UScan

Ultrasonic detection of broken wires in strands

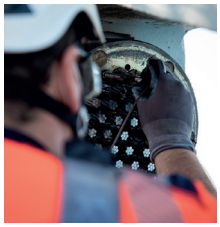
YOUR CHALLENGES

Stay cables and **pre-stressing cables** are **critical elements** for the safety of civil engineering structures and are therefore **well protected against corrosion.**

In some circumstances however, **corrosion** may initiate **inside** the **cable anchorages**, and the condition of the strands in this inaccessible area is then unknown.

In most cases, **corrosion** is unfortunately only **detected after** a **hazard** has occurred.

OUR SOLUTION



UScan provides the **unique possibility** of **evaluating** the **existence** of **broken wires inside** a **tensioned cable** within or just after the anchorage.

This is a **valuable information** for establishing a **maintenance strategy** for civil engineering cabled structures.

THE BENEFITS

- **Knowledge of the cable condition at anchorage**

  UScan is the **only technology providing detailed information** of the cables condition at anchorage. **Other techniques** (endoscopy, magnetic flux, resistivity, or other) **are not applicable** due to the inaccessibility of the area.

- **High resolution**

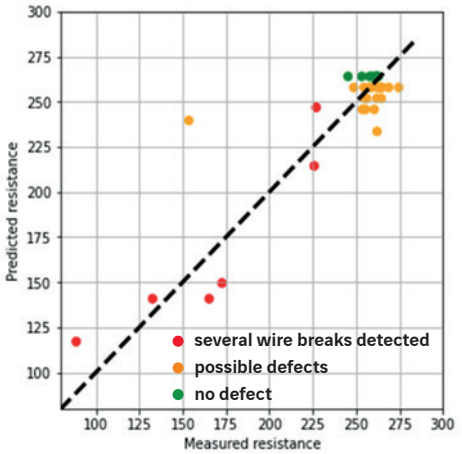
  Uscan probes each individual wire and therefore provides a **detailed instant picture** of the **anchorage condition**.

- **Simple to deploy**

  UScan is composed of a set of **light tools**, designed for field operation, and allowing a **quick deployment** on site.

- **Complementary to acoustic monitoring**

  Uscan provides an **initial reference** (when the initial condition is unknown) to apply **wire breakage** counting integration with acoustic monitoring Uscan has the unique ability to finely locate the wire breakage after it is detected by acoustic monitoring.



Correlation between the mechanical resistance of stay cable strands and a Uscan-based damage classification. Source: Laigaard & al., Data mining corrosion and failure in cable stays - IABMAS Conference July 2022

Sixense's

- The worldwide specialists in accurate and useful measurements.
- With our 20 years experience our teams can operate reliable measurement campaigns, within tight schedules.
- We offer a complete monitoring service and the possibility to combine monitoring and surveys in a global Sixense offering.

CONTACT US

› monitoring@sixense-group.com

Uscan

Ultrasonic detection of broken wires in strands

TECHNICAL PRINCIPLE

Uscan is a **non-destuctive technique** based on the principle of **ultrasonic reflectometry** ("pulse-echo" technique).

The first step is the **preparation** of the **anchorage head** by removing the cap and the filler material of the cable anchorage, and orthogonal cutting and grinding of the strand extremities. *(Fig. 1)*

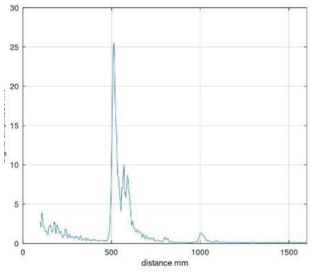
Then an **ultrasonic transducer** is positioned at the tip surface of each wire, after the application of a coupling gel.

The **transducer** both acts as **transmitter** and a **receiver**: it first sends an **ultrasonic burst wave** into the wire, whenever this wave reaches a defects, it is reflected and propagates back to the transducer.

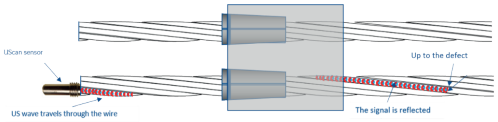
At this stage, the transducer acts as a receiver and **converts** the **reflected wave** into an **electric signal**. The **analysis** of the r**ecorded reflected signals** makes it possible to **assess** the presence of **defects** or **damages**. *(Fig. 2 et 3)*

↑ *Fig. 1* Surface preparation

↑ *Fig. 2* Artificial defect (saw cut) at 50 cm



↑ *Fig 3* Artificial defect signal



APPLICABILITY

- T15 strands wedge anchorage
- Stay cables, pre-stressing cables, ground anchors,
- Accessible anchorages
- Other types of wire / anchorage are subject to feasibility study

SPECIFICATIONS

- All individual signals are recorded and stored for later analysis and comparison of evolution through time
- Distance of inspection varies from 30 cm to 2 m after the anchorage (depending on wire conditions).
- A light machine is dedicated to stay cables and provides only the reduced range of inspection of 30 cm
- A qualitative assessment of corrosion severity may also be provided by the technique

LIMITATIONS

The probability of detection of broken wires varies depending on the extent and severity of corrosion (from 95% to 50% in extreme cases)

In cases when only a low probability of detection may be achieved, a relative classification of the condition of cables at their anchorage is still achievable and provides a useful information as to which cables should be prioritized for maintenance.

RELATED TOOLS & SERVICES

- **Detection** of **wire breaks** by **acoustic monitoring**

REFERENCES

- Ile de Ré Bridge, France
- Normandy Bridge, France

CONTACT US

› monitoring@sixense-group.com