Noise and vibrations are caused by trains. By increasing rail traffic additional noise and vibration mitigating measures have to be implemented. We offer advanced solutions on reduction of vibration along existing rail way lines (retrofit).
Vibration mitigation along rail way lines

Situation
Noise and vibrations are caused by trains. The increase in noise and vibrations is an environmental problem and leads to the annoyance of the increasingly demanding residents. By shifting more transport to rail or increasing high-speed operations additional noise and vibration mitigation measures have to be implemented.

Keller offers advanced solutions (retrofit), especially in confined spaces, on reduction of vibration along existing rail way lines.

Solutions
Keller offers various solutions with different materials. The optimum method and product depends mostly on the emissions of the rail traffic, the subsoil and the available space.

The big advantage of these Keller solutions is that
1. no excavation pit or trench is required and therefore no dangerous soil movements will affect the railway tracks or the adjacent buildings,
2. they can be applied under confined spaces,
3. they can be applied quickly and economically.

Materials with different stiffness can be installed, like improved soil, concrete or steel elements, rubber mats, synthetics.

In 2011 the European Union started a development project under the name RIVAS ("Railway Induced Vibration Abatement Solutions") within the 7th European Framework Program.
The three year research project, which was financially supported by the EU, had the goal to develop innovative measures to reduce the negative effects of vibrations from railway traffic on the environment significantly, whilst still maintaining the competitiveness of railways in Europe.

Innovative solutions have been developed, designed and tested. Keller, as a specialist foundation engineering contractor, was a member of this research group and contributed to the development and testing of various solutions. We are named as a leading specialist in this area.

More information is available: www.rivas-project.eu
**Wave barrier**

Keller has developed a patented method for installing vertical wave barriers. The method and equipment had been tested and optimized together with BAUGRUND DRESDEN.

A wave barrier is buried on one (or both) side(s) along the railway track to attenuate vibrations caused by trains. The performance is mainly affected by the depth and width of barrier and properties of fill material.

For layered ground, the barrier should penetrate the upper layer; a barrier deeper than the top layer(s) does not bring much extra benefit.

The soft wave barrier is very effective at sites with a relatively stiff soil.

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**Jet Grouting Columns**

The jet grouting process “Soilcrete®” is recognized as cemented soil stabilization. With the aid of high pressure cutting jets of water or cement suspension the soil around the borehole is eroded. The eroded soil is rearranged and mixed with the cement suspension. Different geometrical configurations of Soilcrete® elements can be produced.

A jet grouting wall alongside a railway track can act as a stiff wave barrier. There is a critical frequency from which this mitigation measure is able to hinder the propagation of Rayleigh waves in the soil, depending on the dimensions of the barrier and the difference in stiffness between the original and stiffened soil.

A significant vibration reduction can be obtained especially where the jet grouting wall has a higher stiffness than the original soft soil(s).
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