

# Case Study

## Structural Monitoring Jakarta Cathedral Indonesia



In Cooperation With  
GeoSIG Partner



P.T. RISEN ENGINEERING CONSULTANT  
www.risen.id

### Background

Located on the Pacific Ring of Fire, Indonesia must cope with the constant risk of earthquakes. Jakarta, the capital of Indonesia, is located in the North of Java Island with approximately 664 sq km total land area and a total population of approximately 10 million\* people, with a density about 15,000 people for every sq km.

As the capital city, Jakarta has a long history since the Dutch colonial era. Many historic buildings were built in Jakarta, including church buildings. Today many remaining historical buildings and architecture are steadily deteriorating, but some of the old buildings have been restored to their former glory. One of the buildings that has survived to date is Jakarta Cathedral, a Roman Catholic cathedral that is also the seat of the Roman Catholic Archbishop of Jakarta. Its official name is Gereja Santa Perawan Maria Diangkat ke Surga (The Church of Our Lady of Assumption). This Cathedral was consecrated on 21.04.1901 by Mgr. Edmundus Sybrandus Luypen. It is built in the neo-gothic style, a common architectural style to build churches at that time. On 24.09.2018, Jakarta Cathedral was designated a National Ranking Cultural Heritage Site by the Minister of Education and Culture. Previously in 1993, the cathedral had been designated as the Cultural Heritage Site of the DKI Jakarta Province.

### Challenge

There are three main spires in Jakarta Cathedral: the two tallest ones measure 60m and are located in front on each side of the main entrance. The north tower is called Turris Davidica, or "Tower of David"—a devotional title of Mary symbolizing Mary as the refuge and protector against the power of darkness. The south tower, also 60m, is called "The Ivory Tower", with the whiteness and pureness of ivory to symbolise the purity of Virgin Mary. On the Ivory Tower, there are old clocks that are still functioning as well as a church bell. The third spire, called "The Angelus Dei Tower," rises above the roof's cross intersection and measures 45m from the ground. These three towers are steel structures which stand on unreinforced masonry structures. They are the highest part of the building as well as being the most critical parts. They are of course not designed with current building codes, so it is very important to know the structural behavior of these towers, especially due to lateral loads or earthquakes. Due to the civic and historical importance of Jakarta Cathedral, the mandate was to deliver and install a vibration monitoring solution—without damaging any part of the building—with robust, long life sensors, proven to be cost effective and offering longevity.

### Solution

The church has undergone three renovations, first in 1988, 2002 and lastly 2017. In 2017, it was decided to install a Structural Health Monitoring System. [P.T. Risen Engineering Consultant](#), with a wealth of experience in providing end-to-end customized solutions, successfully fulfilled the requirements of this highly prestigious project. The vibration monitoring solution consists of two GeoSIG [GMSplus6](#) data loggers with one internal triaxial accelerometer, three GeoSIG biaxial accelerometers and three GeoSIG uniaxial accelerometers. The tilt monitoring solution consists of three tiltmeters and one gateway. The installed vibrations solution offers reliable and continuous monitoring, providing data based on event detection. GeoDAS, a proven data acquisition and evaluation package developed by [GeoSIG](#), provides highly flexible user-friendly capabilities, graphical and analytical tools with configurable automation. For early tilting detection of the towers, wireless equipment was used as the data is collected once per hour. One tiltmeter on each tower and one gateway for collecting data from all tiltmeters was used. The tilting data can be seen in real time using a web browser as the gateway acts as a web server.

Another solution using GeoSIG instruments, effectively showing that quality and reliability can also be cost-effective.

\*from national census in 2010

### Product links

[GMSplus6](#)  
[GeoDAS](#)

[AC-4X accelerometer](#)  
[SEN-JB\\_GMB sensor junction box](#)



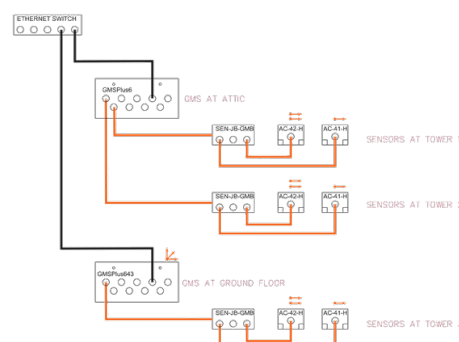
Jakarta Cathedral - sensor locations marked



Sensors installed at Angelus Dei Tower



GMSplus6 data loggers are installed in the cathedral's attic and at ground floor.



Schematic diagram of the vibration monitoring system.