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Use of Impulse GPR for Laboratory Determination of Road Material Permittivity in Core Samples

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Ground Penetrating Radar (GPR) technique is commonly used for recognition of the road construction. The effective reflection coefficient corresponding to the road surface can be easily determined in data processing process. The reflection coefficient is related mostly to electric permittivity in practice and the both electrical quantities can be interpreted as material characteristics of the medium reflecting first of all its composition. These electrical properties are also interesting because their spatial contrasts inside the medium are responsible for generation distinctive reflection signals corresponding to the interlayer boundaries. These are the reasons why direct measurements of electric permittivity (or equivalent quantities) and investigations of its relation to the medium material properties are necessary in GPR practice. These measurements are usually difficult due to instability and methodological complexities and they constitute a large discipline. In the case of strongly inhomogeneous material (like stone-asphalt mixture) some additional difficulties occurs leading to some controversies between different measuring methods.
The paper presents a new method of electric permittivity determination using dispersion of high-frequency electromagnetic impulse on a top of the drilling core. The measurement can be performed by the use of the same antenna which works in the field and thus its result is particularly close to the effective reflection coefficient being determined in GPR practice. The response to the medium inhomogeneity is similar in the both methods and the laboratory tests performed on core samples can be used for interpretations of the field results. The results of measurements were compared also with another method of permittivity determination and the method was applied to determination of the relation between reflection coefficient and lithological type of the stone fraction in asphalt mixture.