

Vibration monitoring, Grand Paris Express, France



Case study

November 2017

Vibration monitoring of T2A sector in the Grand Paris express project

Abstract

The Grand Paris express is a project for the extension of the transportation inside and around Paris (France). The works are focused on:

- the extension of the current metro lines 11 and 14;
- the construction of 4 new metro lines (15, 16, 17 and 18).

The Grand Paris express is the biggest urban project in Europe.

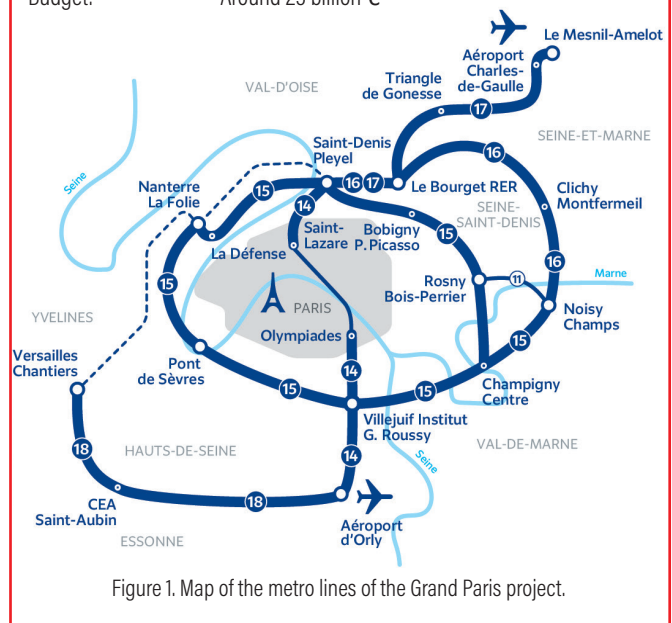
The company Sixense Soldata is responsible for the whole monitoring of the T2A sector, on the new metro line 15, between the stations Villejuif Louis-Aragon and Créteil l'Échat.

The MR3000C instruments made by Syscom are used for the vibration monitoring of the buildings surrounding the construction sites in order to reduce the environmental impact and the disturbances.

25 devices are already installed, and the total expected duration of the vibration monitoring is minimum 4 years.

Grand Paris express project - key facts

City:	Paris (France)
Lines:	2 extended lines, 4 new lines
New railway lines:	200 km
New stations:	68
Passengers/day:	2 millions
Train frequency:	2 to 3 minutes
Automatization:	100% automatic metro system
Urban impact:	90% of lines will be built underground
Duration:	Until 2030
Budget:	Around 25 billion €



Monitoring Summary

Project: Grand Paris, Paris (France)

Sector: T2A, on the metro line 15, between stations Villejuif Louis-Aragon and Créteil l'Échat

Objective: Vibration monitoring of buildings surrounding the construction sites

Duration: Minimum 4 years

Device type: MR3000C with internal triaxial velocity meter

Devices installed: 25 (Nov. 2017) year to date

Output: Data transferred to FTP server and automatic alarm notifications via SMS/e-mails when the trigger level is exceeded.

