: STRAILastic_S, this version with track section base plate GRS for cost effective installation.

Image 2: Casting the concrete slab under the STRAILastic_S system.

Image 3: STRAILastic_S installation in street environment.

Fight noise where it is created

STRAILastic_A

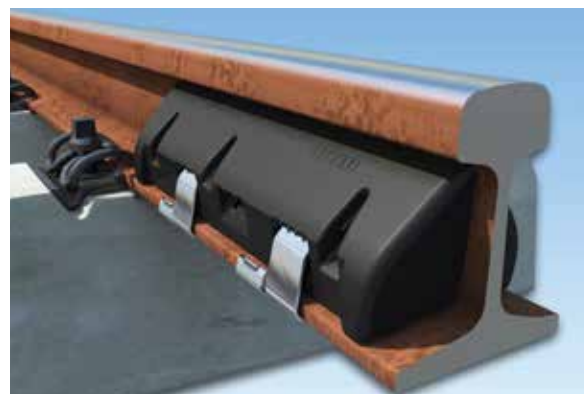
STRAILastic_A synth & inox consist of a heavy elastomer compound, produced in a specialised vulcanizing process. Due to its large mass, the absorber works as a mass damper. In addition, the elastic material increases the overall damping effect. Thus, noise emissions are minimised in two ways.

STRAILastic_A synth/inox are ideally used to reduce noise from tracks running through residential and other urban areas as well as across steel bridges. Due to the special production process and the chosen materials, STRAILastic_A synth & inox are highly effective for the passive damping of vibrations and noise emissions. The passive damping converts the kinetic energy into heat.

STRAILastic_A test report

At the Roslagsbanan near Stockholm, noise and vibration measurements were made to examine the effect of wheel dampers and rail web dampers as a noise reduction measure.

The operators of the Roslagsbanan had to achieve a noise-related improvement of approx. 3.5 dB(A) because of the previous change from wooden sleepers to concrete sleepers



resulting in a too high noise level. Measurements were made at two measurement sites (straight track and curved track) and on four occasions. The measurements investigated the following parameters: wheel dampers alone, STRAILastic_A synth alone and both combined.

The damped wheels achieved an average improvement of 1.1 dB(A) units. The measurement of the combination achieved therefore an average of 3.8 dB(A) units.

Image 1: STRAILastic_A synth metal-free with plastic clamp.

Image 2: STRAILastic_A inox with steel core and rust-proof stainless steel clamps, no parts sticking out outside of rail foot.

Image 3: STRAILastic_A was tested on track Roslagsbanan, Stockholm.

The established green track system



STRAILastic_R

STRAILastic_R is an innovative system for green track. A method that enables an expansion of the city's green areas.

Green tracks retain a large amount of rain water and they bind road dust, which improves the micro-environment in the urban centres. STRAILastic_R is stray current insulating and UV-light resistant. There is an easy maintenance access to rails and fastenings.

Advantages

- Adaptable to all track superstructures
- Can be used by emergency services vehicles
- Stray current insulating and UV-light resistant
- High mechanical strengths by vulcanization
- Smooth surface easy to clean of braking sand
- Environmentally friendly, recyclable
- Easy maintenance access

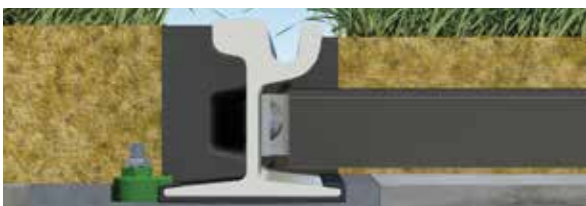


Image 1: STRAILastic_R reduces air-borne noise up to 2dB(A) due to encapsulation of the rails.

Image 2: Type Augsburg: Raise the lawn or sedum surfaces up to rail head height. Natural attenuation and protection of the fixings.

Image 3: Type Zurich: Ingenious self-supporting design, no need for adhesive/clamps and the rail is completely enclosed.

Image 4: Type Belgrad: For grooved rails.

Image 5: Type DeLijn: Stable, corrosion resistant and reasonably priced lawn edge profil.



