DISCOVER THE POWER OF STRUCTURAL HEALTH MONITORING

GeoSIG

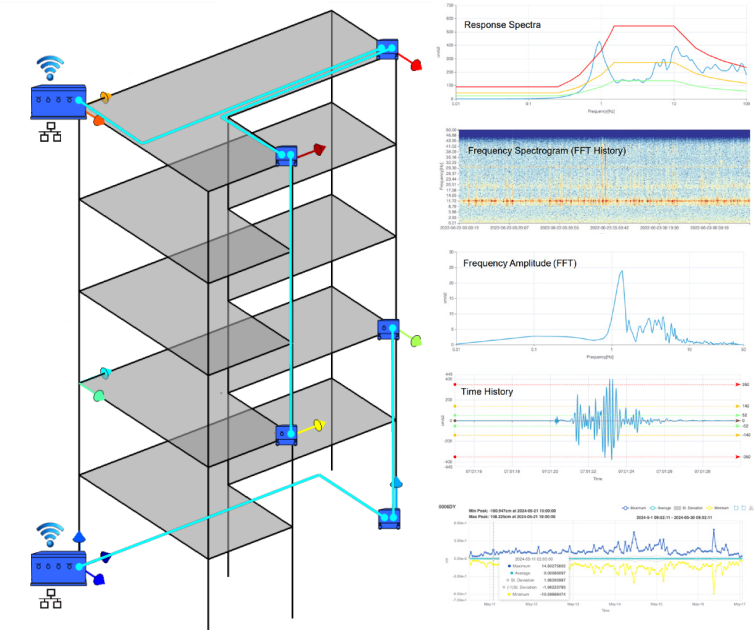
swiss made to measure

ISO 9001: 2015 CERTIFIED

Enhance your building's safety & longevity with a tailored SHM Solution by GeoSIG

Discover the power of Structural Health Monitoring (SHM)

Structural Health Monitoring (SHM) leverages cutting-edge sensor technologies and advanced data analysis to keep a real-time pulse on your building's structural condition. By continuously tracking key parameters like frequency, inter-story drift, acceleration, velocity, and displacement, SHM systems can help identify early signs of wear and tear, damage, or any changes in structural integrity.



Our comprehensive SHM solution

With over 30 years of expertise in seismic sensors and equipment, GeoSIG presents a comprehensive SHM solution. Our state-of-the-art GeoSMART software pairs seamlessly with our Swiss-engineered hardware, manufactured using our ISO-certified processes to provide a robust, reliable monitoring system. This all-in-one solution delivers unparalleled benefits for building owners and facility managers.

The benefits of SHM: why choose GeoSIG?

Early damage detection

Detect minor damages before they become major problems. Our SHM systems help define timely maintenance and repairs, assisting you avoid costly and extensive damages down the line.

Safety assurance

Keep your occupants safe with continuous monitoring that promptly indicates potential hazards or structural weaknesses.

Cost efficiency

Reduce maintenance costs and prevent emergency repairs by addressing issues early. Planned maintenance based on SHM data is more cost-effective than reactive approaches.

Extended lifespan

Regular monitoring and proactive maintenance can significantly extend your building's lifespan, ensuring it remains in optimal condition and minimizing the risk of unexpected failures.

Regulatory compliance

Stay compliant with local building codes and safety regulations effortlessly. Our SHM system provides documented evidence of your building's structural health, which may also help lower insurance premiums.

Data-driven decisions

Make informed decisions about your building's operation, maintenance, and upgrades with valuable data provided by our SHM system.

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Advantages of a monitored building

Equip your building with an SHM system and enjoy several key advantages:

- **Real-time monitoring:** Continuous, real-time assessment of structural integrity.
- **Increased safety:** Timely warnings by emails or visually installed alarm systems of potential structural issues which enhances occupant safety.
- **Optimised maintenance:** Data-driven maintenance schedules prevent major repairs and extend the building's lifespan.
- **Lower long-term costs:** Prevent severe damage and allocate maintenance resources efficiently to reduce overall costs.
- **Regulatory compliance:** Easily comply with safety regulations and building codes with documented monitoring.