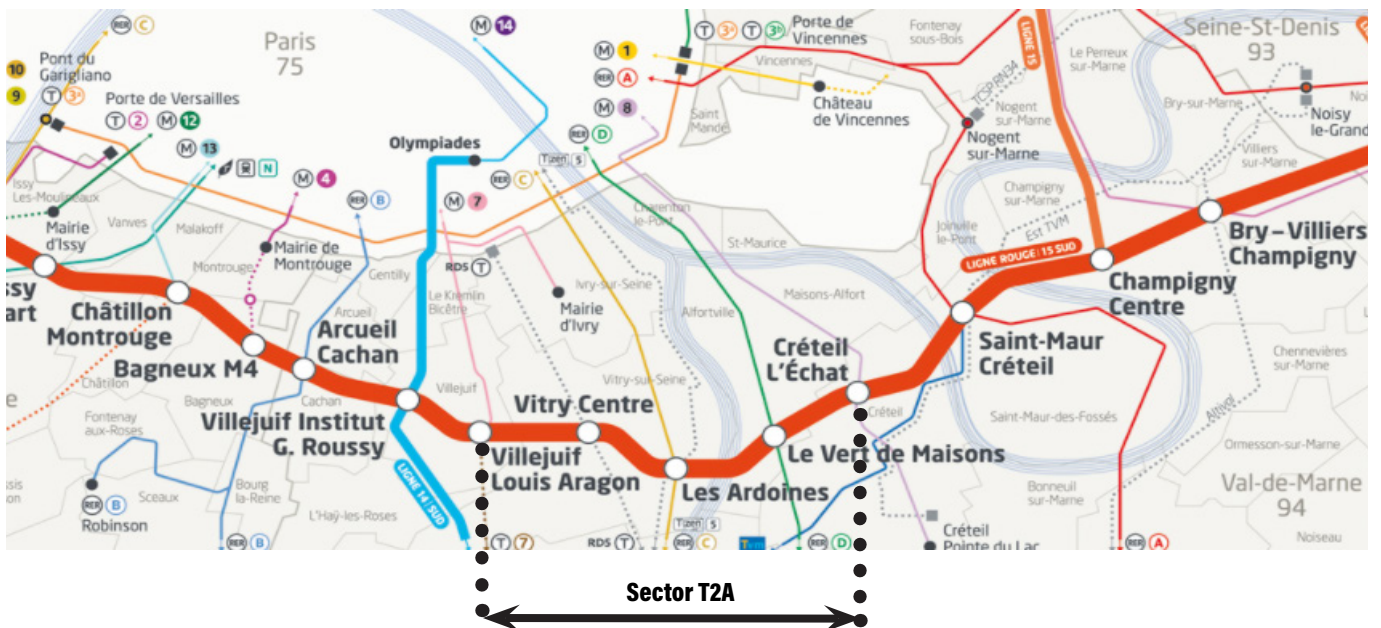


Figure 2. Map of the new metro line 15 with the sector T2A highlighted.

Monitoring configuration

The MR3000C used for the structural vibration monitoring have all the following characteristics:

- Internal triaxial velocity meter;
- Embedded 3G modem for internet connection;
- Vertical or horizontal installation, depending on the location;
- External battery pack, in case of main power loss.

The pictures in Figure 3 show some installations of the instruments: on a warehouse (Figure 3a) and inside buildings, on a load-bearing wall (Figure 3b) or at the foundation (Figure 3c).

In Figure 3a-3b the MR3000C is installed vertically, while in Figure 3c it is installed horizontally. In all cases the devices are fixed by using the holes in their mounting plate.

The MR3000 devices record the following information:

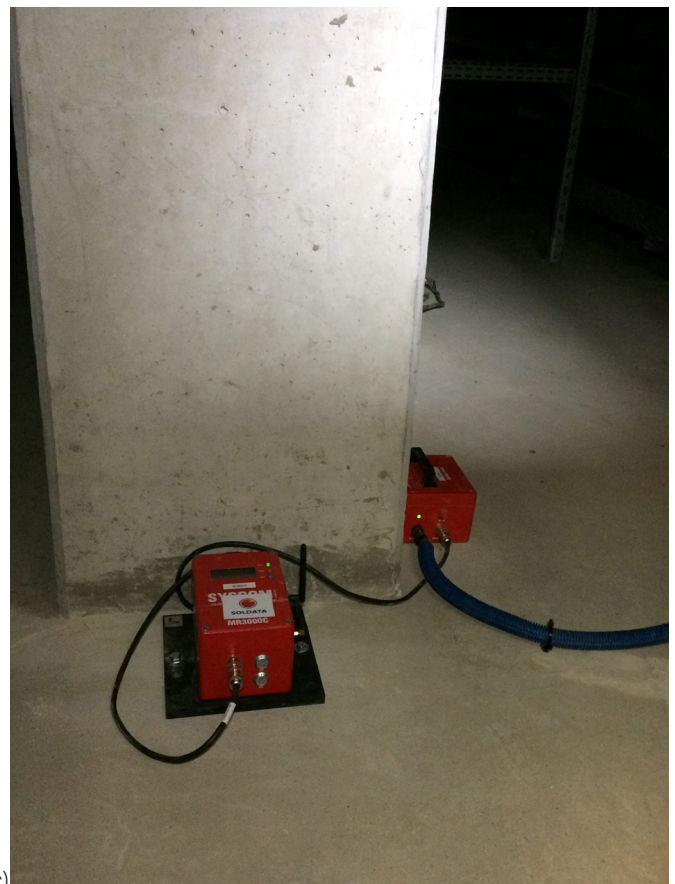
- **Event data:** the time history of the three components (X, Y, Z) is recorded when the threshold limit of 3 mm/s is exceeded on one of the three axes. The event includes a 1 s pre-event and a 3 s post-event.
- **Background data:** every minute, the velocity peaks of the three axes are saved in a new file. The file duration is 1 hour, resulting in 24 files per day.



a)



b)



c)

Figure 3. MR3000C installed in different locations in the T2A sector of the Grand Paris: on a warehouse wall, in vertical position (a); on a load-bearing wall inside a building, in vertical position (b) and at the foundation of a building, in horizontal position (c).

