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Geophysical surveys for the inspection of roadway infrastructure: challenges and perspectives

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Modern roadways contribute to a comfortable and safe ride to roadway users' destinations, ensuring uninterrupted transportation of the public and freight. During the previous decades, roadway engineers' interests have shifted towards maintenance and rehabilitation of existing pavement structures, rather than the construction of new structures. Nevertheless, pavement condition assessment (PCA) remains imperative both during construction for Quality Assurance (QA) purposes and during roadways' service life for efficient maintenance planning.
A broadened utilization of advanced Non-Destructive Testing (NDT) for site investigations enables PCA in a non-invasive manner. Among the multiple NDT systems in use, those based on the scientific principles of Geophysics are both popular and attractive. In particular, thanks to its versatility, the Ground Penetrating Radar (GPR) has gained worldwide popularity as one of the most powerful geophysical NDT that substantially improves PCA covering a wide spectrum of roadway applications.
According to international literature and relevant experience, the increased scientific-technical knowledge and experience of GPR technique has been demonstrated, including roadway applications like accurate thickness evaluation, density control, determination of physical properties (i.e. clay or moisture content of roadway materials) and detection of other surface or subsurface defects. As such, GPR assists pavement engineers at every stage of pavement condition assessment starting from the construction process with the density control and compaction monitoring. Further, during the service life of roadways GPR can be effectively incorporated, as a supplementary tool for roadways pavement monitoring and evaluation within a Pavement Management System (PMS), taking advantage of its capabilities yielded by its NDT character.
A major issue for geophysical assessment techniques is the need for a standardized process of data collection tools and mainly data interpretation techniques. Especially, for GPR systems, a multitude of signal processing methods exists, and as such there is none uniquely recognizable and universally accepted signal processing scheme. The selected analysis method strongly depends on the study objective and the targeted accuracy as well as its impact on decision making in roadway applications. To this extent, a rational balance between the investments in time and human resources needs to be reassured in order to retrieve both reliable and cost-effective information.
Overall, there is confidence that a holistic utilization of geophysical tools as a standard practice for roadway engineering will become dominant in the near future. The inclusion of geophysics as assessment and monitoring methods for site investigations should contribute to the optimization of roadways design and maintenance as well as the preservation of durable and sustainable structures.