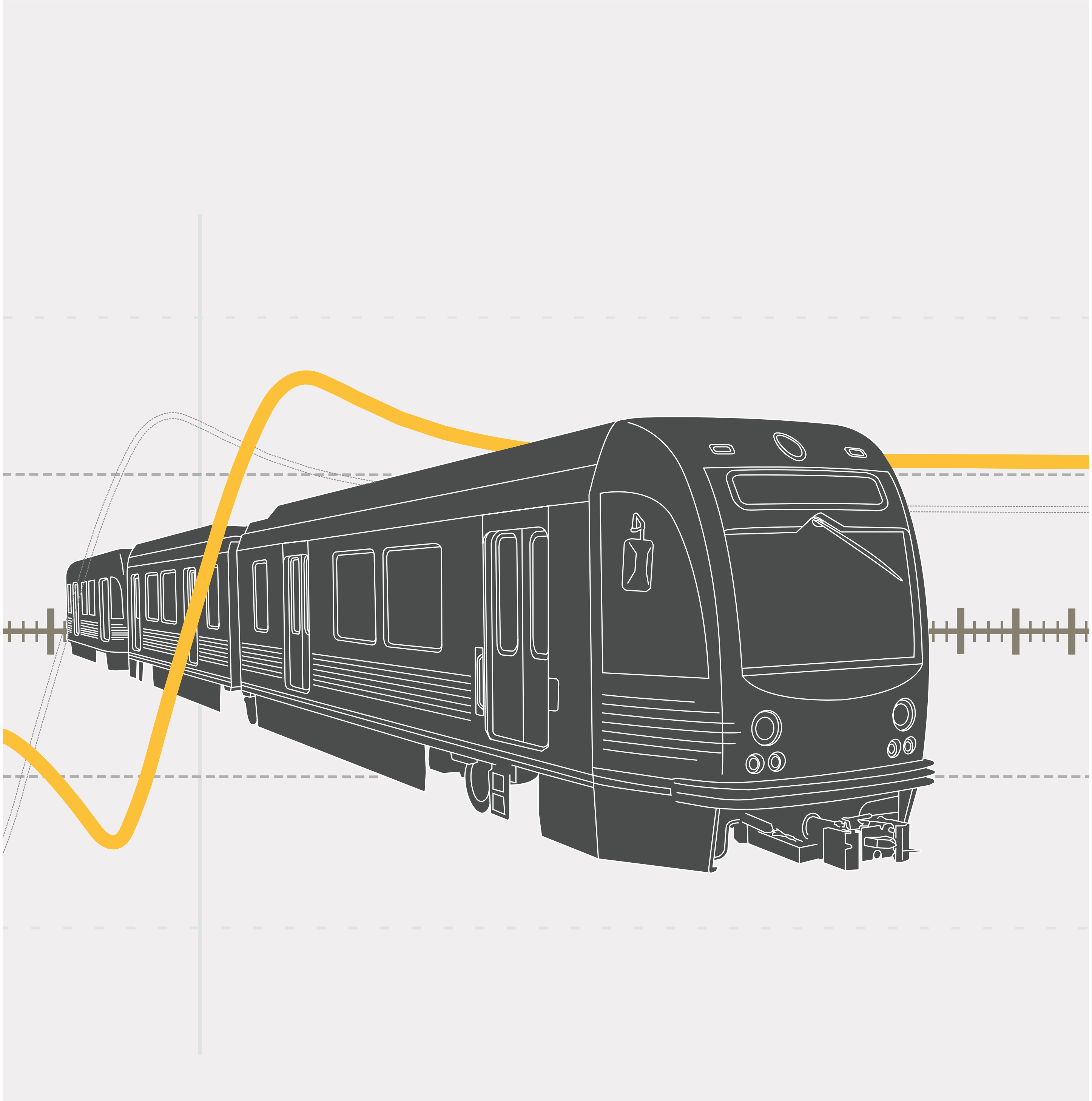


GenieMat® RAIL FST

VIBRATION ISOLATION SYSTEM
FOR RAIL

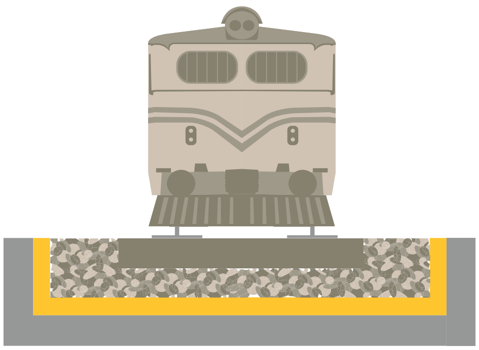
PLITEQ®

Patents: US 8240430 US 8556029 CA 2500956 CA 2503420

GenieMat® RAIL FST

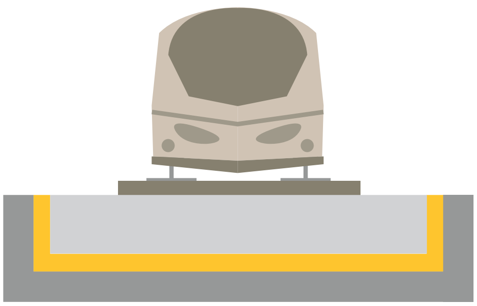
Patented Isolation Technology for Rail Systems