Conclusion: invest in your building's future with SHM

Choosing GeoSIG's Structural Health Monitoring (SHM) solution is a proactive step towards ensuring safety, optimising maintenance, and reducing long-term costs. Continuous monitoring of your building's structural health allows for early detection of potential issues, enabling timely interventions that prevent major damage and extend the building's lifespan. In contrast, non-monitored buildings face higher risks and costs due to the lack of real-time data and reactive maintenance strategies. Invest in SHM for a smart, forward-thinking decision that pays off in safety, cost efficiency, and regulatory compliance. Contact GeoSIG today to learn more about how our SHM solutions can benefit your building.

Typical SHM applications

Buildings/structures with suspected defects

Your building may for a host of reasons show signs of damage appearing as:

- **Cracks in walls, floors, and ceilings**
  Vertical or diagonal cracks: often indicate foundation settling or shifting.
  Cracks: Cracks in any structural (columns, beams, floors, ceilings, shear walls) or non-structural (walls, separations) element may indicate various problems like foundation settlement, tilting, aging, fatigue or damaged elements.
  Stair-step cracks: Typically found in brick or block walls, these can indicate foundation movement.

- **Uneven or sagging floors**
  Floors that slope or sag can be a sign of foundation issues or damage to supporting structures such as beams and joists.

- **Doors and windows**
  Sticking or misaligned doors and windows: can indicate foundation movement.
  Cracks around door and window frames: often a result of structural shifts or settling.

- **Bowing or bulging walls**
  Walls that appear to be bowing or bulging outwards can indicate serious structural problems and should be inspected immediately.

- **Foundation issues**
  Visible cracks in the foundation: small hairline cracks may be normal, but larger cracks or those that grow over time can be a sign of significant issues.
  Water pooling around the foundation: can lead to erosion and weakening of the foundation.

- **Roof issues**
  Sagging rooflines: can indicate problems with the roof structure or supports.

- **Gaps and separation**
  Gaps between walls and ceilings or floors: indicate movement or settling of the building.
  Separation of exterior walls from the building: a severe issue that needs immediate attention.

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Typical SHM applications

If any of these signs are observed, it is crucial to have a professional structural engineer inspect the building to assess the severity of the damage and recommend appropriate remedial actions.

After you may have taken remedial actions if suggested by the structural engineer, you may wish to keep an eye on any further deterioration of your building. Choosing GeoSIG's Structural Health Monitoring (SHM) solution is a proactive step towards ensuring safety, optimising maintenance, and reducing long-term costs. Continuous monitoring of your building's structural health with implementation of additional sensors for areas of concern identified by the surveyor allows for early detection of further potential issues, enabling timely interventions that prevent major damage and extend the building's lifespan.

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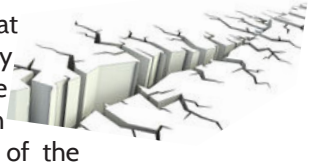
Buildings / structures in seismic zones

Buildings in seismic and earthquake prone areas may be subject to repetitive small earthquakes as well as occasional high intensity earthquakes. Depending on the usage and the size of the building it may easily justify the return on the investment for Structural Health Monitoring (SHM). Typically, after medium to high intensity earthquakes there may be a need to evacuate the building for a qualified surveyor to inspect the building to ensure that the building is still safe and can be reoccupied. This process at best can take from several hours to several days considering that the demand for surveyors will be high as many building owners will require the same service. This can be a costly period if the building is occupied by businesses where the combined unproductive cost of all the workers can run to hundreds or thousands of hours. Equally if it is a residential building the inconvenience and the cost of any temporary accommodation for the residents of the affected building can run into tens of thousands of dollars.



It is also worthwhile to bear in mind that in seismic zones there are often many small earthquakes which could over time weaken the structure of a building which can lead to a change in the behavior of the structure even under normal everyday operational loads.

If a building is instrumented with GeoSIG's unique SHM solution (Discover, the Power of Structural Health Monitoring) after any medium to high intensity earthquake within minutes the health of the structure can be evaluated. Automatic notifications as emails can be sent to authorised individuals as well as physical alert signals such as lights can be installed to provide the required information to the residents. The cost savings and the inconvenience of having to unnecessarily evacuate a suspected damaged building can easily and quickly be appreciated and justified.

