

technology on your wavelength



ARMADILLO
NOISE & VIBRATION

VIBRATION ISOLATION BUILDINGS

Armadillo Noise & Vibration

1 Titleist Drive

Acushnet

MA 02743

Tel: 800 580 3984

Email: sales@armadillonvinc.com

Website: www.armadillonvinc.com

 **REGUPOL** AMERICA

REGUPOL-ACOUSTICS.COM

Vibration Isolation of Building Foundations

Many factors can cause unwanted vibration that transmits into the building structure and living areas as secondary airborne noise. These unwanted vibrations are even more frequent in highly populated areas due to above or underground rail lines and industrial areas.

Real estate costs due to scarcity in major metropolitan areas continue to rise. The lower cost property development near railway lines gives developers an opportunity to construct buildings in otherwise less desirable locations where the buildings may be subject to unwanted vibration from the environment.

Regupol® and Regufoam® have been developed to isolate vibrations in buildings. With 20 unique products, all with varying load ranges and proven performance, demanding projects with different load range issues can be solved.

On-site testing has proven that Regupol and Regufoam routinely outperform the minimum specifications and sound isolations in many projects.

Benefits

- Customized solutions deliver the right material choice for your individual project
- Wide choice of products for the most economical and technically precise solution
- Engineering support and proven product performance

The isolation achieved with Regupol and Regufoam has been documented to consistently perform at a high level. Post construction testing and measurements have revealed long lasting isolation effects within the structure.

In cooperation with acoustic engineers, Regupol America has also developed custom products for particularly demanding project requirements.

Regupol and Regufoam are suitable for all kinds of structural and vibration isolation:

- Full-surface foundation bedding
- Strip foundation bearing
- Block foundation bearing
- Vertical decoupling of walls and columns
- Vibration isolation of individual parts of buildings
- Room-in-room constructions
- Slot walls in the transmission area between vibration source and building

See page 5–8 for detailed information about different structural designs.

Reduce costs by considering vibration isolation measures in the early design stages



Vibration Isolation of Building Foundations

Considerations:

The vibration caused by the source may spread throughout the building structure: it is perceived as noticeable vibration and can spread as secondary airborne sound. In the worst case scenario structural damage to the building or damage to sensitive equipment and machinery can be caused.

Why use vibration isolation?

- Health protection of occupants
- Compliance with building codes
- Protection of sensitive equipment inside the building
- Enhanced market value of land and building

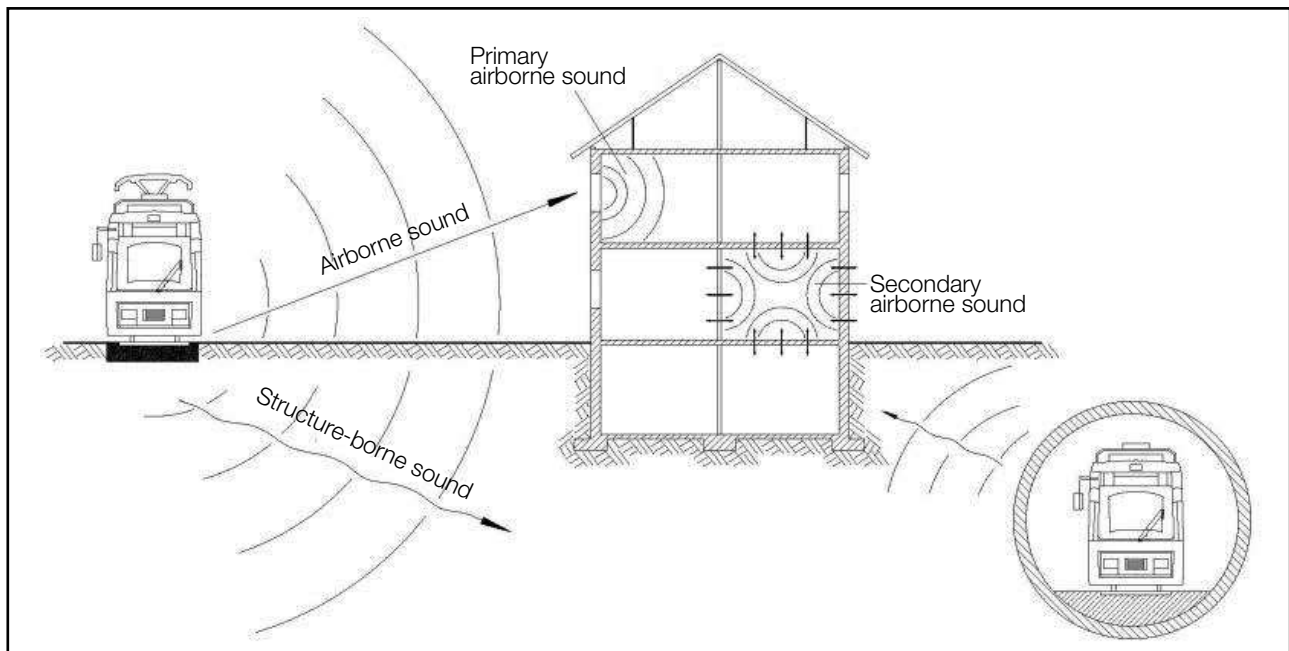
Structure-borne sound refers to vibration which continues through a solid medium, such as soil, rock and the building structure.