FROM THE INVENTOR OF THE PATENTED TECHNOLOGY
(US 8240430, US 8556029, CA 2500956, CA 2503420)



GenieMat RAIL BST - Ballast Mat

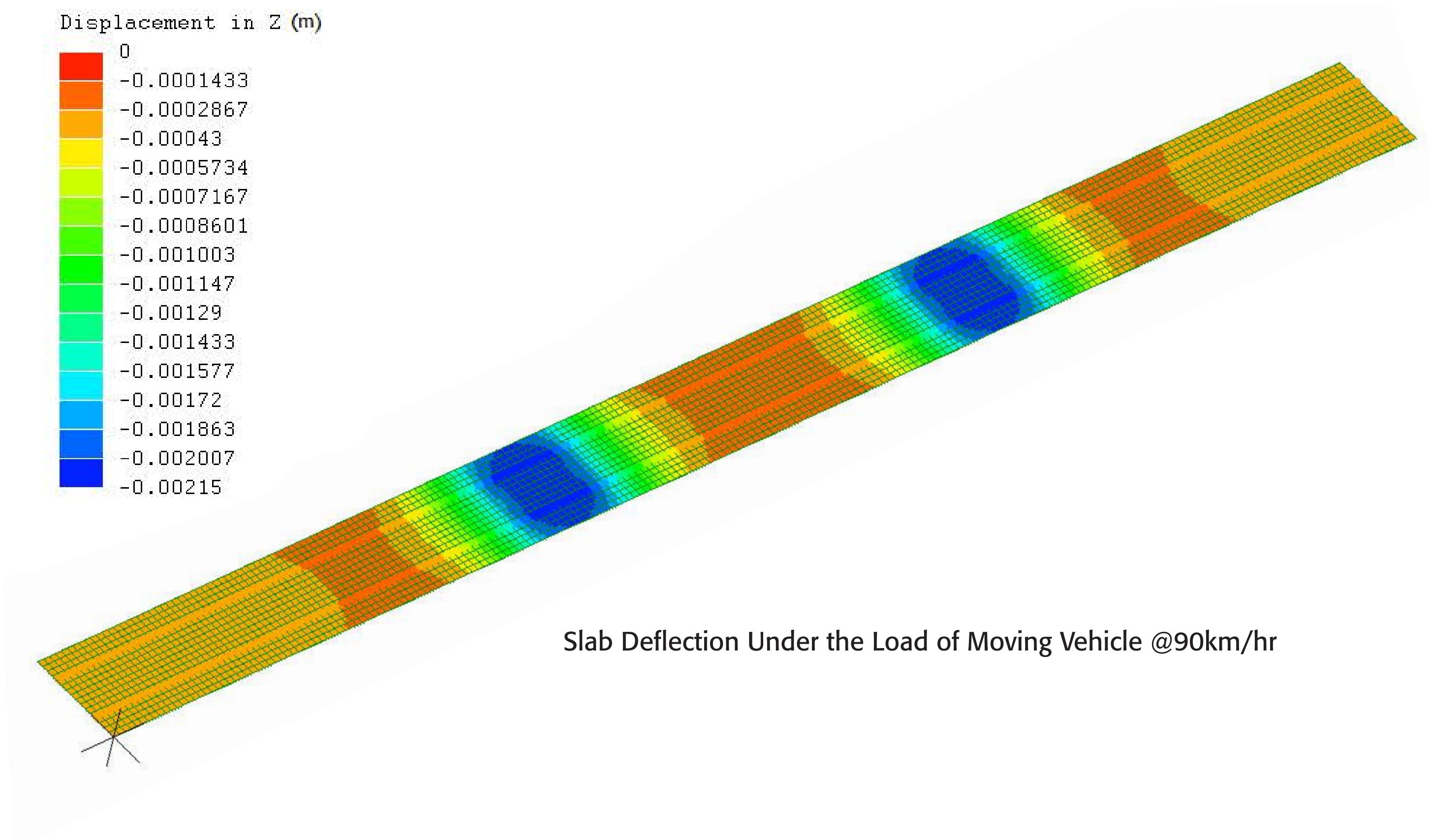
- Engineered for the isolation of freight and passenger rail lines
- Prevents premature ballast degradation
- Water permeable for drainage