Data transfer and analysis

The event and background data are automatically saved in TXT format and sent to the secure FTP server of Sixense Soldata. Moreover, e-mails and SMS notifications are immediately sent to the monitoring engineers once a new event is created, to be informed about anomalous PPV values and to successively reduce the work intensity. The communication diagram for the Grand Paris express project is shown in Figure 4.

In Figure 5, real background data taken from a MR3000C installed in the T2A sector are displayed. The file duration is one hour, showing that the construction works on site end around 17:30. The trigger threshold of 3 mm/s is not exceeded, therefore no events are created in this period.

Data in Figure 5 are visualized in the SCS cloud software (**scs.syscom-instruments.com**).

The SCS is used for any data visualization, and can be used for remote modification of trigger/alarm parameters and automatic creation of PDF reports on data recorded, in order to quickly inform users and authorities about values recorded on site.

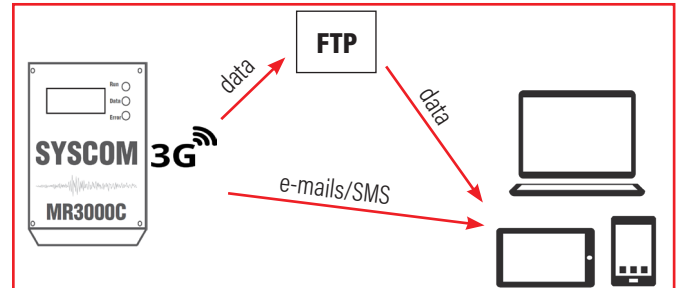


Figure 4. Communication diagram for Grand Paris express monitoring.

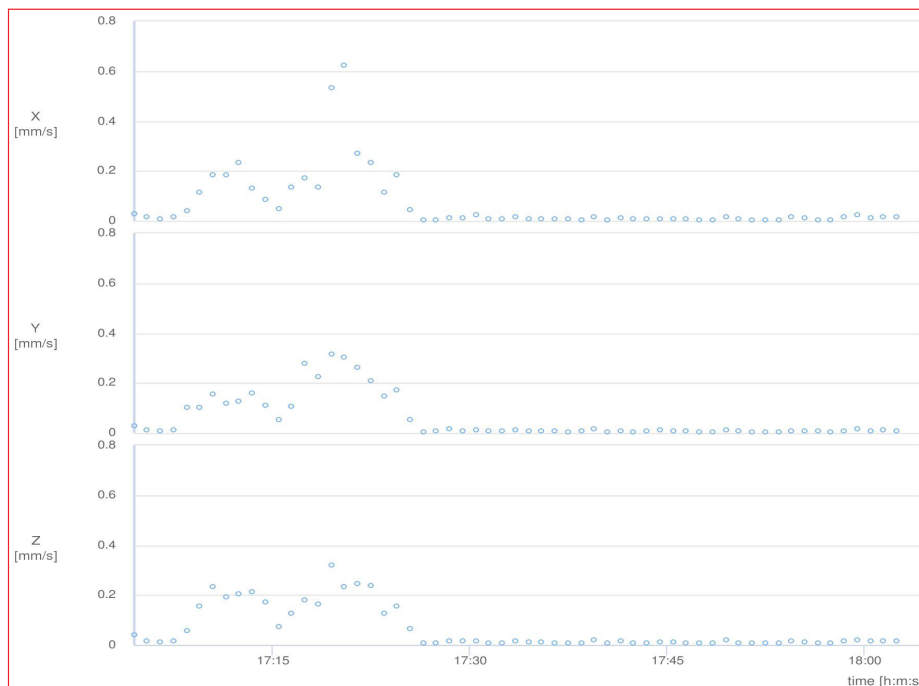


Figure 5. Background data: velocity peaks registered during one hour monitoring, at the end of September 2017.

Conclusion

The MR3000C of Bartec Syscom is used for the vibration monitoring of the T2A sector of the Grand Paris, the biggest urban project in Europe. In November 2017, 25 devices are already installed.

The MR3000C instruments are chosen because of the high reliability and embedded communication capabilities. By means of the internal 3G modem, they automatically send data to the configured FTP server and notifications to monitoring engineers in case of velocity level exceedance. The notifications are sent as soon as the event is created, to inform users in a very short time for optimum risk assessment.

The MR3000C units are completely autonomous and independent, and this results in a very easy monitoring management, making the devices suitable for any kind of vibration monitoring projects.

Special thanks to Sixense Soldata 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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