



Vibration monitoring, Retzstadt, Germany



Case study

November 2020

Vibration monitoring during the renovation of a residential building

Abstract

In Retzstadt (Main-Spessart district) nearby of Würzburg, a multi-family house is undergoing major refurbishment.

The house was built in 1980 and consists of three separate residential units. Both the ground floor (2015), as well as the top floor (2017) have already been refurbished. Now the first floor follows. In addition, a hybrid heating system - Heat pump and gas - is installed.

Vibrations are produced by the following intensive works:

- Demolition of all non-load-bearing interior walls
- Demolition of load-bearing interior walls (replaced by steel beam constructions)
- Opening of external walls for new window elements
- Demolition of the complete screed

The demolition work extends over approximately two months.

The resulting vibrations must be monitored to prevent cracks in the residential building.

Demolition works

The location of Retzstadt on the map of Germany is indicated in Figure 1, while the residential building is shown in Figure 2.

The demolition is mainly carried out with the tools and machines indicated in Table 1 and shown in Figure 3.

Table 1. Technical characteristics of the tools used.

Tool	Technical characteristics
Sledge hammer	4 Kg
Demolition hammer	800 W / 2.5 J
Demolition hammer	1350 W / 9.4 J
Demolition hammer	1700 W / 50 J

Monitoring summary

City:	Retzstadt (Germany)
Objective:	Determine the effect of vibrations on a residential building during refurbishment works
Duration:	Around 2 months
Devices:	3 ROCK
Location:	In the cellar, at the ground floor and at the top floor
Output:	Vibration level comparison with the DIN 4150-3 norm, with PDF reports automatically sent by the SCS cloud software

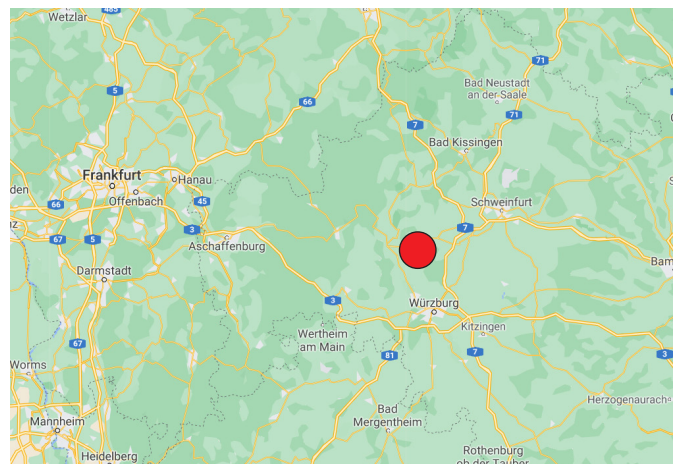


Figure 1: Map of Central-Southern Germany, with location of Retzstadt.



Figure 2: Exterior view of the residential building



Figure 3: Tools used for the works.

The monitoring

In Figure 4, the intense demolition works on the first floor are shown.

For the vibration monitoring, the SYSCOM ROCK devices are selected for two main reasons:

1. 4G wireless automated solution, without cable requirement and operating completely automatically together with SCS cloud software;
2. long autonomy on battery (up to 6-8 months depending of the configuration), particularly suitable for locations without power supply.

The monitoring is carried out at three measuring points:

- MP1: Cellar/foundation
- MP2: Ground floor kitchen
- MP3: Top floor living room

The instruments are shown in Figure 5, while their configuration is indicated in Table 2.

Table 2. Parameters used inside the ROCK devices.

Parameter	Value
Sampling frequency	1000 Hz
Frequency range	1 - 315 Hz (DIN 45669-1)
Trigger level	0.5 mm/s on the three axes
Reference norm	DIN 4150-3, curve related to residential buildings
Alarm 1	75% of the reference norm
Alarm 2	100% of the reference norm



Figure 4. Demolition works on the first floor.

Figure 5. Devices installed for the project: a) MP1 in the cellar; b) MP2 in the kitchen of the ground floor; c) MP3 in the living room on the top floor.

