Vibration Isolation of Buildings

Resilient Bedding of Buildings

BSW

Vibration Isolation of Building Foundations

Various factors may subject buildings to shock which continues in their structure and is perceived by the people living in them as noticeable vibrations or secondary airborne noise. Specifically in areas with a dense infrastructure, these are typically vibration emissions from above- or underground railway lines and from industrial plants.

Especially the high prices of land in conurbations also make locations next to railway lines attractive if the buildings there are sufficiently isolated against the attendant vibrations. The price advantage of acquiring land that is exposed to vibrations of this kind far exceeds the additional expenditures for the resilient bedding of buildings. The materials made of **Regupol®** and **Regufoam®** have been developed to isolate vibrations. Numerous building foundations have already been successfully isolated against vibration impact with **Regupol®** and **Regufoam®**.

With **Regupol®** and **Regufoam®**, BSW offers a total of 20 different materials.

Vibration remeasurements in already completed projects have shown that vibration isolation with these materials was sometimes able to achieve better results than the required minimum value determined in the forecast.

The material **Regupol®** is composed of rubber fibres, rubber granulates (SBR, NBR) and polyurethanes, and **Regufoam®** is a mixed-cell polyurethane foam.

All the physical properties of the vibration-isolating products of BSW which the expert consultants require are sufficiently documented. Thanks to their different load ranges, various types of material can be used for different areas bearing different loads. Consequently, even demanding isolation jobs can be mastered.

The vibration isolation of buildings that is achieved with **Regupol®** and **Regufoam®** remains at a constantly high level for the long term. It has been possible to document the isolating effect of structures through control measurements after their completion and after ten years of use.

In cooperation with the expert consultants, BSW has also developed specifically designed types or modifications of material for particularly demanding projects.

Regupol® and **Regufoam®** are suitable for all kinds of vibration isolation of buildings:

- Full-surface foundation bedding
- Strip foundation bedding
- Pointed foundation bedding
- Vertical lateral vibration isolation
- Decoupling underneath the basement ceiling
- Vibration isolation of individual parts of buildings
- Room-in-room constructions
- Slotted walls in the transmission area between energy source and building

The Benefits

- Isolation effect can be adjusted to the specific requirements
- Choice of two different product lines for the most economical and technically best solution possible
- Precisely definable tuning frequency thanks to individ-ual material thicknesses

Made in Germany

- best quality
- fair pay
- secure jobs
- high environmental standards

Vibration Isolation of Building Foundations

Tasks

The vibrations which are caused by the source of the shock may spread throughout the building structure: they are perceived as noticeable vibrations, they can spread as secondary airborne sound, and when the worst comes to the worst, they can damage the building structure. What is more, the function of machines and measuring equipment in the building may be impaired.

The objectives of the vibration isolation of buildings are:

- health protection
- the protection of the building fabric
- the protection of the technical equipment inside the building

Shock is the common term for mechanical vibrations of solid bodies with a potentially damaging or disturbing effect.

Structure-borne sound refers to vibrations which, contrary to airborne sound, continue through a solid medium. Vibrations in liquids are called fluid-borne sound.

The transmission path of vibrations or of shock may include a change of media.

