ELECTRICALLY ISOLATED POST-TENSIONING TENDONS FOR MORE DURABLE BRIDGES

Electrically isolated tendon (EIT) systems help improve the service life of prestressed concrete bridges by protecting post-tensioning tendons from corrosion and enabling long-term monitoring and inspection of their condition.

Prestressed concrete is frequently used worldwide in infrastructure construction and offers considerable advantages over conventional reinforced concrete. Road and railway bridges built with prestressed concrete are often post-tensioned and bonded by grouting. Although this construction method has generally performed well, a number of known problems can lead to premature replacement or repair of the post-tensioning (PT) tendons. Corrosion of the prestressing steel, in particular, can seriously affect the serviceability and load-bearing capacity of PT bridges.

Why Use EIT?

PT tendons provide the primary load-carrying capacity in prestressed concrete bridges, and therefore inspections are necessary to assess their in-service condition. However, PT tendons are typically located within multiple layers of encasement. EIT systems provide a solution that enables bridge owners to perform non-destructive evaluation (NDE) and monitoring. EIT systems also increase long-term performance by providing the highest level of corrosion protection possible with current PT technologies.

These systems have been developed in Europe over the past 20 years and have proven effective both as a means for protecting against PT tendon corrosion and as an NDE tool for assessing their in-service condition.

Long-Term Monitoring

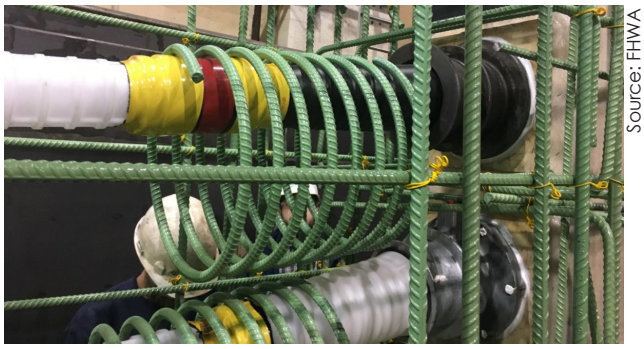
The main advantage of EIT systems is the ability they provide to non-destructively monitor tendon encapsulation. To assess the quality of the EIT encapsulation (leak-tightness) and monitor the condition over time, the AC impedance between the tendon and the ordinary reinforcing steel is measured. In theory, if the tendon is electrically isolated, the ohmic resistance will be controlled by the resistance of the polymer duct, which is relatively high.

Source: FHWA

The main advantage of EIT systems is the ability to non-destructively monitor tendon encapsulation over time. In the photo above, initial construction reading is collected.

Enhanced Corrosion Protection

The plastic ducts used for EIT systems provide a permanent, leak-tight barrier over the full length of the PT tendon. In contrast to conventional metal ducts, plastic ducts are not susceptible to corrosion damage. A damaged plastic duct could provide opportunity for tendon corrosion, but such damage can be identified by the EIT system's electrical resistance reading. In addition, the EIT system has no macro-cell interaction with the reinforcing steel, which will greatly reduce the corrosion rate even if the plastic duct is perforated.

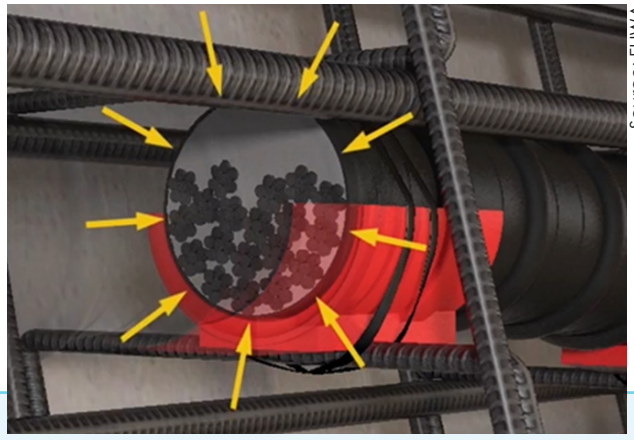


Source: FHWA

The EIT system has no macro-cell interaction with the reinforcing steel.

Demonstration Projects

FHWA's Accelerating Market Readiness (AMR) program is supporting three demonstration projects that will be the first bridge structure applications of EIT systems in the United States. The first demonstration project, the Coplay-Northampton Bridge in Allentown, PA, was completed in October 2018. The second demonstration project is being conducted on State Highway 146 near Houston, TX. Details are available on FHWA's AMR webpage.

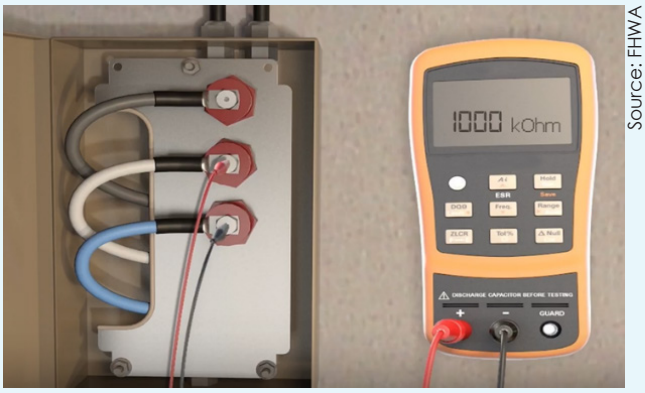


Source: FHWA

The plastic ducts used in EIT systems provide a shield from corrosive substances and stray currents.

Benefits of Using an EIT System

- Bridge owners can use EIT systems to validate the encapsulation integrity of PT tendons and therefore ensure construction quality by confirming proper PT installation.
- EIT provides an NDE tool that offers long-term PT tendon encapsulation condition data.
- The NDE tool provides easily interpretable data that can be used by typical inspection crews.
- EIT systems provide the highest level of corrosion protection possible with current PT technologies, including mitigation of stray current corrosion.
- EIT technology has a proven track record in multiple European countries.



Source: FHWA

By measuring the AC impedance between the tendon and the reinforcing steel, bridge owners can assess the quality of the EIT encapsulation.

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