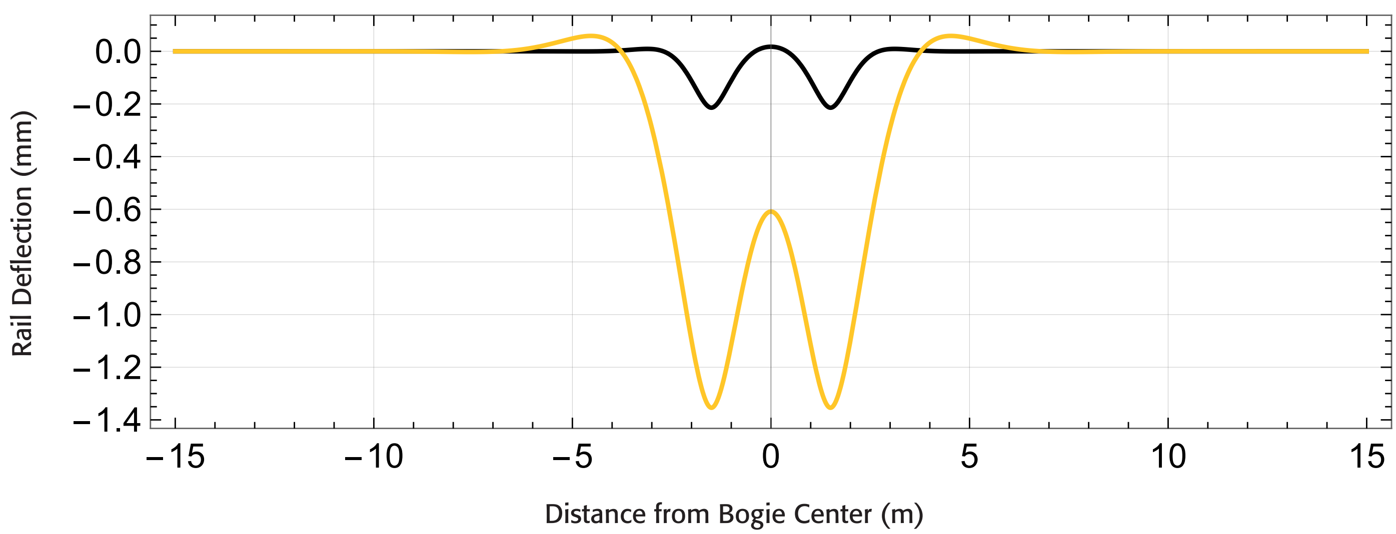
GenieMat RAIL FST - Floating Slab Track

- Engineered to meet enhanced insertion loss requirements for sensitive adjacencies
- Low natural frequency at a wide load range
- Long term creep is less than 1% per decade

