

# [Chapter lift inspection programme) on mewp’s (mobile](https://assignbuster.com/chapter-lift-inspection-programme-on-mewps-mobile/)

Chapter 11. 1.

IntroductionThis is a project about corrosion study of carbon steel embedded in concrete via acousticemission. I have specifically chosen rebar corrosion as it has the most severe deterioration inconcrete structures i. e. Bridges due to vibrations caused by heavy vehicles, Acoustic emissionmethod will be used to monitor corrosion in concrete structures. 1.

2. Company BackgroundSSA Acoustic & Specialised Inspections (Pty) Ltd was established in 2007. SSASI is a SouthAfrican based company that is currently partnered with the MISTRAS GROUP LIMITED(formerly Physical Acoustics Limited UK and Conam Inspections & Engineering ServicesIncorporated).

The MISTRAS GROUP is a leading “ one source” global provider oftechnology-enabled asset protection solutions used to evaluate the structural integrity ofcritical energy, industrial and public infrastructure. SSASI has specialised in delivering proven acoustic emission monitoring methodologies toour specific target market. Services SSASI provides are:? TANKPAC™ online bulk storage tank monitoring;? MONPAC™ online spheres; bullets and pressure vessel monitoring;? TA-LRUT™ automated ultrasonic inspection of tank annular rings, LSI automatedultrasonic inspection of tank shells, tank roofs, pipelines and vessels;? CLIP (Complete Lift Inspection Programme) on MEWP’S (Mobile Elevating WorkPlatforms). SSASI through our strategic alliances can also provide other specialised services on request. With our partnerships SSASI is committed to providing a value added and professionalservice to the oil and gas, utility and lifting industries in South Africa and Sub-SaharanAfrica. SSASI maintains a South African staff base of experienced managers, supervisors andfield engineers. 7Chapter 22. 1.

Acoustic EmissionAE refers to the generation of transient elastic or stress waves during the rapid release ofenergy from localized sources within a material. The source of these emissions in metals isclosely related to the dislocation movement accompanying plastic deformation and theinitiation and extension of cracks in a structure under stress. AE systems are comprised of an AE sensor, preamplifier, amplifier and filter, an acquisitionand a data display. In the corrosion process, an AE parameter is extracted and then therelation with corrosion grading is determined. The parameters commonly used in corrosionapplications include AE HIT, Even and AE energy. 2.

1. 1. AE sensor? The heart of the AE system is the sensor? The function of the sensor is to convert the acoustic wave energy emitted by thesource into usable electrical signal typically voltage time signal. This voltage timesignal is used for all subsequent steps in the AE technique.? Acoustic emission sensors can be based on different physical principles.

? The signals can be generated by electromagnetic devices such as phonograph pickupby capacitive microphones, by magneto restrictive devices or by piezo electricdevices.? The requirements of an AE sensor are ???? High sensitivity? Ruggedness? Wide bandwidth in the case of broad band sensor and narrow bandwidth in thecase of resonant sensor.? Fidelity.

2. 1. 2. Preamplifiers? The preamplifier enhance the signal level against noise? The preamplifier must be located close to the sensor.

? The preamplifier provides required filtering, gain and cable drive capability.? Uses of preamplifiers? To amplify the small sensor signals so that they can be transmitted over longsignal cables? To match high impedance of sensors to low impedance of signal cable.? To provide a means of common mode rejection to reduce electrical pick upfrom sensor cable. 2. 1. 3. Filters? Filters plays an important role in allowing the amplified signal from sensor andattenuating unwanted noise.? Filter with flat frequency response for desired frequencies and sharp cut off forunwanted noise is required.

? Typically low pass, band pass or high pass filters can be used. 82. 1. 4. Amplifier? The output of the filter is fed on an amplifier where the signal is further amplified.? Amplifiers gains in the range of 20 to 60dB are most commonlyused.(kalyanasundaram p.

2007)2. 2. Advantages and limitations of Acoustic Emission? AE can be used in all stages of testing including:? Preservice (proof) testing? In-service (requalification) testing? On-line monitoring of components and systems? Leak detection and location? In-process weld monitoring? Mechanical property testing and characterization? (Less) geometry sensitive? Less intrusive? Global monitoring? Limitations of AE testing:? Repeatability: Acoustic emission is stress unique and each loading is different.? Attenuation: The structure under test will attenuate the acoustic stress wave.? History: Tests are best performed if the loading history of a structure is known.? Noise: Acoustic emission test sensitivity is limited by the background andextraneous noise.

? Testing equipments and personal training is expensive compared to other NDTmethods.(Beattie AG 1983)2. 3. Acoustic Emission method compared to other NDT methods? The main benefits of AE compared to other NDT methods are that AE is a real-timemethod and it is less intrusive. The discontinuities of defects can be detected by AE atan early stage when they are occurring or growing.? Acoustic emission (AE) is a powerful method for non-destructive testing and materialevaluation. Older NDT techniques such as radiography, ultrasonic, and eddy currentdetect geometric discontinuities by beaming some form of energy into the structureunder test.

? AE only detects active/growing defect opposed to all other methods that will detectlatent defect as well. Acoustic Emission Most Other NDT MethodsDiscontinuity Growth/Movement Discontinuity PresenceStress, Damage-related Shape-relatedMaterial Anisotropy is good Material Anisotropy is bad(Less) Geometry Sensitive (More) Geometry SensitiveEach loading is unique Inspections are readily repeatedLess Intrusive More IntrusiveGlobal Monitoring Local ScanningPrincipal limitations, attenuation, historydependence and noisePrincipal limitations, access, geometry, anddependence on discontinuity orientation andproximity to surface92. 4.