Alarm 1 Plot

Selected norm: DIN 4150-3 (GERMANY)
 Axis Legend: ▲ X ◆ Y ■ Z

Residential Buildings

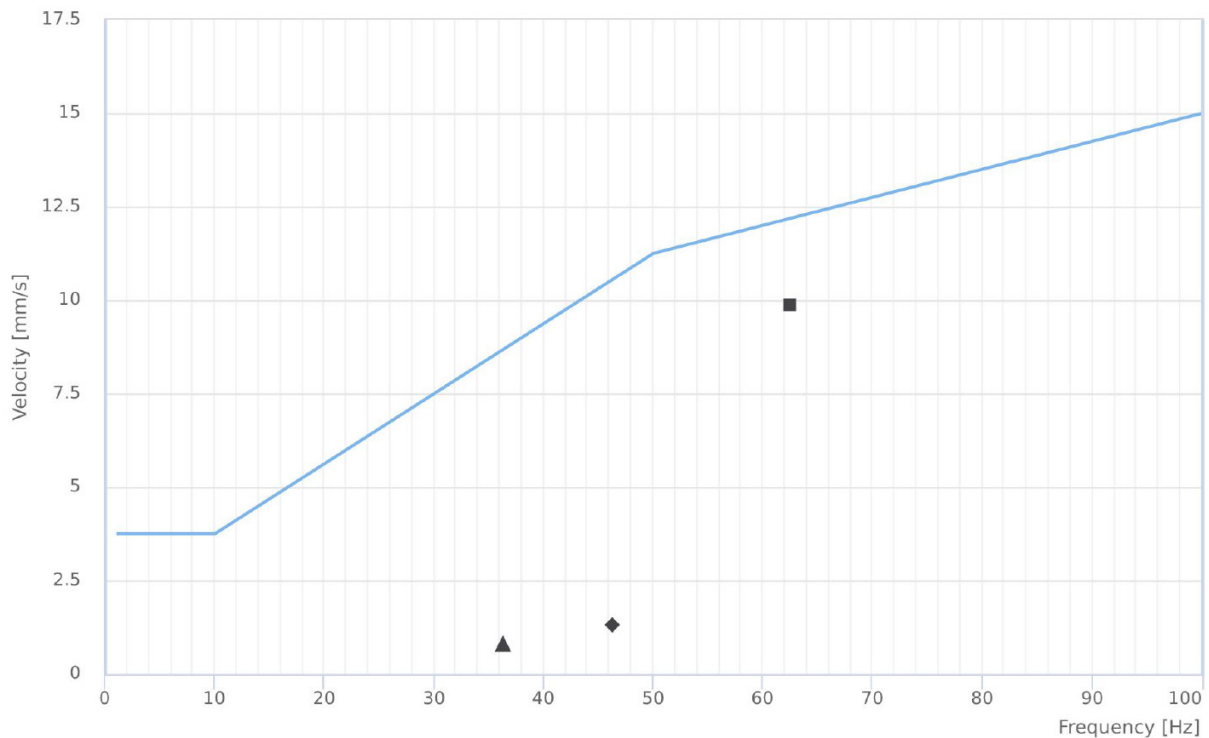


Figure 6. Comparison with the German norm DIN 4150-3, for residential buildings, for an event recorded at the measurement point MP2.

Results

The evaluation of the recorded data is carried out by the SCS (Syscom Cloud Software - scs.syscom-instruments.com). When the trigger threshold is exceeded, the data are automatically recorded and transferred to the SCS, and then compared with the DIN 4150-3 (residential buildings).

The SCS also processes the data automatically by generating a PDF event report and sending notifications to the specified recipients. If the alarm value is exceeded, the landlord is immediately notified with an SMS/e-mail and can take relevant actions when required.

Despite quite high amplitude vibrations in the whole house, the threshold values of DIN 4150-3 were not exceeded. Referring to figure 6, an event with significant vibrations recorded at MP2 is compared with the reference norm.

Conclusion

During the 2 months works, a total of 50 tons of rubbles are removed from the 1st floor. The vibration monitoring setup / solution, based on 3 ROCK devices and the SCS for automated data processing, enabled continuous evaluation of vibration levels during demolition.

This solution allows people being informed in near real-time about the vibration levels generated on site with best reliability and efficiency.

In this monitoring, the reference values of the DIN 4150-3 are never exceeded.

Special thanks to Wölfel Group who allowed us to write this case study.



About Syscom

SYSCOM Instruments is part of Terra Insights platform of trusted monitoring technology brands. Terra Insights is the industry's first, end-to-end sensor to cloud data delivery platform that supports proactive, risk-informed decision making and monitoring. SYSCOM Instruments SA is a leading supplier of vibration and seismic monitoring equipment for the civil engineering and safety markets, in particular for nuclear power plants and LNG plants. The reputation of SYSCOM Instruments SA is based on the reliability of its products, resulting from a meticulous control of all aspects of design and production.

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