Noise and Vibration Control in Railway Track



Metro
Commuter
Main Lines
High-Speed Lines



Company Overview

Zhejiang Tiantie Industry Co., Ltd, is a Chinese company, specializing in noise & vibration mitigation technology for rail and industrial applications. Tiantie's comprehensive product range includes steel and rubber springs for FST, ballast mats, rail dampers, sleeper boots, rubber level crossings, noise absorption panels, and high-resiliency base plates.

Driven by finding optimum solutions for its clients, Zhejiang Tiantie is built on innovation and strong engineering and manufacturing know-how. In addition, the company provides a range of services, such as on-site advisory and commissioning. Products from Zhejiang Tiantie Industry stand for high reliability, long service life, and effectiveness in reducing noise and vibration.

Key Facts

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2003

Revenue

\$135 Mio USD. 2019

Employees

918 (Group)

Competences

Noise and Vibration Control, Rubber Technology

Industries

Railway, Buildings, Industry

Headquarters

Tiantai, Zhejiang, China

Affiliates

10



Product Overview

Tiantie's core competency lies in innovation, design, engineering, and fabrication of track-related noise and vibration mitigation products. Individual, resilient components can be combined to achieve greater track performance, such as FST, and highly resilient fastening systems.

- Steel and Rubber Springs for FST
- Track Mats / Ballast Mats

- Sleeper Boots
- Rail Pads / Highly Resilient Baseplates
- Rail Dampers
- Sound-Absorbing Track Panel

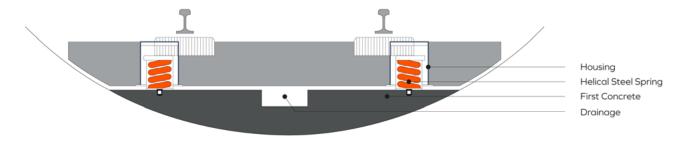
Individual, resilient component layers can be combined to achieve even greater track performance, such as FST and highly resilient fastening systems.

Applications

Floating Slab Track

Floating Slab Tracks, or Mass Spring Systems, are proven to provide the best mitigation in a track. These mass-spring-systems (MSS) consist of floating slabs with the rails mounted on top. The slabs are usually constructed of reinforced concrete. Together with a dead load of rails,

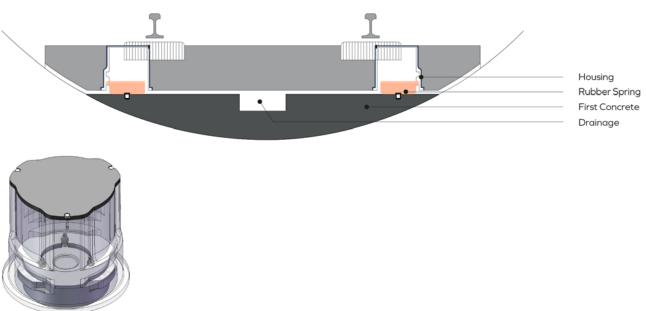
sleepers, and fastenings (and the ballast, if any), they form a dynamically active mass that is isolated from the sub-structure by means of elastic mounts, which may be of rubber, elastomeric material, or steel.





Floating Slab Track (FST) on Steel Springs



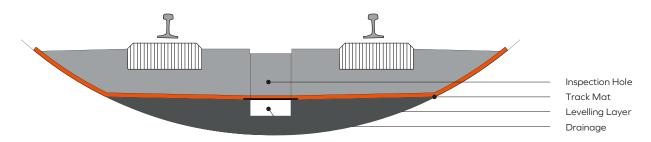


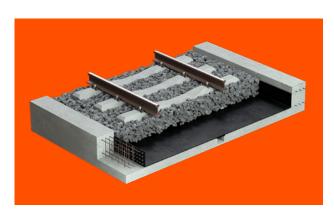
Floating Slab Track (FST) on Rubber Bearings

For optimum support with FST applications, Tiantie offers product options that include steel springs, rubber bearings, and high-resilience track mats.

The steel spring version is integrated into the slab, while the rubber version can be below or also integrated. The FST system frequency can vary between 5 Hz to 15 Hz depending on client specification.

Today, resilient Slab Track Mats are in use at many Metro and Light Rail Systems around the world, especially in applications where tunnels or bridges create groundborne noise. Tiantie's resilient Track Mats present an ideal solution. Track Mats are installed onto a concrete bed, and fresh concrete is then cast directly onto the mats.