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

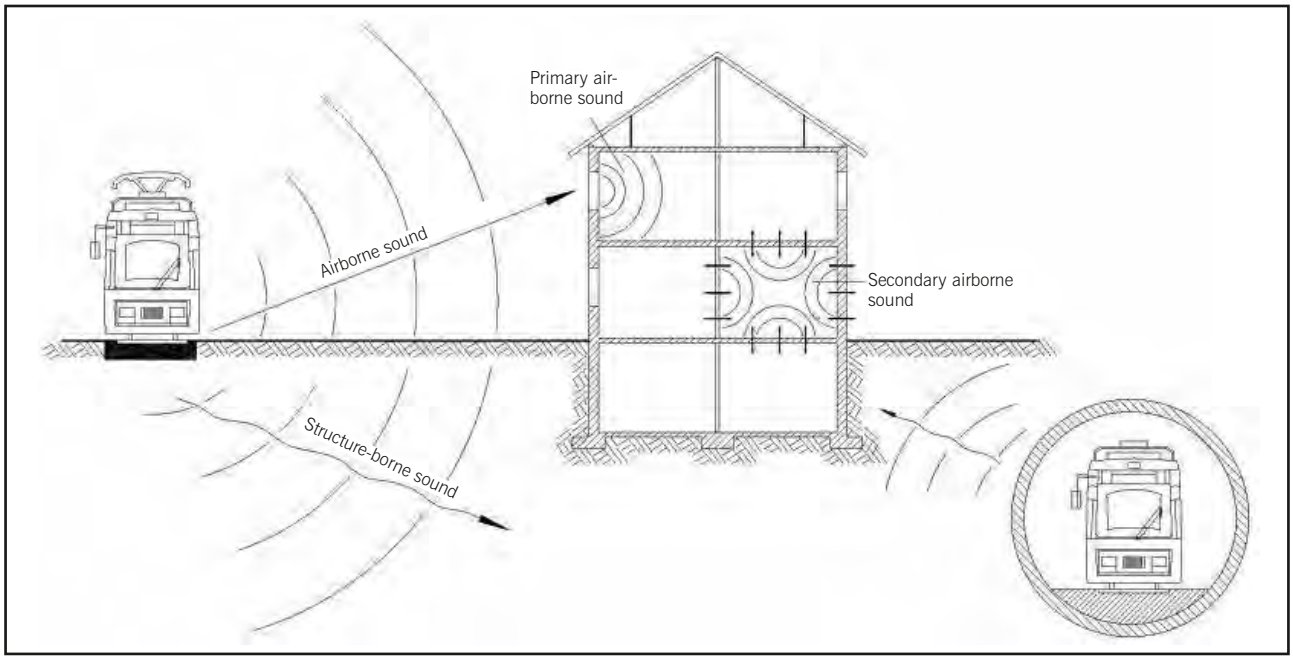
1. Vibration-reducing measures at the place of the emission, e.g. a mass-spring system in a railway track.

2. Interruption of the transmission of the vibration in the transmission area, e.g. through a below-ground slotted wall or by shielding the basement walls.

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 at the earliest. This is the measure most commonly used.

Most decoupling measures are taken at the building foundations and are called resilient bedding of buildings. Railway tracks are one of the most frequent causes of emission. Therefore the majority of the measures apply to resilient bedding of buildings for interfering frequencies between 25 and 100 Hz. Vibrations in this frequency range are critical, as they can lead to building component resonances and thus to secondary sound effects.

Consequently, the resilient bedding of buildings is intended to reduce the transmission of vibrations in the structure of the building with the help of the isolating material and by taking complex impact factors into account. Lowering the level to between 10 to 25 dB, depending on the frequency, is no problem at all with **Regupol®** and **Regufoam®**.



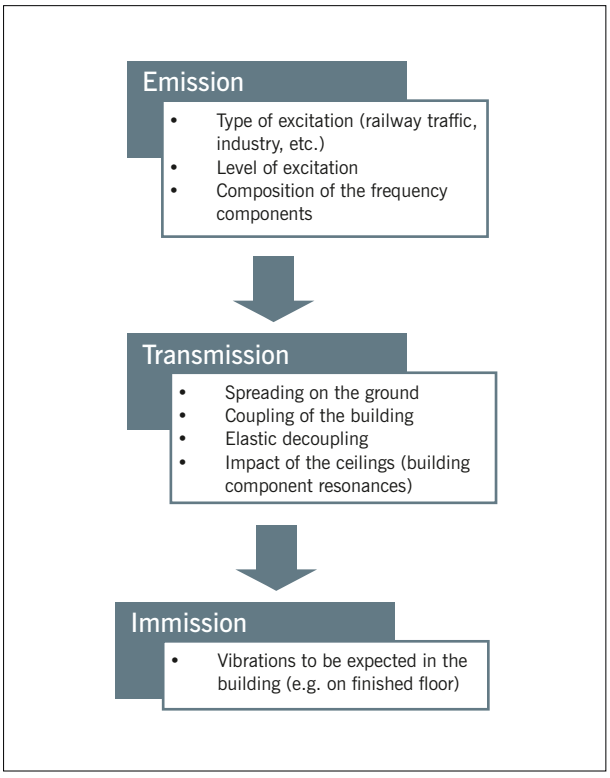
Types of Vibration Isolation of Buildings

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

The vibrations to be expected at the place of immission (the building) depend on the composition of the frequency of the emission source, on the transmission via the specific ground, the coupling of the building and 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 "target situation" of the resilient measure. The resulting requirements of support frequency and isolation effect make it possible to develop the optimum solution from an economical and technical point of view when **Regupol**® and **Regufoam**® are used.

Transmission Mechanism



Impact factors for the transmission of vibrations.