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Buildings / structures subject to man-made vibration

There may be instances where construction of an underground tunnel or major structures, or the demolition of nearby structures, can impact the integrity of the building under consideration. Major excavation work nearby can also exert additional forces on the building. Monitoring the building with access to real-time data allows for continuous assessment of its health. This information, including alerts and notifications, can be shared with the construction company to help them adjust their activities accordingly. For example, they may drill or carry out excavation work at a slower pace to reduce the impact of the generated loads on the target building.

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Typical SHM applications

Buildings / structures subject to high winds / hurricanes

Buildings and structures in certain regions are frequently subject to high winds and seasonal hurricanes. These extreme weather events can impose significant forces on structures, necessitating designs that anticipate and withstand these expected loads. Engineers typically utilize historical weather data and predictive models to inform the design process, ensuring buildings can endure the typical forces they are likely to encounter.

However, similar to seismic events, the intensity and ferocity of hurricanes and high winds are not always predictable. The chaotic nature of these phenomena means that actual forces during an event can exceed those anticipated during the design phase. This unpredictability underscores the importance of post-event structural analysis.

When buildings are subjected to such forces, it becomes critical to assess their behavior during the event and evaluate their post-event structural integrity. Real-time monitoring equipped with sensors can provide valuable data on how the building responds to extreme wind loads, including identifying any deformations experienced by the structure. This data is crucial for understanding the immediate impact of the event and can be used to determine whether the building has sustained any damage that could compromise its structural integrity.

In summary, while buildings in regions prone to high winds and hurricanes are designed with these forces in mind, the

unpredictable nature of such events necessitates comprehensive post-event evaluations. Understanding a building's performance during these conditions and ensuring its continued structural integrity are paramount for the safety and resilience of the built environment.

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Buildings / structures to ground heave / subsidence

Buildings in regions prone to ground heave or subsidence are at significant risk of structural damage or catastrophic failure. Ground heave, which involves the upward movement of the ground, and subsidence, the downward movement, can both exert abnormal stresses on foundations and structures. These phenomena have intensified in recent years due to unprecedented weather conditions, such as extreme rainfall or prolonged droughts, which exacerbate soil moisture variations and subsequently ground movements.

The impact of geological changes on structural integrity is a subject of particular concern for building owners in these regions. Structures in areas with known risks of ground heave or subsidence may require comprehensive strategies to mitigate potential damage. This often involves structural strengthening, such as underpinning foundations or employing flexible construction techniques that allow buildings to accommodate ground movements without significant damage.

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In summary, buildings in areas susceptible to ground heave or subsidence face unique challenges that require a multifaceted approach. Structural strengthening and the use of advanced structural health monitoring systems are critical for mitigating risks associated with geological changes. Continuous monitoring and proactive interventions ensure the long-term safety and integrity of these structures amidst dynamic environmental conditions.

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Typical SHM applications

Aging / historical buildings and structures

Over extended durations, buildings undergo a process of structural degradation, wherein their initial mechanical properties diminish gradually. The deterioration varies based on the materials utilized in construction. Furthermore, alterations to a building's original design may necessitate it to withstand additional operational loads over time. These factors, combined with environmental fluctuations, can impose stresses exceeding the structure's initial design thresholds.

Historically significant buildings, rich in cultural heritage, are particularly susceptible to decay over time. Environmental changes and inadequate maintenance exacerbate this decay, potentially leading to structural failure. In such cases, routine maintenance and preventative measures are insufficient to ensure structural integrity. Structural Health Monitoring (SHM) emerges as a crucial tool for real-time assessment of these structures. SHM offers the advantage of enabling proactive and timely maintenance interventions, thereby averting substantial repair expenses and potential catastrophic collapses.

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Hospital buildings

Hospital buildings are pivotal structures designed with stringent criteria to withstand typical operational conditions and regional impacts of natural disasters like earthquakes or hurricanes. These designs typically incorporate substantial safety margins. However, following a natural disaster, evacuating a hospital for structural assessment is neither feasible nor practical, especially considering patients requiring critical care and life-sustaining equipment.

The evolving environmental conditions over recent decades may subject older hospital buildings to more severe stresses than originally anticipated. Despite regular maintenance efforts, concerns persist regarding the ongoing structural health of such buildings, particularly post-disaster. Given these challenges, the advancement of Structural Health Monitoring (SHM) technology emerges as crucial. It is imperative to assess each hospital building's suitability for SHM implementation based on regional disaster risks and the age of the structure. Evacuating a hospital unnecessarily is simply not an option due to the critical care it provides.

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