Components of Acoustic emission system.? AE sensor? Cable and pre-amplifier? AE data-acquisitionFigure 1: Components of AE System (prateepasen A, 2007)10Chapter 33. 1. Corrosion? What is Corrosion? It is a natural process, which converts a refined metal to a more chemically-stable form, suchas its oxide, hydroxide, or sulfide. It is the gradual destruction of materials (usually metals)by chemical and/or electrochemical reaction with their environment. Corrosion is the deterioration of a metal as a result of chemical reactions between it and thesurrounding environment. Both the type of metal and the environmental conditions, particularly gasses that are in contact with the metal, determine the form and rate ofdeterioration (Jomdecha C 2007)Figure 2: Corrosion on Metal? Do all metals corrode? All metals can corrode. Some, like pure iron, corrode quickly.

Stainless steel which combinesiron and other alloys is slower to corrode and is therefore used more frequently. All small groups of metals, called the Noble Metals, are much less reactive than others. As aresult, they corrode rarely.

They are, in fact, the only metals that can be found in nature intheir pure form. The Noble Metals, not surprisingly, are often very valuable. They includecopper, palladnium, silver, platinum, and gold. 11? Types of Corrosion? General Attack CorrosionThis very common form of corrosion attacks the entire surface of a metal structure. Itis caused by chemical or electrochemical reactions. While general attack corrosioncan cause a metal to fail, it is also a known and predictable issue. As a result, it ispossible to plan for and manage general attack corrosion.? Localized CorrosionLocalized corrosion attacks only portions of a metal structure.

There are three types oflocalized corrosion:? Pitting – The creation of small holes in the surface of a metal.? Crevice corrosion – Corrosion that occurs in stagnant locations such as thosefound under gaskets.? Filiform corrosion – Corrosion that occurs when water gets under a coatingsuch as paint.? Galvanic CorrosionGalvanic corrosion can occur when two different metals are located together in aliquid electrolyte such as salt water. In essence, one metal’s molecules are drawntoward the other metal, leading to corrosion in only one of the two metals.

? Environmental CrackingWhen environmental conditions are stressful enough, some metal can begin to crack, fatigue, or become brittle and weakened.? Common Environmental Corrosion accelerators? Material selection, Alloy are more resistant? Water intrusion? Temperature? Effects of Corrosion? Decrease in structural integrity due material loss? Breaking into smaller pieces of a concrete? A decrease in material quality. 3. 2. Spalling corrosionSpall is flakes of a material that are broken off a larger solid body and can be produced by avariety of mechanisms, including corrosion, weathering, cavitation or excessive rollingpressure (as in a ball bearing).

Spalling on metal is a process of metallic surface failure in which the metal is broken downinto small flakes (spalls) from a larger solid body. This process occurs for many reasons, suchas when another material impacts it at a high speed resulting in chipping the material, or dueto corrosion, weathering, cavitation or excessive rolling pressure. 12Figure 3 : Spalling concrete3.

3. Where does Spalling Corrosion Occur?? Mechanical spalling occurs at high stress contact points.? In corrosion, spalling occurs when a substance (metal or concrete) sheds tiny particlesof corrosion products as the corrosion reaction progresses.? Spallation happens as the result of a large volume change during the reaction.? The spalling can occur at any location on a building but generally shows up in areaswhere the steel is concentrated, such as at window heads and jambs, building corners, pilasters and column. 3. 4. Condition inducing spalling corrosion? The most prominent cause in some areas is the use of road salt or sodium chloride.

Saltacts as a catalyst to enhance the reaction between the oxygen in water and the iron inreinforcing steel. The resultant oxidation (rusting) causes the reinforcing steel toenlarge which creates high internal stresses within the concrete and, ultimately, fracturing of the concrete surface.? Surface cracking can be generated by the reaction between atmospheric carbon dioxideand the alkalis present in the concrete mix itself. These surface cracks can then admitrainwater or snow melt.

? Water expands when it freezes and then contracts when it defrosts. These repetitivefreeze-defrost cycles cause stresses which can break off surface concrete as well.? Improper concrete finishing operations can contribute to the premature spalling ofconcrete surfaces. If water is added to the freshly laid concrete surface to increase itsworkability, it could result in a weakening of that surface concrete. This could lead tothe weakened surface section delaminating from the stronger concrete below and thusadmitting more water to react with the reinforcing steel.

3. 5. Effects of Spalling Corrosion? Spalling can be hazardous in terms of falling debris or trip hazards for areas accessedby the public. 13? Causes structure to become unstable if unmaintained regularly.? If a structure is left to deteriorate then the value of the asset will diminish and, furthermore, maintenance costs will tend to increase as corrosion and spalling becomesmore widespread3.

6. NDT method used to inspect for spalling Corrosion? Acoustic Emission? Radiographic Testing? Ultrasonic testing14Chapter 44. 1. Conclusion? Acoustic Emission inspection is a powerful aid to materials testing and the study ofdeformation, fracture and corrosion. It gives an immediate indication of the response andbehaviour of the material under stress, intimately connected with strength, damage andfailure.

? In Comparison of AE with other NDT methods, I have found that? In the conventional Non-destructive methods, some form of energy is fed into thematerial, which interacts with the flaws and defects in the material and providesevidence of the same. In acoustic emission, we detect the energy that is released fromthe flaw or defect when the same is stressed. AE is thus a process in which dynamicor active flaws are detected.? This technique also provides us with the dynamic characteristics of a flaw or detectsuch as its growth, growth rate, critically and intensity.