ENGINEERED TO MEET PROJECT REQUIREMENTS



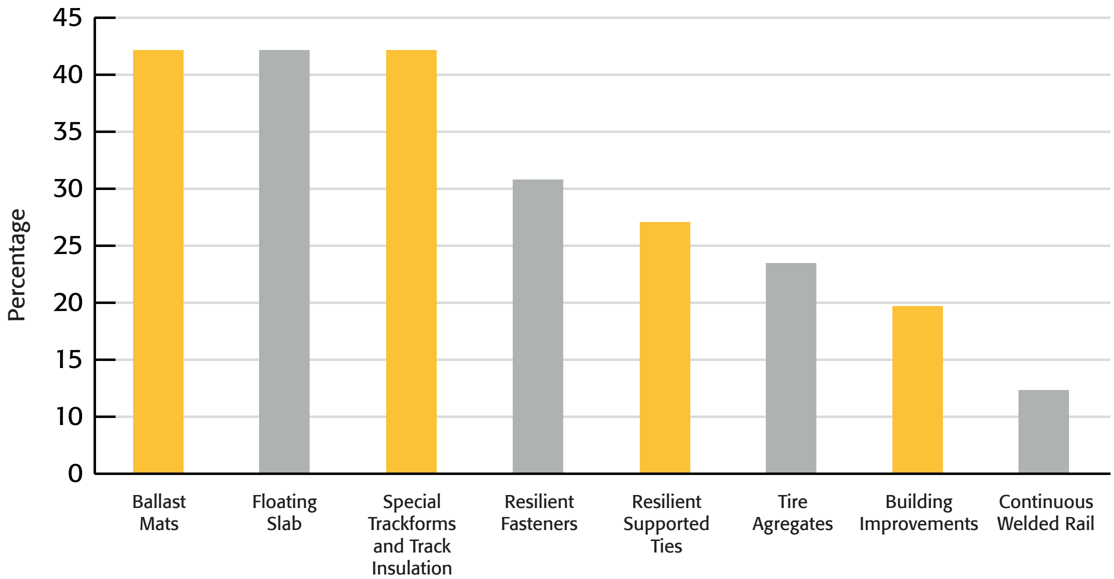
Slab Deflection Under the Load of Moving Vehicle @90km/hr



ENGINEERED FOR GROUND-BORNE VIBRATION MITIGATION

A meta-study investigating the pervasiveness of rail vibration issues by reviewing more than 50 railway ground-borne vibration assessment reports has been completed by researchers at the Heriot Watt University and University of Mons. The reports include overground, underground and bridge track types with a variety of traffic from high speed rail, conventional rail, rapid transit, light rail and freight. Below is the distribution of implemented or recommended mitigation technologies.

- Analysis of 1604 track sections in 9 countries (52 reports, US, UK, AUS, Belgium, Greece)
- Vibration limits exceeded in 44% of assessments. Mitigation required on 50% of projects, mostly at the source.



Connolly, D. P., Marecki, G. P., Kouroussis, G., Thalassinakis, I., & Woodward, P. K. (2016). The growth of railway ground vibration problems — A review. Science of The Total Environment, 568, 1276–1282. https://doi.org/10.1016/j.scitotenv.2015.09.101

VIBRATION CONTROL BASICS

The benefits of incorporating acoustic isolation into engineering design can be demonstrated using a simplified single degree of freedom lumped element model. If we consider only the vertical displacement x(t) of the system and apply Newton's Laws of Motion we can describe the system analytically using Equation 1.