Increased elasticity gives increased availability

Increased track availability

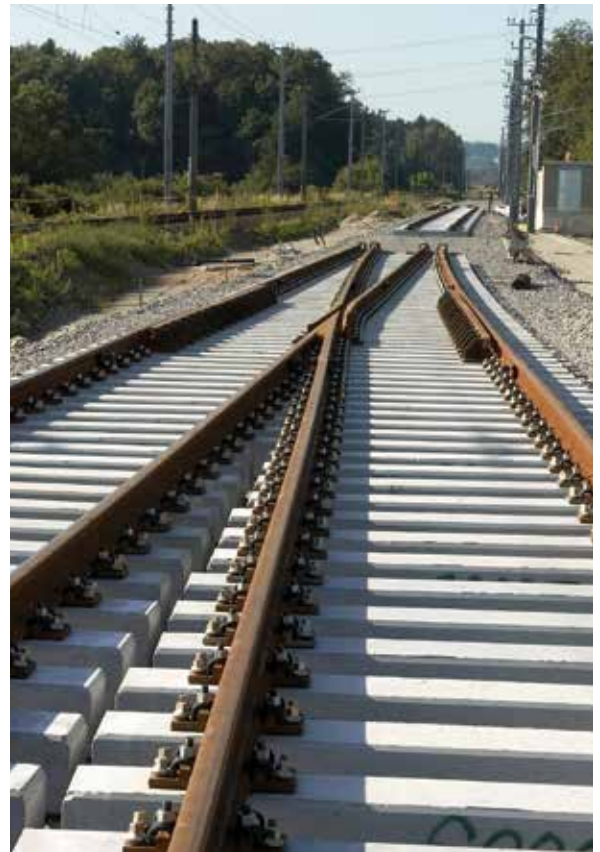
Increased elasticity in the form of USP or ballast mats increases availability on the track and gives improved conditions for “non-stop operations”. The result of higher qualitative track design is less stoppages and disturbances through an extended service interval and a longer material life. In the end this also signifies a lower life cycle cost.

Increased elasticity is a part of today’s modern track design

We know that the right application means reducing dynamic forces in the ballast, increased load distribution along the track and increased contact surface between the sleepers and ballast. As a result you get longer intervals between servicing and a long life primarily from the ballast.

Improvements are also gained for problems such as corrugation in curves, wear at switches and transitions zones.

Sylomer® properties are designed-for-purpose so that an optimum solution is chosen with a comprehensive view of the dynamics of the track design. Our wide range represents a cost optimum solution with a documented long life.



Examples of implemented projects:

- Railway, Emmaboda/Karskrona - Trafikverket
- Railway, Oslotrakten - Jernbaneverket
- Railway, Ofot line - Jernbaneverket
- Railway, Farum line - BaneDanmark
- Railway, Uppsala station - Banverket
- Railway, Fruäng line - SL, Stockholm
- Railway - Austrian Federal Railways / ÖBB, Austria
- Railway - German Federal Railways / DB, Germany
- Railway - Swiss Federal Railways - SBB, Switzerland

Elastic pads for improved economy



Examples of implemented projects:

- Railway, Tegelbacken Stockholm - Banverket
- Railway, City tunnel - Banverket
- Railway, Södra strömbrom - Banverket
- Railway - HSL South, Holland
- Underground - Jubilee Line, London
- Railway - New York City Transit, USA
- Railway - Chinese High Speed Line Development, China
- Railway - TTCl test track - USA

We offer:

- Technical advice and analyses in connection with the choice of solution in relation to demands
- Optimization of the solution with regard to price and performance
- Total vibration-engineering responsibility with a comprehensive view from planning to completed track

Sylomer® and Sylodyn® as an elastic pad offer significantly improved properties compared with many other materials. They give major benefits where structure-borne noise isolation over a broad frequency range is required or where comfort is valued highly.

Additionally, you receive a material with high elasticity, small creeping and a long life.

Field measurements on e.g. "rail pads" that have been in the track for a long period and under a high load show negligible changes in static and dynamic rigidity and settlement. In comparative fatigue testing of rail pads, competing materials become seven times more stiff than Sylodyn® after 2.5 million load cycles.

Pads of Sylomer® and Sylodyn® can be mounted directly under rails or in fastenings and the properties are adapted to the occurring loads.

The goal is to produce optimum functionality under as long period as possible.

We believe that with a well-defined specification and with improved materials, conditions for more economic and long-term solutions increase.





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