Elastic decoupling is only effective if certain specifications are adhered to during the installation. Special care must especially be taken to make sure that there are no direct connections (structure-borne sound bridges) between the property to be protected and its surroundings.

The decision of where the resilient measure is to be applied at the building depends on the properties of the foundation. We distinguish between full-surface decoupling underneath the base plate, strip decoupling under strip foundations, the rising walls or point decoupling. When exterior building components touch the ground above the decoupling level, it is necessary also to decouple them vertically from the ground.

Recommendation and coordination of specialist planners for building acoustics.

Find out more on Page 63.

BSW specialist planning service

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Full-Surface Decoupling

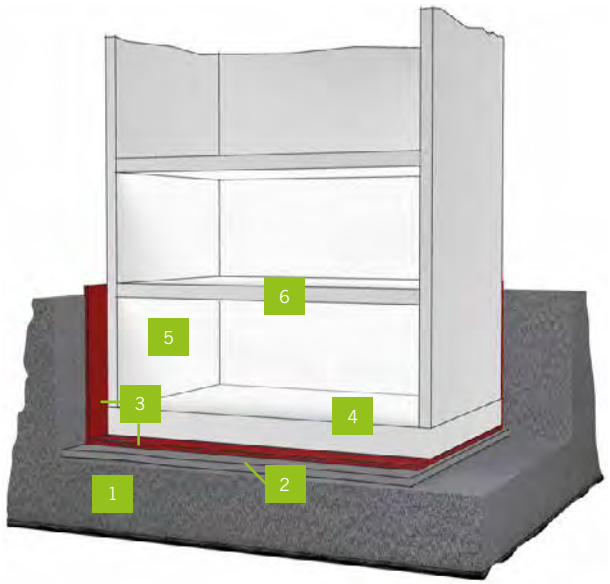
In full-surface decoupling, the entire base plate is separated elastically from the building ground. The elastomer is either applied on a thicker foundation course or on a specially dimensioned supporting plate.

To achieve optimum efficacy, the foundation should be as rigid as possible. Since it is a full-surface installation, the isolation can be performed quickly and easily, and the risk of acoustic bridges is very low, too.

The building loads are distributed over a large area of the subfloor. The degree of rigidity of the elastomers is selected by taking the different compression ranges into account. As a result, fairly 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 so as to avoid vibration of the structural components and dynamically activating large masses of material.

Finally, the elastomer must be covered with PE foil for protection against concrete slurries.



Full-surface 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

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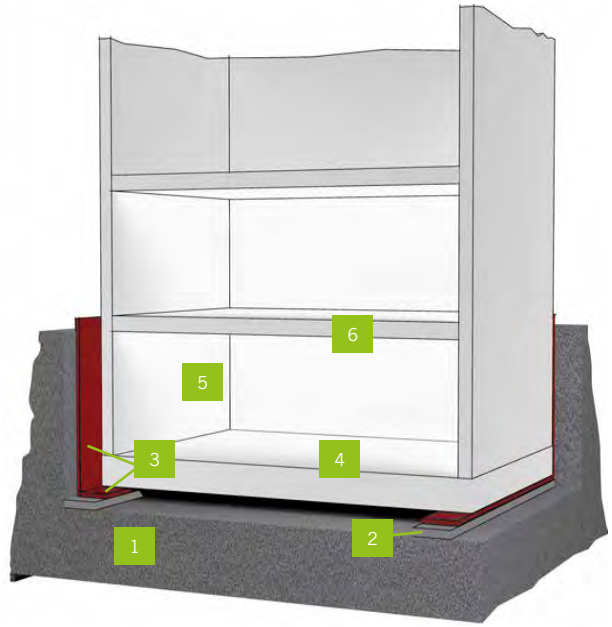
Strip Decoupling

Linear decoupling is a vibration isolation option for buildings with strip foundations. The width of the foundation should be such that the elastomers are used optimally by the load-bearing area to make sure that the best isolation effect can be achieved.

An alternative option is strip decoupling on the rising walls underneath the basement ceiling. With this method, it is also possible to do without vertical isolation of the exterior structural components towards the ground.

The adjoining structural parts, such as ceilings on top of the structural part, must be sufficiently rigid to avoid vibrations of the structure. Installation can be done either with in situ concrete or using prefabricated parts.

To prevent the penetration of concrete slurries into the elastomer, the latter should be protected by a PE foil with a thickness of at least 0.2 mm.