Features and Benefits

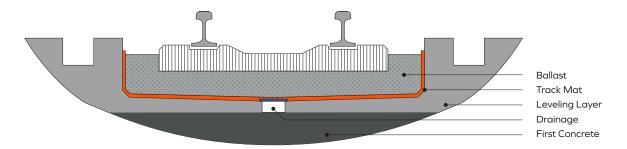
- Provides greatest isolation efficiency, up to 30 dB
- Broad product range of FST bearings
- System frequencies from 5 Hz to 15 Hz
- Customized solutions
- Low profile
- Fatigue-resistant

Track Mat Installation: Slab Track



Ballast Track

Tiantie Track Mats are one of the most effective methods of reducing vibration transmission from ballasted or slab track. When installed under ballast, Ballast Mats isolate the track structure from the supporting foundation or substrate, and can attenuate the vibration transmission by 20 dB in many cases.



Track Mat Installation: Ballast Track

Tiantie Track Mats are designed for optimum static and dynamic performance, specifically suitable for applications with main line, urban light rail, and metro axle loads. Track Mats are proven to perform reliably over a very long service life, and under any climate.

| Mat Type | Width (mm) | Thickness (mm) | Static Bedding Modulus (N/mm³) |
|-----------|---------------|-------------------|--------------------------------|
| G 1015 | 1550 | 15 | 0.100 |
| G 1023 | 1500 | 23 | 0.060 |
| G 1027 | 1500 | 27 | 0.030 |
| G 1032 | 1550 | 32 | 0.020 |
| USM 1000 | 1550 | 30 | 0.019 |
| USM 1000W | 1550 | 30 | 0.016 |
| USM 2020 | 1550 | 27 | 0.020 |
| USM 2025 | 1550 | 27 | 0.025 |
| USM 2030 | 1550 | 27 | 0.030 |
| USM 3000 | 1550 | 27 | 0.041 |
| USM 3060 | 1550 | 27 | 0.060 |
| USM 3080 | 1550 | 27 | 0.080 |
| USM 4010 | 1550 | 14 | 0.100 |
| USM 4015 | 1550 | 14 | 0.150 |



Features and Benefits

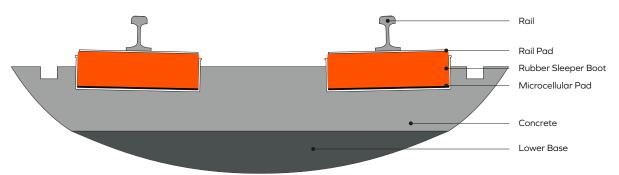
- Profiled Sheet Technology from Germany
- Enhanced acoustical performance
- Dynamic stiffening only cdyn/cstat=1.4
- Reduces degradation of ballast by more than 50%
- Reduces stress on structures
- Provides bridge deck and waterproofing protection
- Reduces maintenance costs

Sleeper Boots

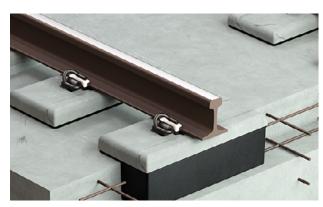
Sleeper Boots provide excellent noise and vibration control. They are used with conventional slab tracks, and provide a degree of elasticity to help control smooth track deflection. The system consists of a concrete block surrounded by a rubber boot, and a block pad

embedded in slab concrete.

Zhejiang Tiantie offers various elasticities for their rubber boots depending on loading and requested isolation efficiency.







Sleeper Boots

Features and Benefits

- Available in different thicknesses,
 with stiffness as low as 14kN/mm
- Exceptional acoustic performance
- Custom-engineered solutions





Rail Pad / Highly Resilient Baseplates

Rail pads are elastic rubber mats mounted between steel rails and the fastening system, to protect the sleeper top from wear and impact. A rail pad is also essential

reducing shock and vibration in a rail system. Highly elastic pads offer the following features and benefits:

Features and Benefits

- Load distribution over a larger surface
- Elimination of load concentration and the resultant fatigue stresses
- Centering of loads on the supporting element

Zhejiang Tiantie offers certified rubber pads that are specifically designed for harsh-environment railway

- Rail
 Clamps 6mm thick
 Damping Block
 Clamp
 Rubber Strin
- Rail Damper

- Absorption of uneven contact surfaces between rail and support
- Reduction of noise and vibration
- Reduction of wear of the rail and its support

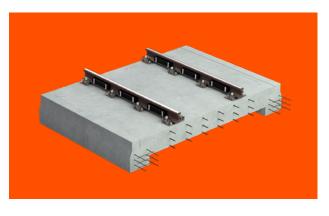
applications. Advantages include long service life, and resistance to abrasion and corrosion.





