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Applications of Ground Penetrating Radar in Bridge Health Monitoring Using Different Frequency Antennae Systems

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Inspection and assessment of bridge structures within the context of health monitoring of structures as well as the life cycle of structures is of paramount importance for structural engineers and bridge owners. No doubt the early detection of structural defects in particular internal structural elements such as bridge deck delamination, formation of cracks and corrosion of rebar will enable engineers to remedy the imperfection and prolong the serviceability of the structure. Applications of Ground Penetrating Radar (GPR) have proved to be effective in detecting such imperfections if utilised correctly.
This paper presents and discusses the applications of GPR in assessing the structural integrity of a heavily used bridge in a town centre position (Pentagon Road Bridge, Chatham, Kent, UK) using different antennae in terms of frequency and method of application (2 GHz and 200-600 MHz GPR antennae). The paper focuses on the effectiveness of using the 'correct' tool and data processing in terms of better understanding possible structural defects. Processing, interpretation and analysis of collected data were supported by GRED software, with three-dimensional scanning capabilities. Reported results illustrate the effectiveness of GPR mapping providing valuable information regarding the positions of rebar (upper and lower reinforcement), unknown structural features as well as possible moisture ingress within the structure.
The results also demonstrate a possible phenomenon in identifying the presence of moisture within the bridge deck confirming a similar finding in an earlier case (Forth Road Bridge in Scotland).

Keywords: Bridge; Structure; Health Monitoring; Moisture Ingress.