Revealing the hidden structure of an historical masonry bridge from high resolution geophysical data: A case study of Pont de Coq, Normandy, France

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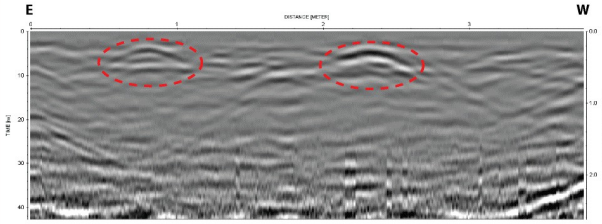


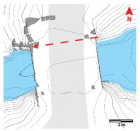
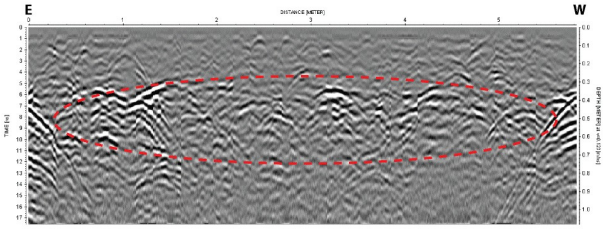


Figure 1. Ground Penetrating Radar (GPR) profile realized on the bridge deck in the transversal direction of the structure with a resolution of 25 cm (f =400 MHz). The local diffraction hyperbolas as shown by the red circles may be associated with the presence of a developped root system within the road (also seen on the longitudinal profiles, figure 5).



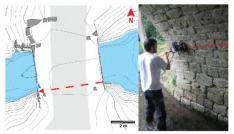
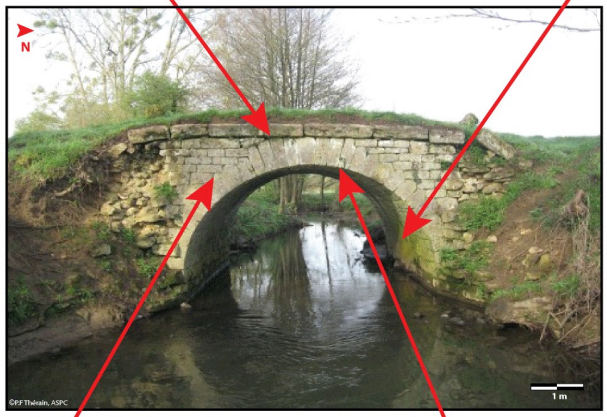
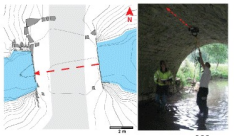


Figure 2. GPR profile realized at the fifth row of stones of the South vault with 1.5 GHz antennas (resolution: 4 cm). Note the important contrasts between 5 and 11 ns, corresponding to the presence of voids or roots. The anomaly observed at 1 m is related to the presence of the root of a tree which grew at the East side of the bridge.

Trees growing within the bridge, West arch, 2003 (©P.F Thérain, ASPC)



The bridge surface after cleaning, 2011 (© P.F. Thérain, ASPC)



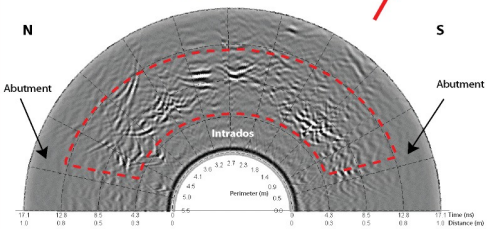


Figure 3. GPR observations (1.5 GHz) performed in the longitudinal direction at 50 cm from the West side of the bridge. The first row of stones (intrados) is similar to an homogeneous medium (no contrast) and seems to be in good condition. The second row (between 5 and 12 ns) reveals high contrasts which may be associated to the presence of voids and roots (visible at the front of the bridge).

