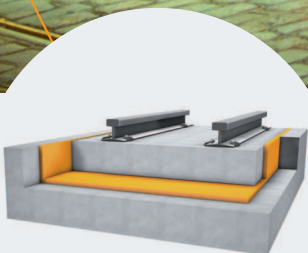
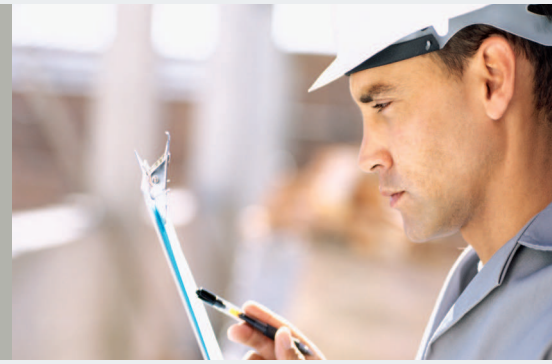


Mass-Spring Systems for **Trams**



1 | Urban Transport as a Source of Noise Pollution





The noise and vibration insulation offered by full-surface mass-spring systems manufactured by Getzner enhances the attractiveness of trams as a comfortable and environmentally-sound form of urban transportation.

Our services

- Solution development
- Alternative solutions
- Detailed solutions
- Calculations
- Modelling
- Efficiency forecasting
- Material testing
- Material development
- Project consulting
- Installation work
- Technical acceptance of installation work
- Training
- Documentation
- Proof of efficiency

Impact of structure-borne noise

The increasing mobility of modern society results in an ever higher level of noise and vibrations. This problem is particularly acute in inner-city areas and in heavily urbanized metropolitan areas, where traffic infrastructure and residential property are often immediately adjacent. Traffic-generated noise and vibration is a detrimental aspect for the quality of life of the residents in the vicinity and confronts traffic planners and public transport companies with new challenges.

With its mass-spring systems, Getzner has developed a solution for trams which provides efficient vibration reduction via isolation of the tracks.

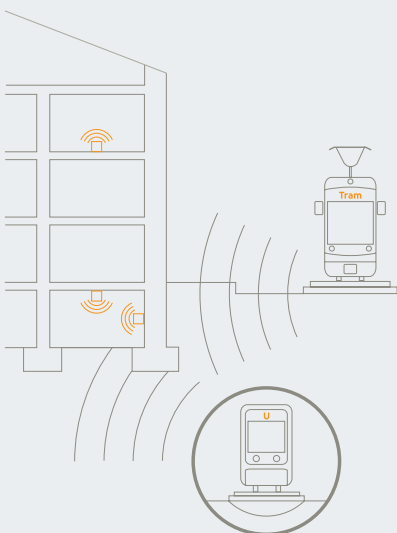
Transmission of structure-borne noise to the surroundings is reduced at the source, thus enabling emissions to be kept to a minimum. This approach has the additional advantage of effectively hindering the development of audible secondary airborne noise, which is caused by the vibration of buildings and other infrastructure components.

**Welcome to Getzner,
the good vibrations company.**

Providing solutions

Getzner is much more than just a specialist for top-notch products for vibration isolation: we are a provider of comprehensive, all-around solutions. Our scope of services ranges from planning, development of optimized, customer-specific solutions, participation in installation, specification of all aspects of the solution and comprehensive after-sales service.

Above and beyond these aspects, Getzner has very well equipped laboratory and testing facilities. Our specialists work together closely with customers, placing their wealth of know-how and expertise at their disposal. Modelling, material testing, efficiency measurements and ongoing consulting are key points in the development of effective solutions, and these strong points have made Getzner a leading provider of specialized solutions for these types of applications.



2 | Mass-Spring Systems for Trams

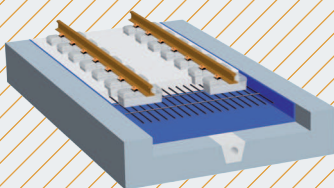
Three base systems for tramway applications

Backed by over 30 years of experience in the realization of mass-spring systems, Getzner offers three standard packages for the isolation of track superstructures with various degrees of efficiency. In terms of the desired natural frequencies f_0 , these systems cover most requirements and are thus promising solutions with a bright future ahead of them.

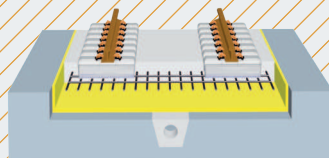
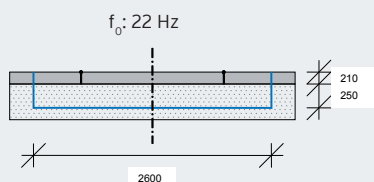


Advantages

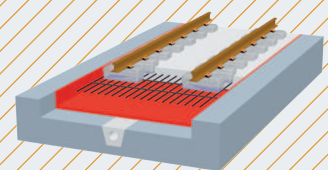
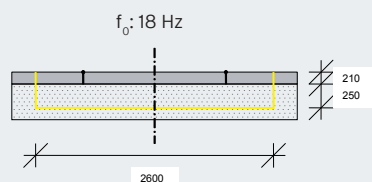
- Simple and quick construction
- Low possibility of construction errors
- Wide distribution of loads on the subgrade
- Mitigation of structural vibrations in the track superstructure
- Easy maintenance
- Durable, cost-effective overall system



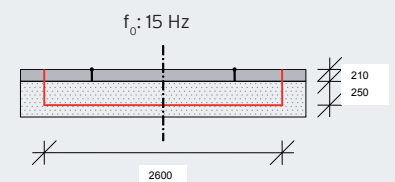
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With these three standardized solutions, natural frequencies from 15 Hz to 22 Hz can be covered, allowing for structure-borne noise isolation of up to 20 dB in the critical frequency range.