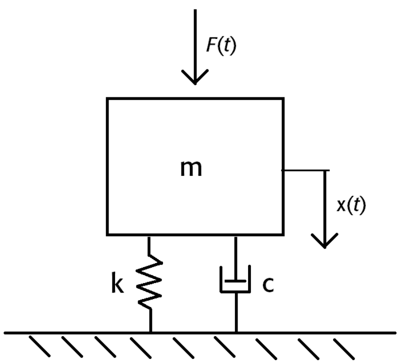


Figure 1: Single Degree of Freedom lumped element model for simple forced harmonic motion.

$$m\,x''+c\,x'+k\,x=F(t) \tag{1}$$

This second-order differential equation can then be solved, prompting some useful definitions:

$$2\pi f_n=\sqrt{\frac{k}{m}}=\omega_n \qquad \text{Natural Frequency} \quad (2)$$

$$\zeta=\frac{c}{2\,m\,\omega_n} \qquad \text{Critical Damping Ratio} \quad (3)$$

Of interest when engineering vibration isolation systems is the ratio of the force transmitted to the force input, or Transmissibility.

$$Tr=\frac{F_T}{F_{in}} \qquad \text{Transmissibility} \quad (4)$$

Transmissibility is a function of frequency. For frequencies near the natural frequency of the system, amplification will occur. For frequencies well above the natural frequency, isolation will occur. The crossover point is at $\sqrt{2}f_n$.

The behavior of the system also depends on the degree of damping. In this context we are interested in the underdamped scenario (ζ<1). The greater the damping of the system, the less amplification will occur near the natural frequency but also the less isolation will be provided at higher frequencies.

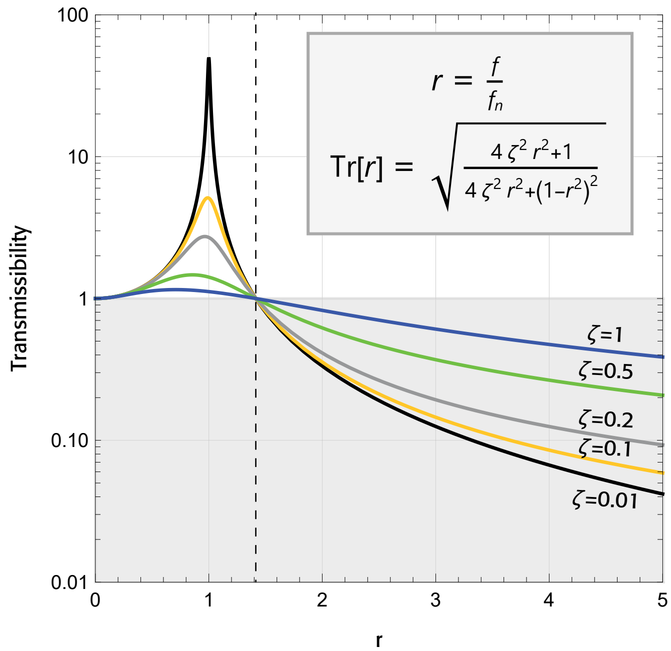


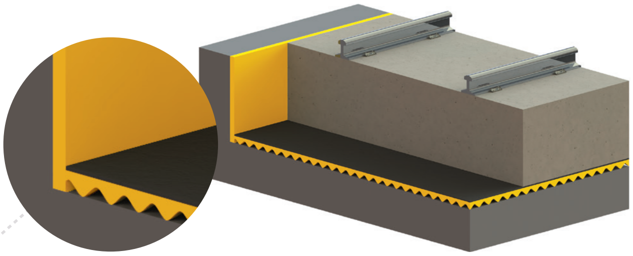
Figure 2: Generic transmissibility curves from simplified model.

Steel has a critical damping ratio of ζ = 0.005-0.01, while resilient materials such as rubber will have a critical damping ratio of ζ = 0.05-0.15 for example.

