

## Strong motion monitoring of Plovdivtsi Dam in Bulgaria with MR3000DMS

### Abstract

The Plovdivtsi Dam is located in the small village of Plovdivtsi, in the south part of Bulgaria, very close to the Bulgarian-Greek border.

The dam is built on the Iskrets River, in order to provide potable water to the surrounding area.

Plovdivtsi Dam is a rock-fill type dam with asphalt-concrete diaphragm, and its height is 52 m. The construction works of the dam finished in 2017 and, since the whole southern part of Bulgaria is a highly seismic zone, a strong motion monitoring system is needed on the structure to control the vibrations in case of earthquakes.

For this purpose, the MR3000DMS devices made by Bartec Syscom are selected for the conformity to the required specifications and for the ease of installation.

### Summary

Objective:	Strong motion monitoring of the Plovdivtsi Dam
Dam type:	Rock-fill type with asphalt-concrete diaphragm
Dam height:	52 m
Location:	Plovdivtsi (Bulgaria)
Installation date:	June 2017
Instrumentation:	3 MR3000DMS with internal triaxial accelerometer
Interconnection:	Fiber optic cables
Output:	Data recordings (events) when the trigger levels defined by the Bulgarian Seismic Institute are exceeded



Figure 1. The location of the Plovdivtsi Dam, in the South of Bulgaria.

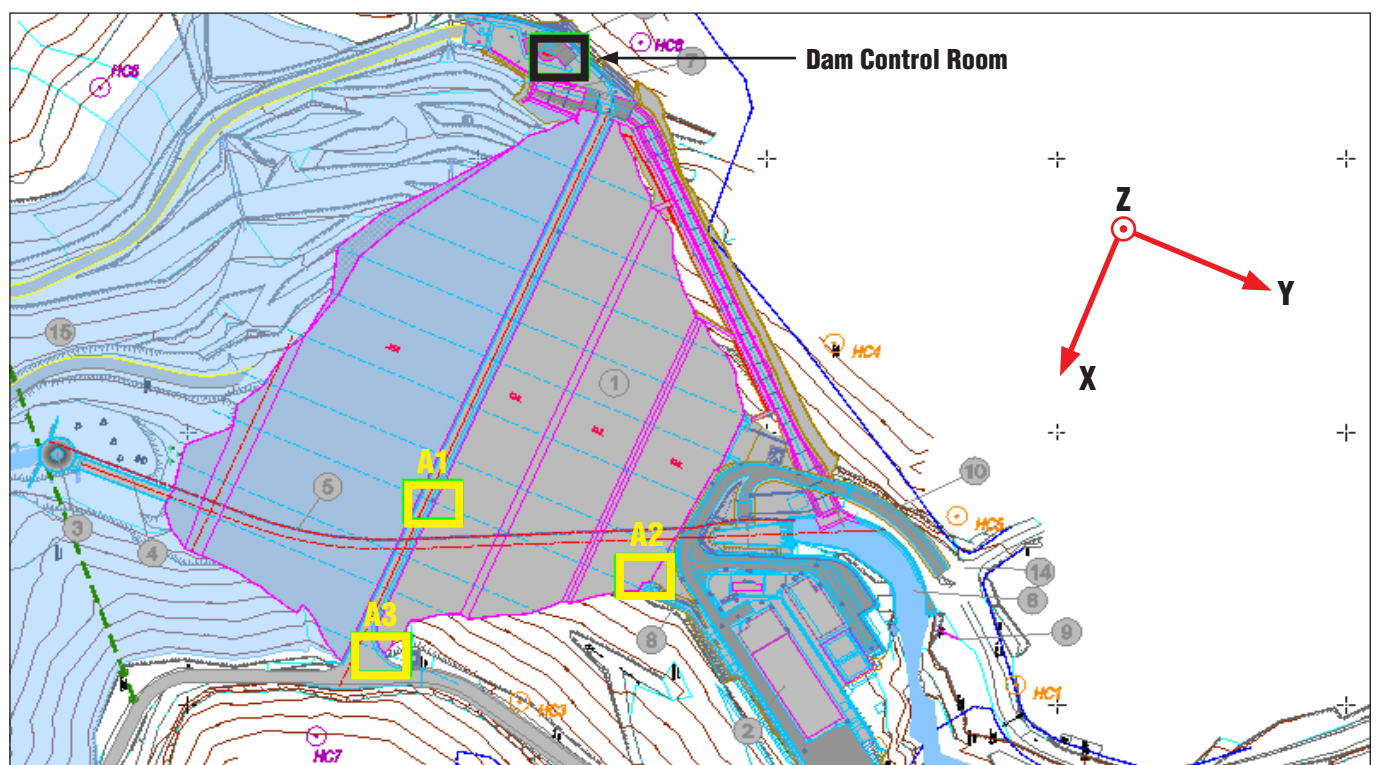


Figure 2. Map of the dam with the location of the measurement points.



Table 1. Main characteristics of the measurement points.