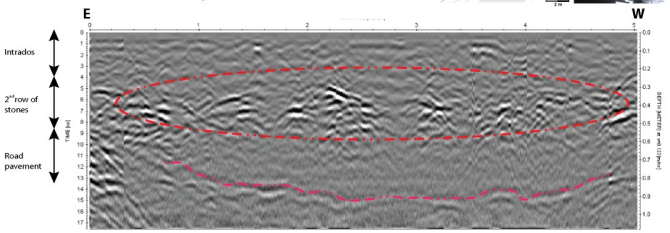


Figure 4. GPR profile realized at the keystone in the transversal direction with 1.5 GHz antennas. Three layers are perfectly observed (the first row of stones constituting the intrados, the second row of stones and the road pavement. This observation confirms that the intrados seems to be in good condition, while minor contrasts are detected between 5 and 9 ns, which may correspond to voids associated to the slight dislocation of the road lying above (affected by a root network and the poor condition of 3 wingwalls).

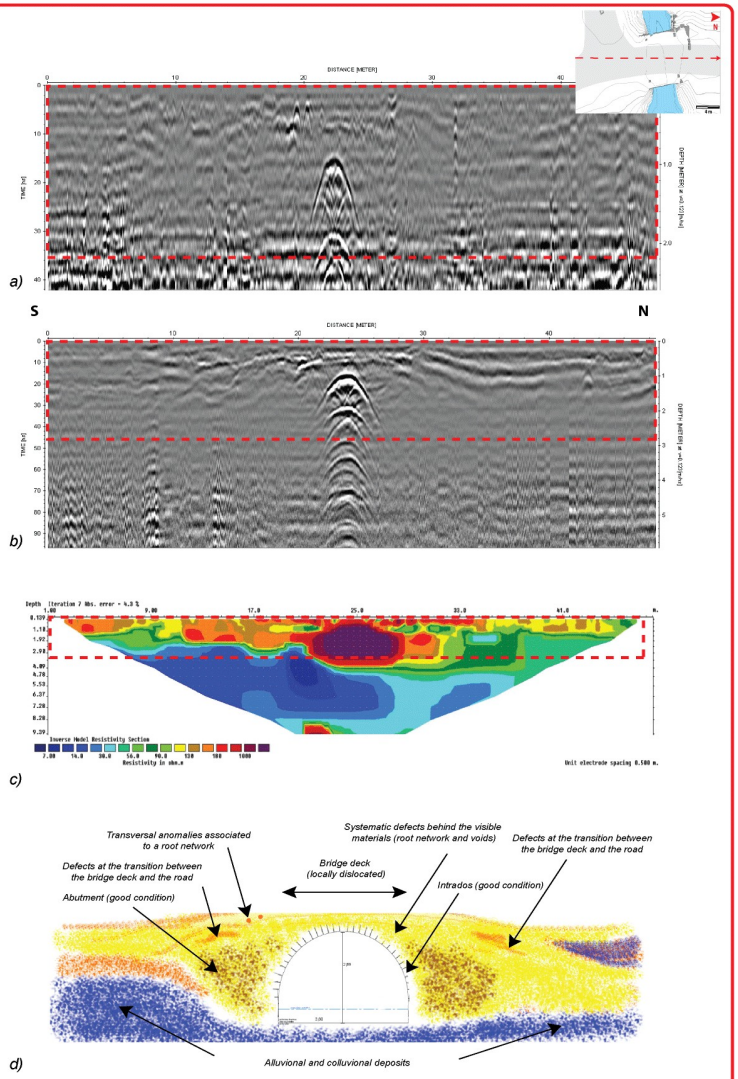


Figure 5. Comparison between a) the longitudinal GPR profile realized with 200 MHz antennas; b) the longitudinal profile with 400 MHz antennas; and c) the longitudinal Electric Resistivity Tomography profile at the same location; d) possible model for the bridge and the soil beneath the bridge.

Acknowledgements. This study was lead with the active collaboration of the Pont de Coq Conservation Association.