STRAAM: Structural Risk Assessment and Management

A New Era in Managing Structural Safety and Integrity
Introducing STRAAM

Every building has a heartbeat; tiny vibrations that create the structure’s unique “dynamic signature”. These almost-imperceptible vibrations happen every day, in all structures, and are normal. Even as monolithic structures look immovable, they are constantly vibrating and shifting in response to any number of environmental factors; like temperature changes, winds, traffic movements (including people walking), nearby construction, earth tremors, and of course, earthquakes.

It’s important to understand the building’s heartbeat, or normal vibrations, to identify abnormal responses that are indicative of structural damage or weakness.

Getting an early warning of potential structural weaknesses or damage is crucial for:

- insurance purposes
- occupant safety
- litigation avoidance
- further damage prevention
- asset management

Until now, it has been practically impossible to effectively measure a building’s heartbeat in real time.

Mainmark now offers STRAAM technology for Australian and New Zealand businesses

STRAAM is an acronym for STructural Risk Assessment And Management. It is the world’s most advanced platform for easily measuring and analysing the performance of structures to determine the cause of damage, risk of further damage, and overall structural stability.

Mainmark technicians use STRAAM non-destructive technology to conduct a Structural-Cardiograph (SCG), which establishes the building’s dynamic signature and provides real-time reports that accurately assess the strength of a structure and changes in the capacity of the structure due to ageing, earthquake, or other activity.

STRAAM technology can make communities more resilient to natural disasters, and help keep people and property safe.
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<th>FEATURES</th>
<th>BENEFITS</th>
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<td>Full-scale non-destructive testing</td>
<td>• Less costly, comprehensive reports.</td>
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<td>• Measures extremely low amplitude vibrations to extract the structure’s unique dynamic signature</td>
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<td>• Rapid measurement and early warning of damage.</td>
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<td>Reports use a three-dimensional model</td>
<td>• Delivers a fine-tuned view of the structure’s integrity.</td>
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<td>Extreme accuracy</td>
<td>• Leads investigators and repairers directly to the source of weakness for faster, more effective damage mitigation.</td>
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<td>Measure constantly or take before and after readings</td>
<td>• Convenience to suit the individual environment and circumstances of the structure, optimising budget for the most appropriate approach.</td>
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<td>• For example, monitor during a nearby construction project, or take a baseline measurement and then measure again after a significant event such as an earthquake.</td>
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<td>Real-time measurement</td>
<td>• Lets engineers and other decision-makers understand implications of certain activities sooner, potentially reducing the risk of further damage.</td>
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<td>• It also immediately confirms whether a building is habitable following an event such as an earthquake.</td>
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<td>Continuous measurement</td>
<td>• Offers insight into the changing risk profile of the structure over time.</td>
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<td>Dynamic monitoring system</td>
<td>• Records all impacts that occur during a specified time period, which lets assessors and engineers correlate any potential damage or change to the structure with the events that occur.</td>
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<td>System measures a range of factors including tilt, modal displacement, spectral response and more</td>
<td>• Offers a fuller picture of the building’s movements, therefore making it possible to detect potential issues faster, as well as pinpointing the cause and location of the damage.</td>
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<td>Online access to reports</td>
<td>• Reports can be accessed while still on-site and decisions can be made and implemented faster.</td>
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<td>Rapid baseline measurements take just hours</td>
<td>• Decision-makers get the information they need faster, so they can make the right decision sooner regarding asset management.</td>
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<td>• Provides improved tools for decision making when assessing the need for evacuations, building repairs, changes in structure usage or increased loading, etc.</td>
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CONSTRUCTION: assessing and managing dilapidation risk for adjoining properties

By placing STRAAM monitoring devices on nearby structures, construction organisations can monitor the effect of their works on surrounding buildings. This lets them proactively manage the risk of damage, letting them make decisions around stopping work or changing their approach before potential damage becomes actual, costly damage. The use of continuous real time STRAAM monitoring allows accurate determination of whether a change has occurred in the adjoining structure during the works. It clearly establishes if a link exists between claimed damage and construction activity.

Using STRAAM, construction companies and contractors can proceed with projects knowing that any potential damage can be detected before it becomes irreparable. It can also reduce the organisation’s potential legal liability for damages, reducing costs and providing additional peace of mind.

STRAAM gives detailed information about the condition of structures prior to works, providing a more complete dilapidation survey. The STRAAM modelling can also be used to identify the resilience of the adjoining structures and their capacity to resist different construction methods.

ENGINEERING AND ARCHITECTURAL: gaining an analytically accurate starting point for engineering design

Structural assessments are more comprehensive and informed using STRAAM. Engineers can therefore certify the structure’s integrity with more confidence. This is particularly important following significant seismic events, for example, where many buildings must be assessed before the occupants can return. Being able to assess the building’s integrity quickly, accurately, and comprehensively, means fewer people are displaced after the event and commercial operations can return to normal sooner, reducing the event’s effect on the economy.

The STRAAM system uses dynamic response parameters to describe the structure’s capacity-to-demand ratio, how it dissipates energy, and where deviations from the design philosophy may occur.
REAL ESTATE AND BUILDING OWNERS:
knowing your asset is structurally healthy and fit for use

Building owners can minimise their legal exposure by using STRAAM technology to alert tenants to potential instability and issues in good time.

Real estate organisations can use STRAAM for property condition assessments and seismic monitoring.

Using this technology can help real estate organisations and building owners to protect their property investments.

INSURANCE:
understanding the inherent risks in insured assets

By relying on STRAAM measurements, insurance organisations can potentially determine the cause and origin of building damage, as well as assess the extent of the damage after an event. These results can then help determine the best course of action in terms of both safety and cost minimisation.