Specialized solutions also available

If the requirements for the efficiency of the system to be installed are even more stringent or other project-specific details must be resolved, Getzner is also a competent partner for the formulation of specialized solutions tailored to the particular needs at hand.

Thanks to a flexible modular construction approach, all of the systems offered by Getzner can be adjusted to the necessary overall conditions. This can be particularly advantageous for retrofitting of existing infrastructure, and Getzner can develop optimized solutions for these types of projects.

Based on its broad range of highly elastic polyurethane elastomers marketed under the brand names Sylomer® and Sylodyn®, Getzner can also meet the most stringent requirements in terms of construction design and the amount of structure-borne noise mitigation.



References

Getzner has completed over 300 projects using full-surface bearing systems with Sylomer® and Sylodyn® and enjoys a solid reputation around the world as an experienced specialist for the reduction of structure-borne noise and vibrations.

Some of our references:

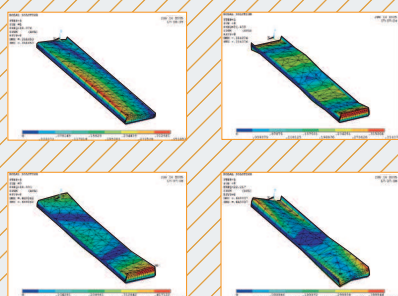
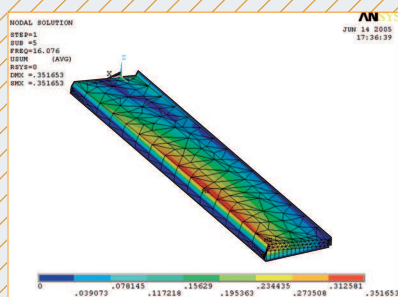
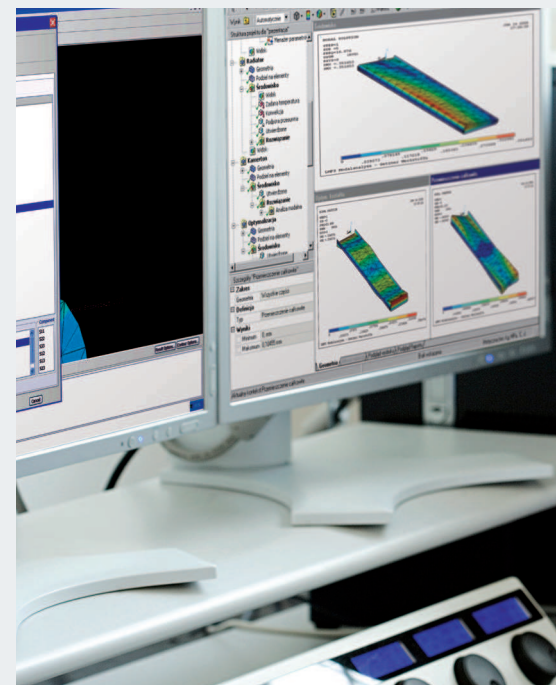
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| + Dresden | + Paris - St. Denis |
| + Geneva | + Prague |
| + Graz | + Rome |
| + Grenoble | + Rouen |
| + Cracow | + Seville |
| + Le Mans | + Strasbourg |
| + Linz | + Valencia |
| + Madrid | + Vienna |
| + Milan | + and many more... |

3 | Wide-Ranging Competence and Know-How

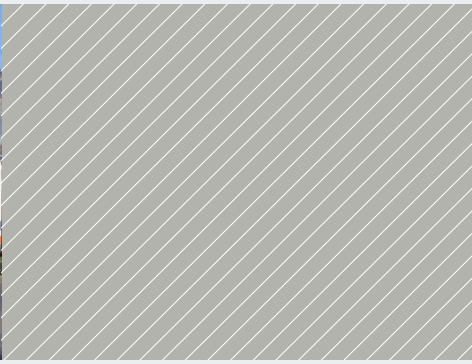
Mass-spring systems play an active role

Vibration isolation in rail applications for local transportation systems involves isolating the track superstructure from the surroundings, which helps to prevent the transmission of vibrations and structure-borne noise. Mitigation of vibration emissions occurs at the track itself, where it is most effective.

A calculation model using a one-dimensional single mass oscillator can be used for the determination of the natural frequencies. An oscillator of this type is often described as a single degree of freedom (SDOF) system. Additionally, it is possible to determine oscillation patterns of track slabs using computerized simulations.



Oscillation forms, calculated using the finite element method (FEM)



Determining the limits

The finite element method (FEM) is used for the theoretical investigation of an oscillating system. In this type of calculation model other degrees of freedom which are relevant for the real system are permitted, compared to the single mass oscillator approach. Modal analysis can also be performed. This form of analysis is used for the determination of the natural frequencies and natural oscillation forms. It can provide important parameters for understanding the system and for the design of a structure for dynamic loads.

Real-life modelling in the laboratory

Getzner is able to model operational loads both in numerical terms and in our real-life testing facilities, which feature a wide range of equipment that is available for the physical testing of materials. In addition to several hydro-pulse units for product testing, Getzner has developed its own large-scale testing stand which can investigate the function of complex systems composed of individual components. This competence paves the way for a holistic approach, taking into account various influencing factors and helping to guarantee the development of a reliable and durable solution.

- 1 Large-scale testing stand
- 2 Hydro-pulse unit
- 3 Thermal analysis



1



2



3

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