

## Vibration monitoring of Bonn Center demolition with MR3000C and MR3000BLA

### Abstract

The Bonn Center was a commercial center in Bonn, in the western part of Germany. It was built in 1968–1969 and it had a height of 60 m. Recently the municipality of Bonn decided to replace it by a new center and its demolition was programmed for Sunday 19<sup>th</sup> of March 2017.

Since the Bonn Center is located in the centre of the city, the municipality decided to monitor the blast-induced effects on some surrounding structures, in particular two residential buildings, a hotel and the building of the International Paralympic Committee.

Parallel to the official measurements done by the blasting company, four additional monitoring devices made by BARTEC SYSCOM are used to record the velocities in three directions and the air pressure in the measurement point closest to the demolition site.

The data are analyzed by means of the SCS (Syscom Cloud Software), where the comparison with the German norm DIN 4150-3 is automatically and quickly performed.

### Summary

|                  |  |
|------------------|--|
| Objective:       | Vibration monitoring of buildings close to the demolition site of the Bonn Center  |
| Date:            | March 19 <sup>th</sup> , 2017  |
| Location:        | Bonn (Germany)   |
| Meas. points:    | 4  |
| Instrumentation: | - 3 MR3000C with internal triaxial velocity sensor and external battery pack<br>- 1 MR3000BLA with external triaxial velocity sensor and air pressure microphone |
| Analysis:        | SCS Cloud Software ( <a href="http://scs.bartec-syscom.com">scs.bartec-syscom.com</a> )  |
| Regulation:      | DIN 4150-3 (Germany) – Vibration at foundation - Residential buildings   |
| Output:          | Comparison of the maximum velocities and frequencies with the limits of the DIN 4150-3 norm  |

### Monitoring configuration

The demolition of the Bonn Center is performed on 19<sup>th</sup> March of 2017. In Figure 1, the building few minutes before the demolition is displayed.

The vibration monitoring is done on 4 different points close to the demolition zone, according to the map in Figure 2. The instruments in the different locations are shown in Figure 3, while the devices used and the distances from the demolition zone are listed in Table 1.

In Figure 4, successive time instants related to the demolition of the Bonn center are represented. They are taken from the Bonn Marriott Conference Hotel.

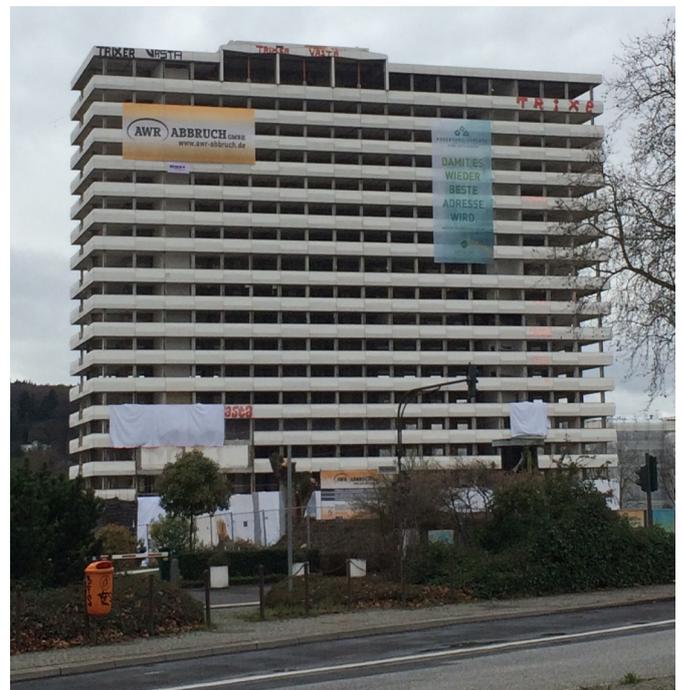


Figure 1. The Bonn Center few minutes before the demolition.



Figure 2. Map with the demolition zone and the measurement points.



Figure 3. Instruments installed for the vibration monitoring: MR3000C in MP1 (a); MR3000BLA in MP2 (b), MR3000C in MP3 (c) and MR3000C in MP4 (d).

