Bridge Testing and Monitoring of Steel Components with Acoustic Emission

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Visual inspection of bridge infrastructure at regular intervals only can be ineffective in identifying flaws until they are of such as size that integrity has been compromised. The use of other NDT methods (PT, MT, RT or UT) can be inefficient due to the restricted access and/ or other limitations. The Acoustic Emission Testing (AT) is a very sensitive method to detect and locate cracks very early in life, long before they are detectable by the naked eye or other NDT methods. The AT is using normal traffic loading to identify active fatigue (for example in welds of the box girder) or breaking of wires in post-tensioned bridges and in the cables of suspended bridges. The AT is a quick screening tool for detecting active fatigue sources, even if the sources are present in hidden or in inaccessible areas. All sources exceeding a defined level of activity are evaluated, to determine their likely cause (active fatigue, extraneous noise, fretting) and to grade active fatigue sources. This allows the prioritization for further assessment and repair. Moreover the AT is able to provide the information about the origin of the source by using f.e. triangulation methods. The development of active fatigue sources in time can be observed and assessed by repeated testing. External Parameters (like strain, vibration, etc.) has to be measured simultaneously with the AT for correlation purposes. The information about the origin, the severity and their loading dependent behavior of sources helps to reduce the maintenance and inspection costs to a minimum. It helps also to find a strategy for further use of the bridge: optimized loading restrictions and/ or necessary lorry-to lorry distance and/ or necessary velocity restriction. The Acoustic Emission Testing can be used to assess follow-up repairs as well. It can be used as monitoring technique for local crack areas, where for example a repair is not feasible.

The long-term Acoustic Emission Testing (Monitoring) is mostly used for breakage detection of wires in post tensioned concrete bridges and in the cables of suspended bridges. MISTRAS has tested more than 100 bridges with steel components world-wide.