

NDT MEASURE OF TENSIONAL STATE OF CABLE AND STRANDS BY X-RAY DIFFRACTION. AN INNOVATIVE PORTABLE XRD.

Verification of the operating condition of civil infrastructure is a subject of considerable current importance and the assessment of the real security status of the infrastructure requires the verification of multiple risk factors. Several different test methods are currently used based on existing technology.

One of the most important verification is the correspondence between the design pretension value of tendons and the magnitude of the actual situation after years of operation.





X-ray diffraction is a widely used method in the field of mechanics to evaluate the stress state of components. This technique, due to the limitation imposed by instrument dimension and management of ionizing radiations have been not considered for many years as potential tool for NDT testing in civil engineering.

Notable technical improvements have been done on X-ray components making possible the production of miniaturized and portable systems as the model SpiderX-Edge made by GNR Srl.

Over the last 3 years, several studies have been conducted to verify its applicability in the field of civil engineering.

The first tests were carried out through laboratory tests to verify the correspondence between external load applied to wires and strands and the measurement of the stress state by X-ray diffraction using a SpiderX-Edge in its standard configuration.





Following the excellent results, several infrastructure verification campaigns were undertaken with measures directly on bridges.

These initial surveys revealed the need to make the measuring system even more manageable in order to meet the needs of measurement in environments and situations not very comfortable and above all to be able to minimize the intervention on the infrastructure and minimize the restoration works of the original state. GNR SrI was then commissioned by SINA SPA to design and develop a prototype that would meet these needs.







The combination of GNR's thirty years of experience in the field of X-ray diffraction and SINA's experience in the field of structural verification led to the implementation of the EDGE_P system, model derived from the SpiderX-Edge system and specifically designed for field measurements.

The extremely portable and handy system consists of a measuring head that can perform the determination of the tensional state in a few minutes, an easy and fast fixture tool to the structure offering several degrees of freedom for correct positioning to ensure optimal measurement of strands and cables.



Some reference work on testing activities using XRD

New trends in assessing the prestress loss in post-tensioned concrete bridges

- Mariano Angelo Zanini¹, Flora Faleschini^{1,2} and Carlo Pellegrino¹
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https://www.frontiersin.org/articles/10.3389/fbuil.2022.956066/full

Damage detection, localization, and quantification for steel cables of post-tensioned bridge decks Isabella Mazzatura^a, Walter Salvatore^a, Silvia Caprili^a, Simone Celati^a, Michele Mori^b, Massimo Gammino^b ^a Department of Civil and Industrial Engineering, University of Pisa, Pisa, Italy ^b SINA Site Service S.p.A (ASTM Group), Milano, Italy *https://www.sciencedirect.com/science/article/pii/S2352012423014029*

X-ray diffraction method for the evaluation of the stress level of PT tendons - Paper in progress Silvia Caprili, Isabella Mazzatura, Francesca Mattei, Walter Salvatore, Luca Pezzato, Claudio Gennari, Manuele Dabalà, Luigi Pisani, Luca Seralessandri, Alessandro Torboli, Massimo Gammino, Andrea Piscini, Michele Mori, Filippo Ferrari

Development of methods for the assessment of stresses in pre-stressed concrete elements by X-ray diffraction This application is object of a PRIN Project (Project of National Interest) PRIN 2022ATXMTH Principal Investigator Morelli Francesco Università di Pisa Associated Investigator Cattaneo Sara - Politecnico di Milano, Dabala Manuele - Università di Padova

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