Table 1. Location, distance and device for each measurement points.

| Meas. point | Location  | Distance from site | Device    |
|-------------|---|--------------------|-----------|
| MP1         | Bonn Marriott Conference Hotel, inside a room                 | 160 m              | MR3000C   |
| MP2         | Residential building, close to an external wall               | 40 m               | MR3000BLA |
| MP3         | International Paralympic Committee, on the stairs of the cave | 70 m               | MR3000C   |
| MP4         | Residential building, on external stairs                      | 80 m               | MR3000C   |

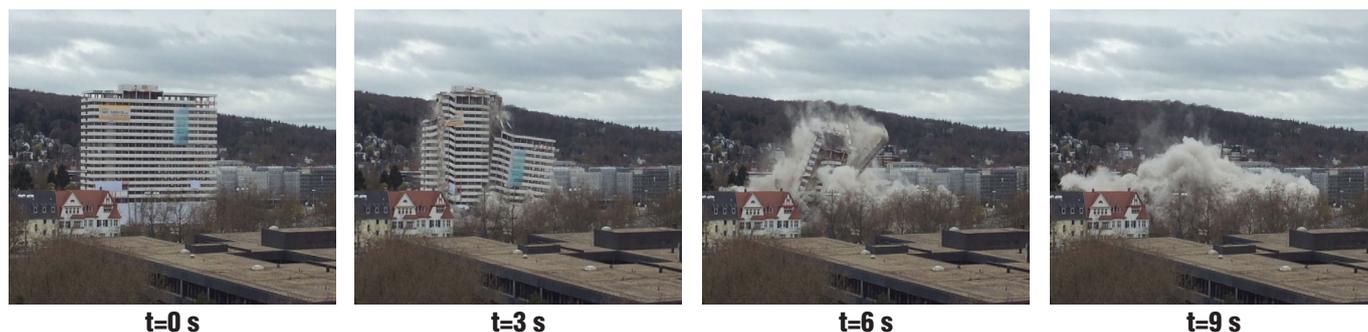


Figure 4. Successive instants of the Bonn Center demolition, seen from the Bonn Marriott Conference Hotel.



Figure 5. Time histories recorded in MP1, in the Bonn Marriott Conference Hotel, during the demolition of the Bonn Center.

Three MR3000C and one MR3000BLA are used for the vibration monitoring. The MR3000BLA is installed in the point closest to the demolition site, to measure also the air pressure. The microphone is oriented in the direction of the explosion.

The MR3000C in MP1 is installed in a room inside the Bonn Marriott Conference Hotel, while the instruments in the other locations are installed close to the foundations of each building, in order to measure the vibrations transmitted from the ground to the structures. For this reason, the values recorded are compared to the limits defined by the German standard DIN 4150-3, concerning vibrations at foundation for residential buildings.

All the instruments are installed temporarily during the demolition and are powered by a battery.

**Data analysis with Syscom Cloud Software**

The analysis of the data is done with the SCS cloud software. In Figure 5, the time histories recorded in MP1 are displayed. The Bonn Marriott Conference Hotel shows significant vibrations for a duration of about 12 seconds.

The maximum velocity peaks recorded and the dominant frequencies calculated by means of the FFT do not exceed the limits defined by the DIN 4150-3 norm, as can be seen in Figure 6, which relates to a successful blast.

**Conclusions**

The demolition of a building in a city center has a significant impact on the surrounding structures, where vibration instruments should be installed to check if the velocity values are compliant to the reference norm, in order to ensure that the demolition works do not cause any structural damage.

The SCS cloud software ([scs.bartec-syscom.com](https://scs.bartec-syscom.com)) allows to automatically analyze the data from the devices and to compare them with the limits defined by the German norm DIN 4150-3.

**Special thanks to Wölfel Group, our German Sales Partner, and their customer Bayernspreng GmbH who allowed us to write this case study.**

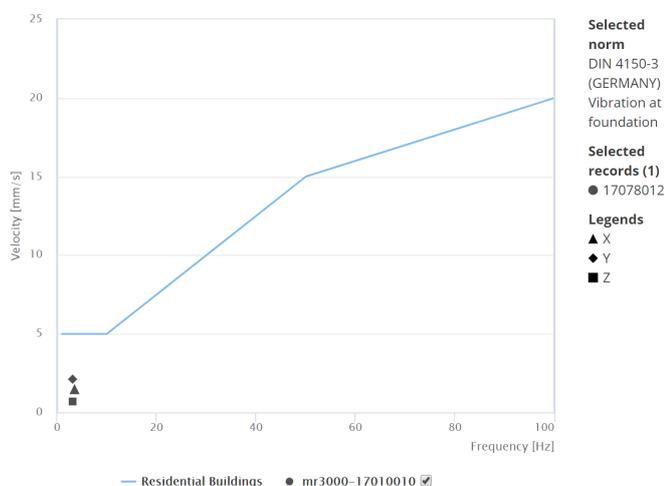


Figure 6. Comparison of the velocities/frequencies of the event recorded in MP1 with the limits of DIN 4150-3 for residential buildings at foundation.

**About BARTEC SYSCOM**

SYSCOM Instruments SA is a subsidiary of BARTEC GROUP, a multinational manufacturer of industrial safety equipment. SYSCOM Instruments SA is a leading provider of vibration and seismic monitoring equipment for civil engineering and safety related markets, especially for NPP and LNG plants. SYSCOM Instruments SA reputation rests on the reliability of its products, coming from a meticulous control of every design and production aspects.