The protection of buildings against vibrations can be achieved through different measures:

1. Vibration-reducing measures at the place of the emission, e.g. a mass-spring system in a railway track.
2. Interruption of the transmission of the vibration in the transmission area, e.g. through a below-ground slot wall or by shielding the underground building structure.
3. Shock and structure-borne sound decoupling at the place of immission, underneath the building foundations and at the exterior side of the basement walls. This is the measure most commonly used.

Railway tracks are one of the most frequent causes of vibration emission, therefore the majority of the interfering frequencies are typically between 25 and 100 Hz. Vibrations in this frequency range are highly problematic, as they can lead to building component resonances and thus to secondary sound effects.

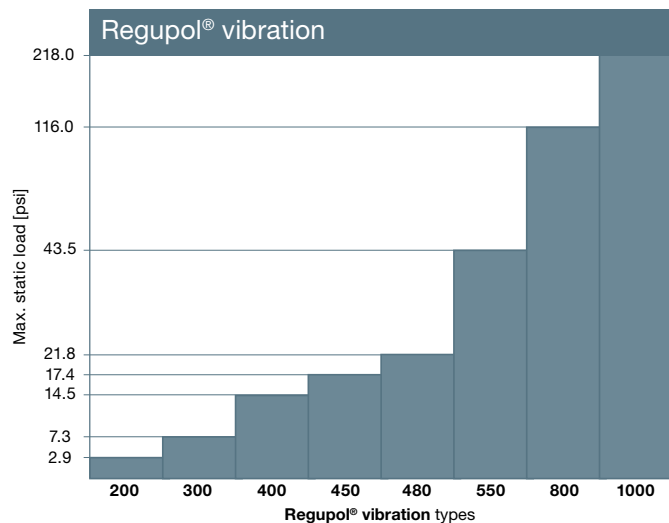
Resilient bedding of buildings reduces the transmission of vibrations in the structure by using isolation materials with specific technical characteristics. Depending on the frequency Regupol and Regufoam can reduce the sound level from 10 to even 25 dB.



Regupol® Vibration Product Overview

Regupol vibration is a high performance elastomer made of rubber fibers, granules and polyurethane. It is available in 8 unique types, each engineered for a specific load range, and is available in rolls or sheets.

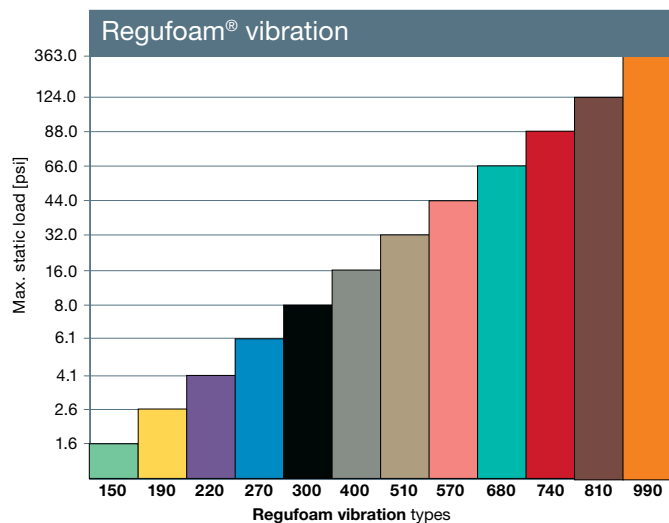
Regupol vibration offers low natural frequencies ($f_0 \geq 7.5$ Hz), which are constant over wide load ranges and can be installed in multiple layers. Some types are supplied with a dimpled underside to decrease the dynamic stiffness and to provide an air gap.