Features and Benefits

- Noise Damping of approx. 3 dB
- Variable Tuning Frequencies
- Available for all Vignol Rails
- Robust
- Easy to install and replace





Sound-Absorbing Track Panels

To reduce railway noise generated by friction between wheels and rails, engineers have developed flexible, porous track panels. Installed on the track between the rails, these panels have proven to be more effective than lining the walls of tunnels. The highly durable panels are made from non-combustible material, and are designed

to withstand the high-impact world of track workers. Track panels can easily be cleaned, have a long service life, and provide high sound absorption. cleanability, and high sound absorption.

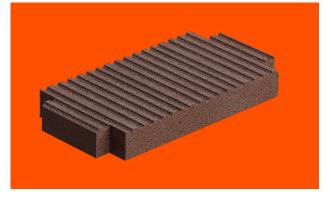
Features and Benefits

- Designed to reduce railway noise
- Stand-offs at bottom of panels create air gaps,
 which elevate the acoustic performance further
- Raised panel platform benefits workers

- Excellent sound absorption characteristics
- Rugged and durable material
- Easy to install and clean
- Custom sizes available



Sound absorbing Track Panels





Technical Product Information

Detailed engineering and technical information is available with corresponding Specification sheets.



Engineering Services

To ensure optimum product performance, Tiantie uses specialized computer-and predictive modelling software in the design process, taking into account parameters such as track dynamics and rail deflection under various loads.

In addition to Tiantie's wide range of noise and

Dynamic analysis of a railway track

New product development is the essence of Tiantie's corporate philosophy. Our engineering experts are actively participating in national and international committees. Tiantie's commitment to innovation, along with close collaboration with universities, design consultants and end-users, provide a solid basis for the development of next generation state-of-the-art products.



Tiantie In-house testing

vibration mitigation products, the company also provides expert installation services and/or supervision. Experienced engineers are available for installation and commissioning of all our products, including onsite monitoring and adjustments, Installation reports confirming "as-built" characteristics can also be provided.



Installation of Track Mats

Continuously changing market conditions, evolving technology and new technical requirements demand timely responses and action. Tiantie's extensive in-house laboratories and testing facilities are well equipped to perform application testing or performance verification testing quickly and effectively.



Tiantie on-site testing



Production Plants and Annual Capacity

Wholly-owned Zhejiang Tiantie production plants are large scale manufacturing facilities. Intelligent stateof-the-art production equipment and processes ensure

highest quality products that meet customer needs, as well as regulatory requirements for environmental protection.

- Track mat $> 360.000 \text{ m}^2$
- Rubber sleeper boots > 300.000 sets
- Rubber bearings > 60.000 pcs

- Rail damper > 40 km
- Level crossing panel > 50.000 m²
- Steel spring > 60.000 pcs



Production Plant



Production Plant

Quality Control

Global markets require compliance with a variety of different standards. Tiantie's Quality Management System ensures that product and process standards



Environmental Management System according to ISO 14001



Quality Management System according to ISO 9001

are consistent and in compliance, and documented in accordance with standards. Test reports, certifications and customer testimonials are available on request.



Occupational Health and Safety System according to ISO 45001



References

Zhejiang Tiantie is a market leader in the development and manufacturing of noise and vibration mitigation products for High-Speed Rail, Main, Commuter and Metro lines. The company's commitment to innovation, quality, reliability and favorable pricing is reflected in the long list of successfully installed and commissioned projects.

Length of completed installations:

| Track Mats | 605 km | Rubber Sleeper Boots | 988 km |
|------------------------|--------|----------------------|--------|
| FST on Rubber Bearings | 26 km | Rail Pads | 330 km |
| FST on Steel Springs | 5.5 km | Rail Dampers | 44 km |



Ballast Mat: Wuhan Metro



FST on Rubber Bearings: Ningbo Fengshua Line



Rail Dampers: Nanjing Metro Line 4



FST on Helical Steel Springs: Kunming Metro



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