

Continuous Acoustic Monitoring System (AM) – SoundPrint®

SoundPrint® is the registered name of an acoustic monitoring system developed by Pure Technologies, Ltd., of Calgary, Alberta, Canada. The SoundPrint® system was developed to provide long-term monitoring of structures to detect failures in tensioned steel elements, and to provide bridge surveillance for damage from vehicular or ship impact.

Although Acoustic Emission (AE) has been used for highway structures for many years, AM differs from AE in that lower frequency noises are monitored, which allows significantly fewer sensors at greater spacing. AM detects actual breakage of wire elements rather than progressive growth of a fatigue crack. AM has the disadvantage of also picking up many “normal” ambient highway noises, but these can easily be filtered out so only meaningful events are reported. The sensors attached to a structure can detect a wide band of frequencies. Consequently, an excellent facsimile of each event can be processed by the AM system.

Each event is initially examined by an analog band pass filter connected to a triggering circuit. This circuit is tuned to be most responsive to the frequencies of interest – that is, the frequencies that are known to be generated by the snaps of wires or strands, etc. This simple process eliminates the vast majority of highway-generated noises from consideration.

Failures in tensioned components can occur for any number of reasons, but one of the most insidious is successive failures of individual wires within a tensioned component such as a multi-strand cable for suspension or cable-stayed bridges. Wires within the strands or cables can break without the owner’s knowledge for these types of bridges, since there is no reliable inspection equipment available. Pre-tensioned ground anchors for retaining walls and other earth retaining structures are also unable to be inspected.

The lack of inspection techniques to detect hidden deterioration of capacity due to wire breakage in cables and strands in these structures poses a serious problem for bridge owners and engineers. Owners are faced with the prospect of incurring major expenditures for intrusive investigation, strengthening, repair, or even total replacement of the structure due to the lack of reliable data on the rate and location of wire breakage. Even the very expensive intrusive methods often are not capable of fully assessing the extent of wire breakage, or even if a problem exists. An example would be a bridge cable consisting of thousands of individual wires, which are often thousands of feet long.

SoundPrint was invented in 1994 to address concerns about corrosion in unbonded buildings and parking structures in Western Canada. The first commercial system was installed in a building in Calgary in March 1994. The system is still operational. Presently, over 4 million square feet of unbonded structures are being monitored in North America. The system is being installed on a number of large suspension bridges in North America, as well as other post-tensioned bridges in France and the UK.

Note: The SoundPrint Acoustic Monitoring System for reinforced concrete structures was nominated for the 1997 NOVA Awards. Its nomination summary is in the CIF searchable nomination database at www.CIF.org.

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