Regufoam® vibration Product Overview

Regufoam vibration is a mixed-cell polyurethane foam, developed and engineered for vibration and structure-borne sound isolation. It is available in 12 unique types, each for a specific load range.

Regufoam vibration offers outstanding internal damping and low frequency isolation while supplying minimal deflection. This material comes in standard thicknesses of 25 mm (1") and 12.5 mm (½") and can be installed in multiple layers to achieve a total thickness of 37.5 mm (1 ½"), 50 mm (2") or more.



Detailed technical data on Regupol and Regufoam is available by request.

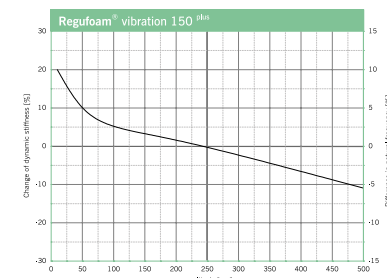
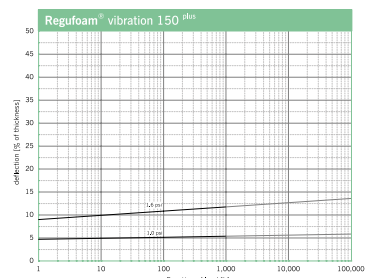
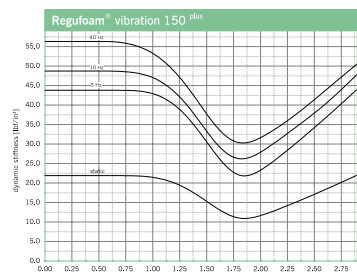
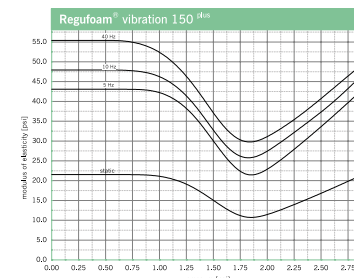
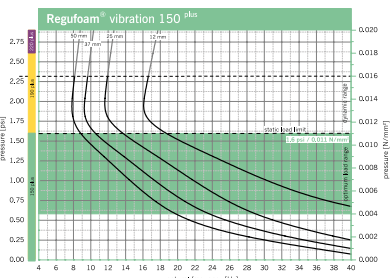
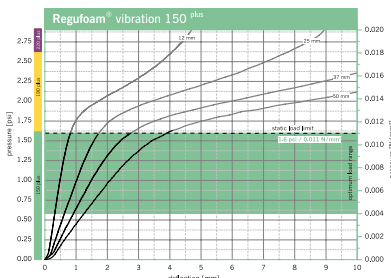
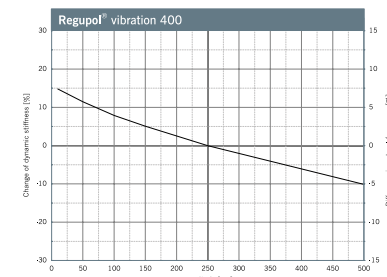
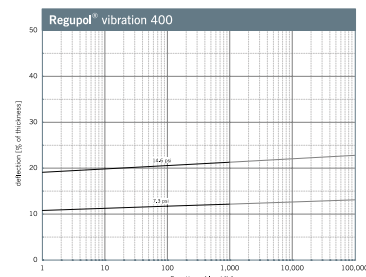
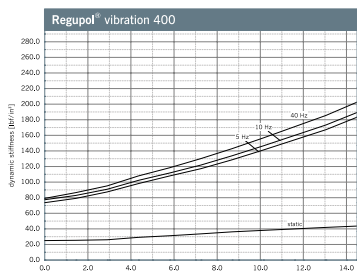
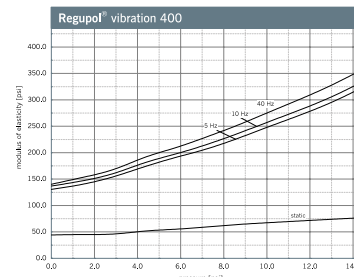
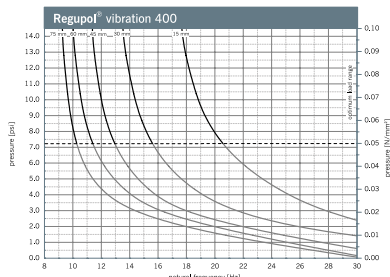
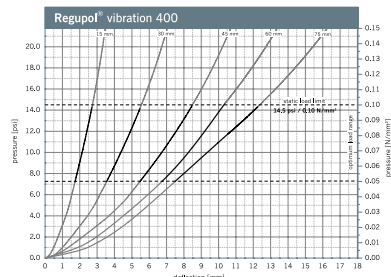
Please contact Regupol America:

Phone: +1 717.675.2190

Email: vibration@regupol.com

For the selection of the most appropriate **Regupol** or **Regufoam** vibration type you may consider the following design attributes: Static load (dead load), dynamic load (live load), point load, max. allowable deflection, max. allowable natural frequency, required dynamic stiffness, mechanical loss factor, compression hardness, durability.

Excerpt from the technical data handbook: to receive a copy of the complete data handbook, please contact us.



The graphs shown here are incomplete and serve as an example only. Please refer to the technical data handbook for applicable information.

Types of Vibration Isolation of Buildings

The decision of which measures to take always depends on various factors and must be taken based on the individual case.

The vibration at the place of immission (within the building) depends on these four factors:

- Nature of the frequency of the emission source
- The transmission via the specific ground / soil
- The foundation design and coupling of the building
- The continuation of the vibrations within the building structure.

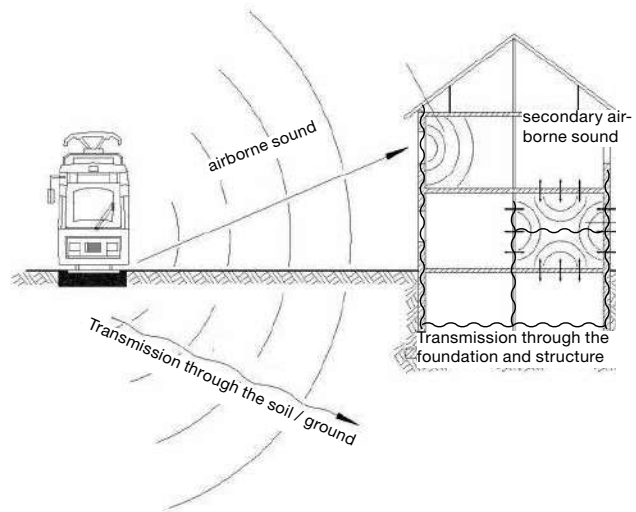
As a rule, the existing situation should be assessed by taking vibration measurements. With the help of complex, computer-assisted calculation models the expert consultants can then come up with a forecast for the property and define the solution using Regupol and Regufoam, which can be economically and technically sound.

Elastic decoupling is only effective if a high level of care is used during the installation. Special attention must be taken to make sure that there are no direct connections (structure-borne sound bridges) between the building foundation and its surroundings.

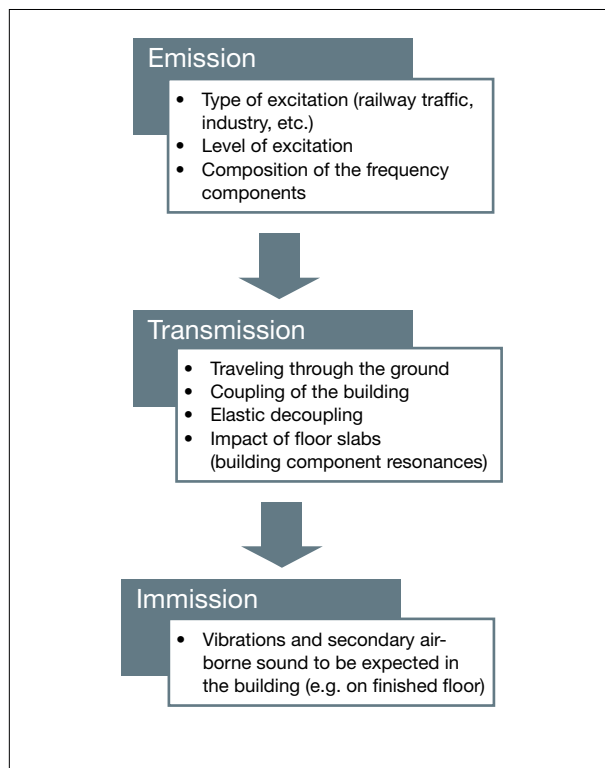
Where the resilient isolation material is to be applied depends on the properties of the foundation. Regupol America offers solutions for various types of foundations, such as:

