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An overview of ground-penetrating radar signal processing techniques for road inspections

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ABSTRACT - Ground-penetrating radar (GPR) was firstly used in traffic infrastructure surveys during the first half of the Seventies for testing in tunnel applications. From that time onwards, such non-destructive testing (NDT) technique has found exactly in the field of road engineering one of the application areas of major interest for its capability in performing accurate continuous profiles of pavement layers and detecting major causes of structural failure at traffic speed. This work provides an overview on the main signal processing techniques employed in road engineering, and theoretical insights and instructions on the proper use of the processing in relation to the quality of the data acquired and the purposes of the surveys.

Keywords: ground-penetrating radar; GPR; pavement engineering; data processing for road inspections

1. INTRODUCTION

Safety concerns and economical savings in road construction and maintenance strategies are no doubt the two main issues around which considerable efforts of engineers and practitioners are being increasingly focused. In terms of driving safety, it is well known how cracks, potholes, and surface deformations can generate sudden vertical accelerations on the vehicle tires, thereby lowering the effective friction between tires and pavement surface and raising the probability of car accidents [1]. As far as the economic aspect is concerned, three main factors have a great influence nowadays in orienting the policies of investment of governments and local authorities in the transportation area, namely, i) the general lack of economic resources which causes a lowering of the demand for new constructions; ii) the need for a road asset that can