Insurance organisations can also undertake predictive modelling to determine the insurance premiums payable according to the potential risks of the building based on STRAAM measurements.

Liability can also be determined using STRAAM technology, potentially minimising the risk of insurance firms paying out for incidents that aren’t covered under the terms of the relevant policy.

BUILDING COMMISSIONING:
knowing the building is built to code and performance specifications

STRAAM testing can deliver data that confirms code compliance and validates designs. This is important because traditional building commissioning services generally aren’t able to provide the same level of detailed information.

STRAAM technology delivers invaluable information to the party taking ownership of the new building by providing a completely objective measure of the structure’s performance. This confirms that the building was built as intended.
DAMS AND BRIDGES: gaining confidence in the structure’s ongoing integrity and usefulness

Ongoing monitoring helps determine the integrity of dams and bridges, and can identify early if they are in danger of partial or complete collapse. STRAAM evaluates continuously in real time and reports risks instantly. Or, a comparison of the dynamic signatures from before and after impacts from barges, trucks, blasts, or extreme weather can provide an immediate diagnosis of the bridge’s or dam’s changed condition.

This type of information helps maintain the safe operation of critical infrastructure. STRAAM provides Dam managers accurate and detailed assessment of the dam condition and capability to enable more informed and specific decision making.

LOCAL COUNCILS: managing assets more strategically for better return on investment

Using STRAAM technology, local councils can minimise health and safety issues due to ageing infrastructure. Councils can measure the stability of ageing structures and make informed decisions regarding how to preserve or dispose of those structures. This can minimise unnecessary expenditure on costly preservation techniques that may not be warranted. It can also help councils make smarter decisions, faster, about structures that need immediate rehabilitation.

FACILITIES MANAGEMENT: making smarter decisions, faster, after events

Using STRAAM technology, facilities managers can assess the habitability of buildings following events such as earthquakes or construction. This lets them make decisions regarding building evacuations and re-entry sooner, minimising cost and inconvenience to occupants.

They can also conduct continuous monitoring (depending on environmental conditions) to understand the structure’s ongoing performance. This lets them make decisions regarding repairs or renovations sooner, limiting the risk of damage.
How STRAAM works

During the inspection process, the STRAAM equipment is placed on the structure at specific locations where it can capture dynamic information. The system is set up in just minutes, and comprises accelerometers, which are wired to the Structural-Cardiograph (SCG).

The dynamic signature processed from the captured data provides the structure’s dynamic response, which is a record of its condition at that time.

The STRAAM equipment measures:

- **Vibration intensity level**: if vibration levels are high it could indicate that an area has lost strength. This information can be compared over time to look for changes in the response.

- **Dynamic signature information**: through advanced algorithms, STRAAM technology processes acceleration data into the dynamic signature of the structure. A low-frequency response likely indicates a problem with the structure before it can be seen through an inspection.

- **Random Decrement (RANDEC) damping algorithm**: the non-linear damping response of a structure is important to detail how energy is dissipated within the system. It can also be used to extrapolate the capacity of a structure as well as identify specific flaws in the structure.

- **In-depth analysis**: further processing of the data can be used to calibrate finite element models to provide a detailed understanding of how a structure performs and to perform load ratings.

- **Long-term monitoring**: continuous monitoring can provide assurance that a structure is safe. Changes to the structure, which cannot be seen through a visual inspection, can cause an obvious change in the dynamic signature when the proper instruments are deployed.

All information is uploaded to STRAAM CENTRAL, a real-time web portal where the information can be presented for real-time viewing. Each sensor is shown in a graphic display, which has pre-set thresholds and alarms.

Above: Example Spectral Response comparison after inspection has been completed.

Above: Example Certificate of Risk Assessment after inspection has been completed.

Above: Non-invasive monitoring equipment with real time output.

Below: Non-invasive monitoring equipment with real time output.
About STRAAM Group

STRAAM Group was founded to make available innovative technologies and methodologies that have been developed over 40 years of research and development. The company provides structural performance services including assessments and monitoring to asset owners and their engineering consultancies, operators, insurance companies, and legal firms worldwide.

STRAAM Group inspects and uses technology to rapidly quantify the performance of buildings, bridges, dams, marine structures, energy facilities, and other large, monolithic structures. We process the structure’s measured response into information used to identify the behaviour associated with weaknesses, anomalies and damage. This is used to quantify the risk profile of the structure. We then provide periodic assessments or continuous monitoring to track changes to the structure over time. Our advanced services provide those who are responsible for structures to have the most detailed condition assessment available and understand the risks associated with its operation or modification into the future.

Mainmark is the licensed distributor and installer of STRAAM technologies in Australia and New Zealand.

The Mainmark group of companies are leaders in advanced ground engineering and asset preservation technologies. For more than 20 years, Mainmark has led the world in offering unique, innovative solutions for foundation repair, and rectifying problems in residential, industrial, commercial, civil engineering, and mining situations.

In Australasia, the Mainmark group of companies has been in operation since 1995, with seven offices throughout Australia and New Zealand. Since 2001, we have also operated wholly-owned subsidiaries in Thailand and Japan.

We are a privately-owned company with highly-trained technicians and state-of-the-art equipment. Our solutions are all non-toxic, inert, and environmentally neutral. All of our works are planned, supervised, and executed by our own experienced personnel. We guarantee our products.

Companies of the Mainmark group present creative, effective solutions to many types of ground engineering problems in a wide range of sectors: industrial; commercial; residential; civil; and mining. Some of the companies offer related solutions in the building and construction areas. Many of these solutions are unique to Mainmark and its associates.