- Full-surface decoupling beneath the base plate
- Strip decoupling under strip footings (underground)
- Strip decoupling under rising walls (within the building)
- Point decoupling under footings

Transmission paths of vibrations

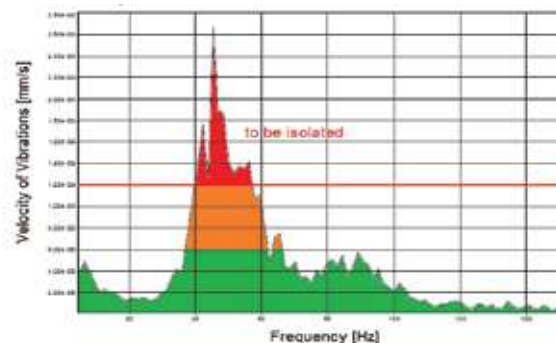


Transmission Mechanism



Impact factors for the transmission of vibrations.

Exemplary frequency spectrum of structure-borne sound caused by train traffic



Full-Surface Decoupling

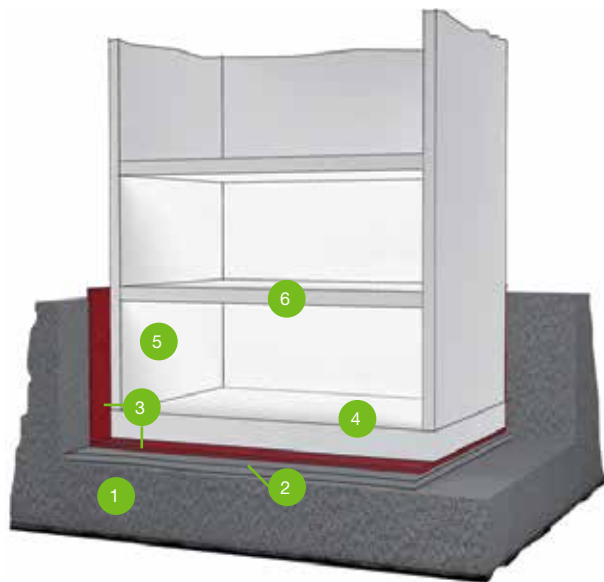
In full-surface decoupling, the entire building foundation is separated with Regupol® and Regufoam® elastically from base plate and soil. The elastomer is either applied on a thicker foundation course or on a specially dimensioned supporting plate.

To achieve optimum efficacy, the foundation should be as rigid as possible. Full-surface coverage allows for quick and easy installation and provides minimal risk of sound bridges.

The building loads are distributed over a large area of the subfloor. The degree of stiffness of Regupol and Regufoam elastomers is selected by taking the different compression ranges into account. As a result, even deflection of the entire base plate can be achieved.

The base plate and the adjoining structural components should also be as rigid as possible to avoid vibration of the structural components and potentially activating large masses of material.

Regupol and Regufoam must be covered with a polyethylene film (thickness at least 8 mil) for protection against the concrete.



Full-surface decoupling of a building foundation with Regupol and Regufoam vibration damping material: 1 natural surface

- 2 impedance plate
- 3 Regupol/Regufoam vibration isolation
- 4 foundation plate
- 5 basement wall
- 6 floor slab

Strip Decoupling

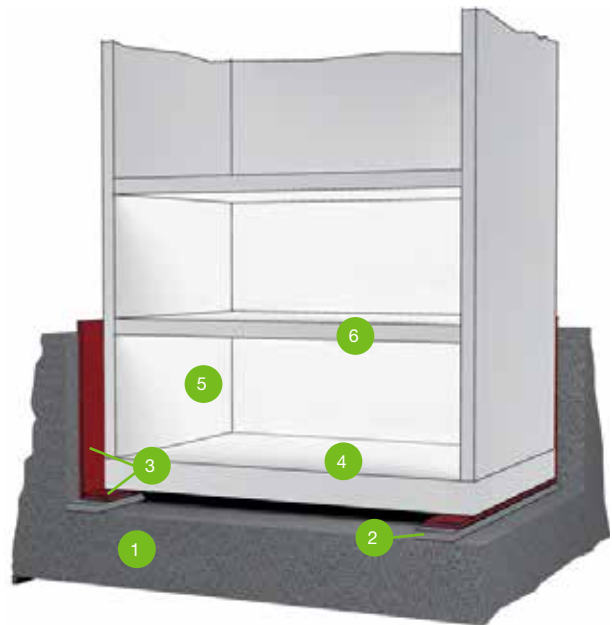


Strip decoupling is an isolation design option for buildings with strip foundations.