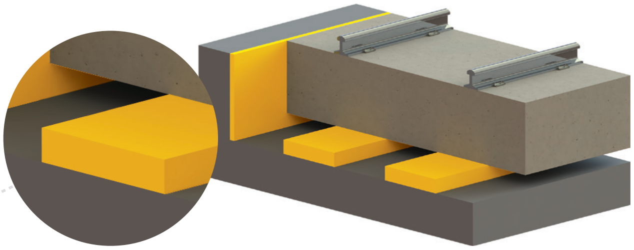
In the real world, more degrees of freedom and their elastic properties may be considered to incorporate additional elements of an ever expanding lumped model (rail, tie, ballast, subgrade etc.). The fundamental behavior of this simple system remains relevant.

GenieMat® RAIL FST - FLOATING SLAB TRACK

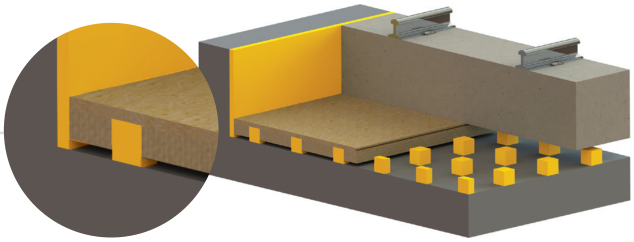
For substantial ground-borne vibration mitigation, a mass-spring system is considered the most effective vibration isolation design. The properties and configuration of the **GenieMat RAIL FST** isolators are dictated by the required insertion loss frequency range, vehicle axle-load, speed and surrounding soil properties among other parameters.



Continuous isolators for ease of installation, and natural frequencies from 12 – 20 Hz.

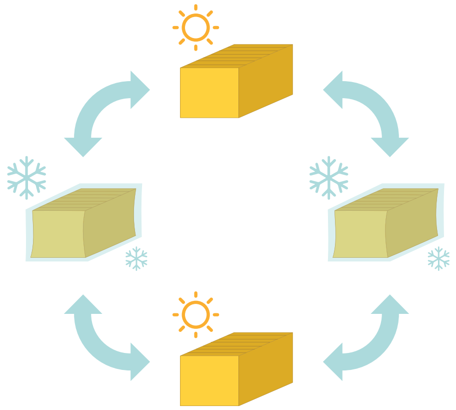


Linear isolators for increased loading and lower natural frequencies from 8 – 15 Hz.



Discrete isolators for the greatest loading and lowest natural frequencies from 5 – 12 Hz.

KEY PROPERTIES OF AN ISOLATOR FOR GROUND-BORNE VIBRATION



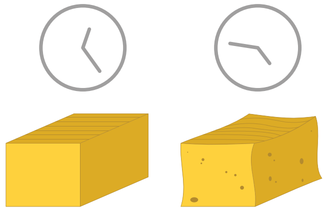
FREEZE-THAW

RESISTANT TO FLUCTUATIONS IN TEMPERATURE

There is a number of methods that can be employed in order to determine the resistance of a resilient material to fluctuations in temperature.

To ensure consistent long-term performance, the stiffness of resilient products designed for railway is monitored for changes after multiple freeze-thaw cycles.

Governed by particle properties with a low glass transition temperature and high thermal stability, **GenieMat** products have an operating range of -40 deg. C to +80 deg. C, allowing construction in virtually any climate.

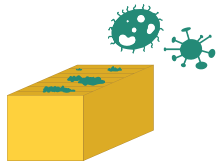


AGING

LONG TERM PERFORMANCE

The long-term performance of resilient materials is quantified by its resistance to change in deflection under constant load, and the consistency of its performance after undergoing an accelerated aging process.

GenieMat maintains a consistently low creep rate at loads up to 1.5x the maximum design load, providing a stable solution for generations to come.