Strip 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

Point Decoupling

Because of the high point loads in foundations with poles and supports, elastomers with a high load-bearing capacity are typically used for vibration decoupling. The elastomers should already be included in the plan at an early stage to make sure that the vibration isolation can increase the security of the entire structure.

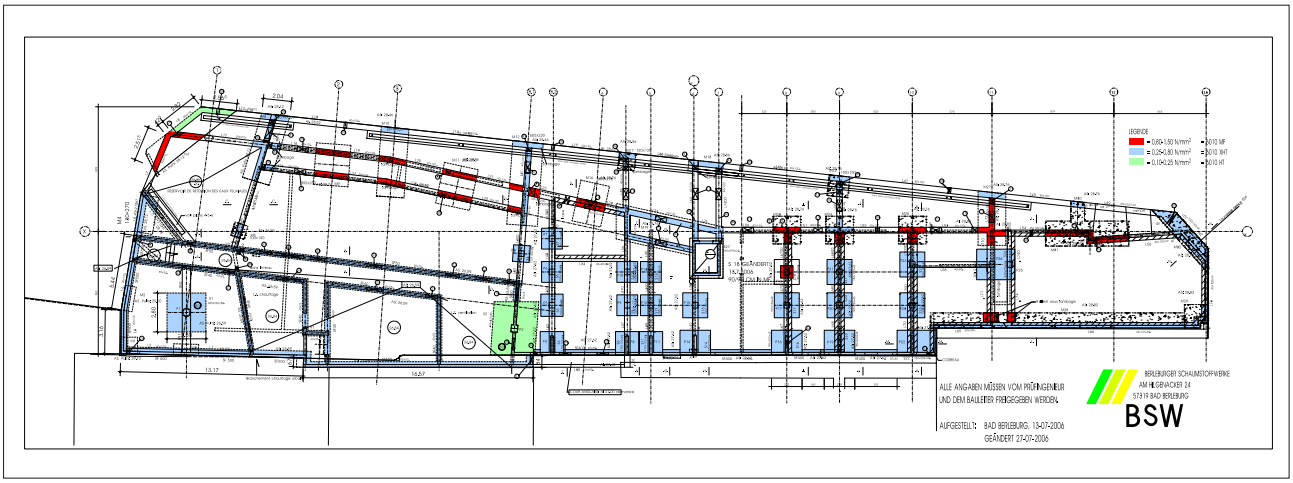
The pile cap structure can be optimised by keeping the pressure on the elastomer constant by varying the measurements. The result is an even deformation and isolation behaviour of the entire foundation construction and the elastomers.

The foundation structure should be rigid as well so as to activate adjoining parts of the overall structure as dynamic masses and to reduce structural vibrations.

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 (France) Music School as a Real-Life Example

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.

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Vertical Decoupling

In some cases it suffices to install a vertical partition at the exterior structural components in order to reduce vibrations. Vertical partitions are often installed between existing and to-be-constructed buildings.

In these applications there are diverse requirements of the elastomer. The more dynamically soft the material, the better the reduction of the vibration. However, it still has to be able to bear the loads that occur. These loads, which may be the result of earth or concreting pressure, may be up to 120 kN/m^2 and in exceptional cases even considerably higher.

Generally a plate-shaped, soft elastomer from the **Regupol®** group is used for this type of application. Even though they have a constant load-bearing capacity of up to 120 kN/m^2, **Regupol®** elastomers still have very low dynamic rigidity. Moreover, the material is insensitive to moisture and very quick to install thanks to the installation aids.

The material is available in plates of 1,000 x 500 x 50 mm as standard to ensure good handling. Depending on the requirements for the vertical isolation, the material can also be installed in double layers with 100 mm thickness. Special thicknesses (e.g. 25 mm) are available upon request.

The vertical isolation can be glued onto the partition wall. To this end the construction site must offer the usual gluing conditions such as a dry and dust-free surface.

Alternatively, the material can be nailed or plugged onto the wall with mounting aids, regardless of the weather conditions.

Prior to backfilling the site, the elastomer should be protected against sediments and sharp rocks by covering it with a geotextile.

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Mounting

Gluing

The vertical isolation can be glued onto the partition wall. To this end the construction site must offer the usual gluing conditions such as a dry and dust-free surface.

Mechanical Mounting

Alternatively, the material can be nailed or plugged onto the wall with mounting aids, regardless of the weather conditions.

Execution (Example)

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www.bsw-vibration-technology.com

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