An alternative option is to employ strip decoupling on the load bearing walls underneath the basement ceiling. With this method, it is also possible to eliminate vertical isolation of the exterior structural components. However, caution should be used to avoid sound bridges.

Adjoining walls and ceilings must be sufficiently rigid to avoid resonance effects within the building. Installation can be done either with cast in place concrete or by using prefabricated concrete.

Regupol® and Regufoam® must be covered with a polyethylene film (thickness at least 8 mil) for protection against the concrete.



Strip decoupling of a building foundation with Regupol and Regufoam vibration damping material: 1 natural surface • 2 impedance plate • 3 Regupol/ Regufoam vibration isolation • 4 foundation plate • 5 basement wall • 6 floor slab

Point Decoupling

Due to the high point loads in foundations with structural columns, Regufoam® and Regupol® with a high load-bearing capacity should be used for vibration decoupling.

Constant pressures under the footings are critical to avoid potential structural issues. By customizing the footing dimensions, the pressure on Regupol and Regufoam remains constant, therefore even deformation and isolation behavior is achieved.

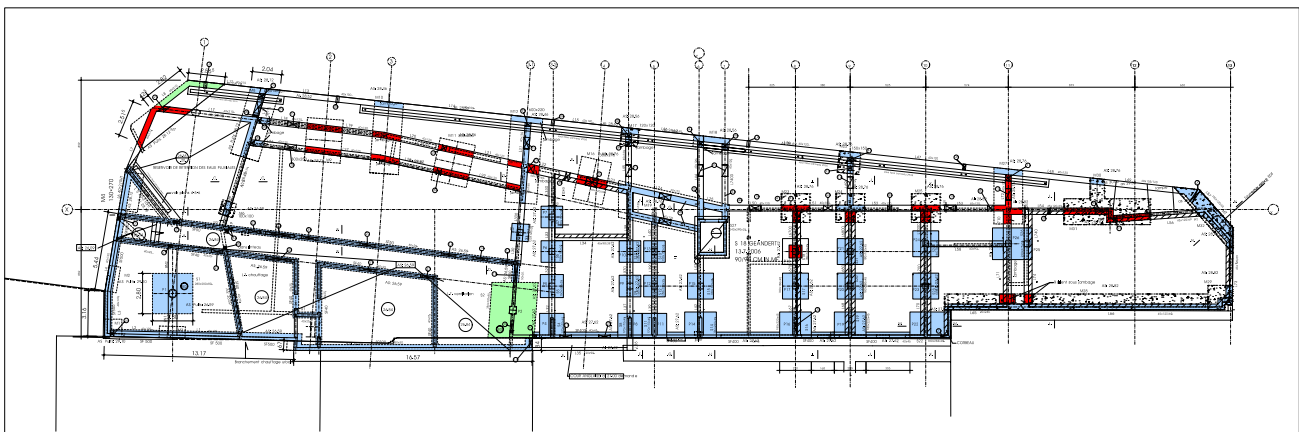
Adjoining walls and ceilings must be sufficiently rigid to avoid resonance effects within the building.



Point decoupling of a building foundation with Regupol/ Regufoam vibration damping material: 1 natural surface • 2 impedance plate
 • 3 Regupol/ Regufoam vibration isolation • 4 foundation plate
 • 5 basement wall • 6 floor slab

The Clichy Music School (France) as a case study

Decoupling of the building foundation of the Clichy Music School with Regupol vibration damping material. The red, blue and green fields indicate the installation of various Regupol types.



The red, blue and green fields indicate the installation of various Regupol® types.

Vertical Decoupling



Every foundation isolation project requires a vertical decoupling of the exterior foundation walls in addition to the elastic bearing beneath the foundation. For existing buildings near existing rail lines a vertical decoupling of the foundation wall is the only feasible way to protect the building from external vibration sources subsequently.