FUNGUS AND MOLD

BIOLOGICAL RESISTANCE

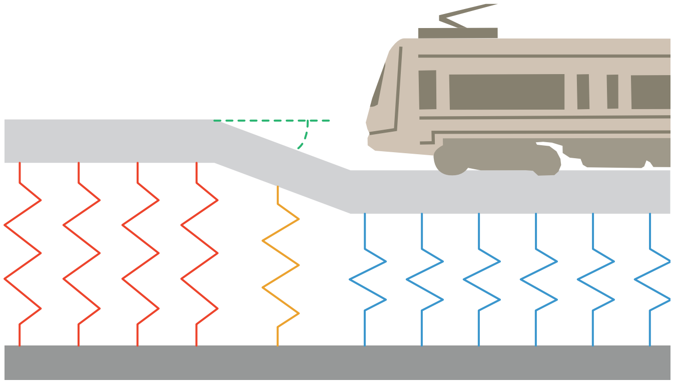
Any construction material that promotes mould growth can pose a health risk to contractors and end users. Moisture-sensitive products should not be installed in inherently damp environments such as construction sites and railways.

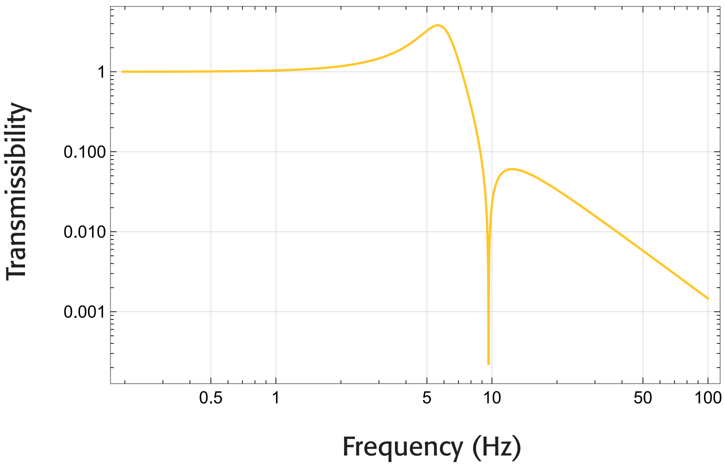
Thanks to the durable nature of rubber, **GenieMat** products are inherently mould and mildew resistant. When exposed to Aspergillus Niger (a common and resilient fungus) in an incubator for 14 days, **GenieMat** products conclusively demonstrated that they do not promote mould growth.

REDUCES IMPACTS AND MAXIMIZE TRACK COMPONENT LIFESPAN

Due to the change in substructure stiffness, track components in bridge transition zones are subject to higher impacts and vibrations magnitudes.

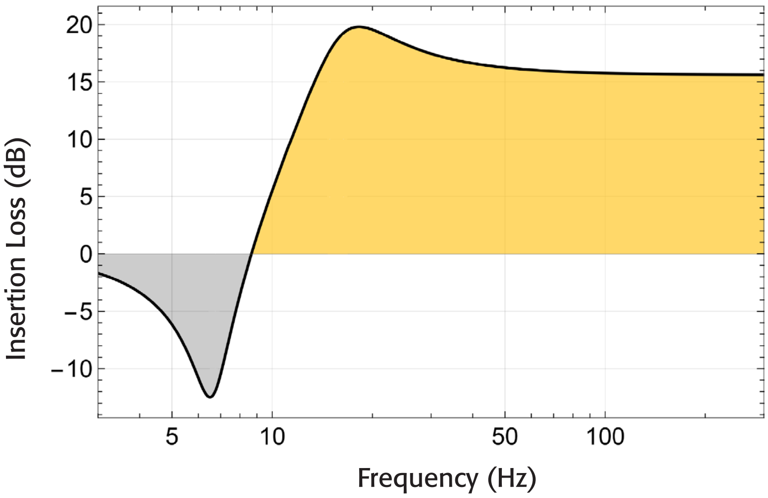
If these areas are left untreated, the track, ballast, and sleepers will suffer a shortened lifespan and increased operating costs.





To reduce impacts in bridge transition zones, engineers use FEA to specify **GenieMat FST** products that will moderate the stiffer portions of track and equalize deflection throughout.

When acoustical isolation is necessary, **Pliteq** offers insertion loss calculations based on the use of **GenieMat FST** under the specific project conditions.



Contact Us

For Your Project Specific Questions
T. 416.449.0049 | **E.** info@pliteq.com

08.22