Measurement point	Location	Unit type	GPS antenna
A1	Dam top	Master	Yes
A2	Dam base	Slave	No
A3	Abutment	Slave	No

Table 2. Installation directions, for all the measurement points.

Axis	Positive direction
X axis	towards right bank
Y axis	downstream
Z axis	towards the sky



Figure 3. MR3000DMS instruments installed on the Plovdivtshi Dam: A1 (a); A2 (b) and A3 (c).

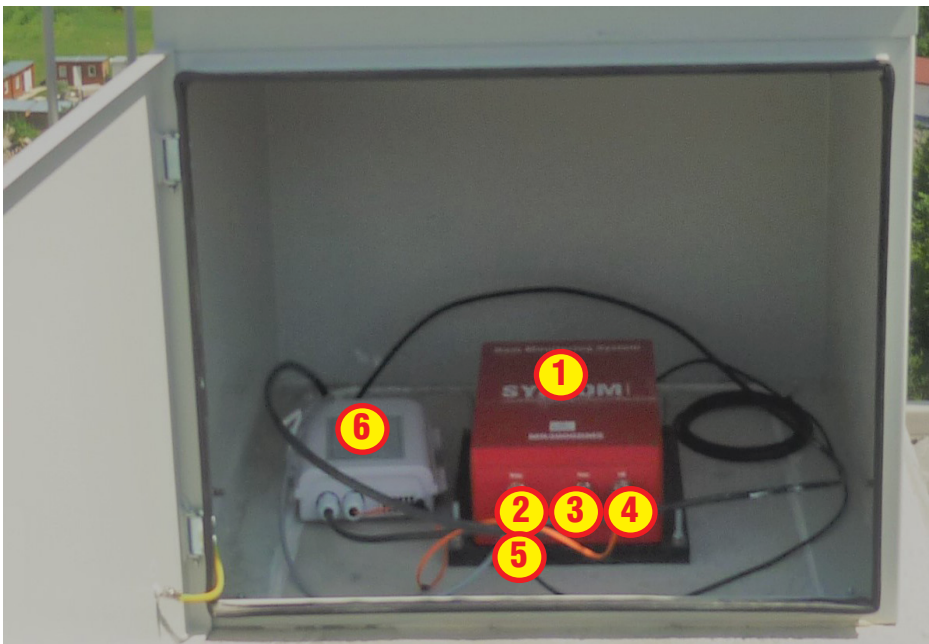


Figure 4. Internal view of the cabinet related to measurement point A1 with: the MR3000DMS, the junction box and the cables.

### Monitoring configuration

The strong motion system includes three MR3000DMS with:

- Internal triaxial accelerometer
- Internal relay outputs
- Internal over-voltage protection
- Communication with fiber optic cable
- AC power

The locations of the different units are showed in Figure 2 and the main characteristics are listed in Table 1. All the instruments are oriented according to the directions indicated in Table 2.

The measurement points A1, A2 and A3 are showed in Figure 3. Every station has a cabinet containing a MR3000DMS and a junction box (all the details are showed in Figure 4). The cabinet is installed on a concrete block which is strongly coupled with the ground. The MR3000DMS in A3 is installed slightly rotated in order to have the same axis orientation of the other devices, for easier signal post-processing.

The instruments are interconnected with fiber optic cables, to be linked in the same LAN network and to quickly retrieve all the recordings from the control room. Moreover, the event files are automatically sent to the SCADA system of the dam.

The MR3000DMS in A1 is the master device, and it is able to manage common trigger and alarms. A GPS antenna is connected to it, in order to have an absolute time reference for the whole network. The GPS antenna is installed on the dam railing (Figure 3.a).

The units measure continuously and automatically produce self tests once per month, in order to check periodically the state-of-health of the system without stopping the monitoring. The permanent auto-check of the system eliminates the periodic maintenance and alert the operators only in case of a problem.

1. **MR3000DMS**
2. **Alarm cable**
3. **AC power cable**
4. **Fiber Optic cable**
5. **GPS cable**
6. **Junction box** able to manage:
  - External alarm devices, activated in case of instrument error;
  - AC power, to reach the closest AC power supply;
  - Fiber optic cables.

The alarm levels of all the instruments is set to 50 mg, for all the axes, as recommended by the Bulgarian Seismic Institute.

### Conclusions

The Plovdivtzi dam is a fundamental water resource in the southern part of Bulgaria. Since the region is highly seismic, the dam is equipped with 3 MR3000DMS strong motion systems.

The units continuously monitor the vibrations at the dam top, base and abutment, by sending the data to the SCADA system of the dam and by activating the alarm devices in case of errors.

Moreover, the units are completely autonomous and they do not require any periodic maintenance nor calibration.

The strong motion monitoring provided by Bartec Syscom is able to provide information useful for a structural health monitoring of the dam and then to improve the risk assessment and the sustainability of the asset.

**Special thanks to Start Engineering JsCo who allowed us to write this case study.**

### 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.