Regupol® and Regufoam® offer excellent material properties for this application as the material withstands most potential environmental influences, such as freeze/thaw, water and high loads from soil and concrete.

Typically sheets of soft Regupol or Regufoam types are used for this application. Even with high load bearing capacities, Regupol and Regufoam still have very low dynamic stiffness for superb sound isolation. Regupol and Regufoam vibration products are quick and easy to install and have been engineered for long-term exterior use.

Standard sheet size is 24" x 24", for easy handling and installation. Custom thicknesses and sheet sizes may be available upon request.

The vertical isolation sheets should be adhered to the foundation wall. Please contact Regupol America for installation instructions.

Prior to backfilling the site, the elastomer should be protected from fill by covering it with a geotextile fabric. Please contact Regupol America for specifications.



Worldwide References with Regupol® and Regufoam®

Hotels & Apartments

- Avalon Communities by AvalonBay, Glendora, CA
- Motel One Hotel, Berlin, Germany
- Apartment Complex, Walton-on-Thames, United Kingdom
- Piano House Apartments, Warszawa, Poland
- Vaterstetten Apartments, Munich, Germany
- Kurfürstenplatz Apartments, Munich, Germany
- Hikari Hotel and Apartments, Lyon, France
- Ten Townhouses Holweide, Cologne, Germany,
- Carpathia Luxury Apartments, Warszawa, Poland
- Hotel Zoo, Berlin, Germany
- Southampton Row Apartments, London, United Kingdom

Convention Centers & Education

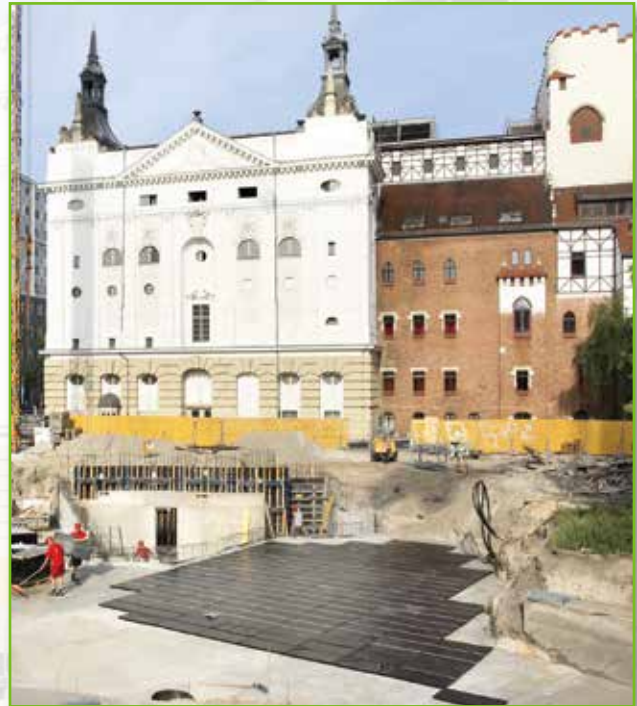
- UNC Imaging Research Building, Chapel Hill, NC
- RBC Convention Center, Winnipeg, Canada
- Music School Ecole de Musique, Clichy, France
- Music Academy, Zagreb, Croatia
- Spokane Convention Center, Spokane, WA

Administration and Commercial Buildings

- AGBU New York Administration Office, Yerevan, Armenia
- Cineplex Cinemas, Ingolstadt, Germany
- Sternschanze Administration Office, Hamburg, Germany
- Cinema and Commercial Complex, Clisson, France
- Rossmann Corporate Headquarters, Burgwedel, Germany

Industrial Buildings

- AUDI Production Plant, Győr, Hungary
- VW Volkswagen Plant, Poznan, Poland
- Mainova Power Plant, Frankfurt, Germany
- SITA Power Plant, Poznan, Poland



Please feel free to contact us for:

- Detailed technical information
- Calculations and recommendations
- Custom solutions for your individual project
- Installation instructions

Phone +1 717.675.2190

Email vibration@regupol.com



Armadillo Noise & Vibration

1 Titleist Drive

Acushnet

MA 02743

Tel: 800 580 3984

Email: sales@armadillonvinc.com

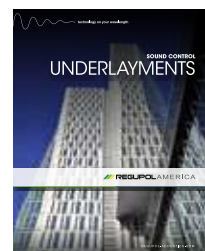
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