

Case 8.2 Injection quality of old cable ducts with impact-echo, Florida, USA

The 15 years old bridge is a cantilevered box girder bridge containing cable ducts, longitudinal as well as transverse in the bridge deck. The owner FDOT requested testing of the ducts, performed by impact-echo. Due to the cantilevered shape, evaluation had to be done directly from the ducts, only. The ducts were located by GPR in the bridge deck, and testing made by DOCTer impact-echo in the centerline of the ducts.

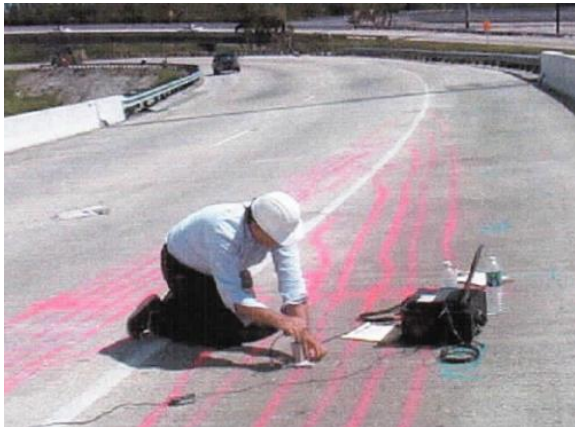
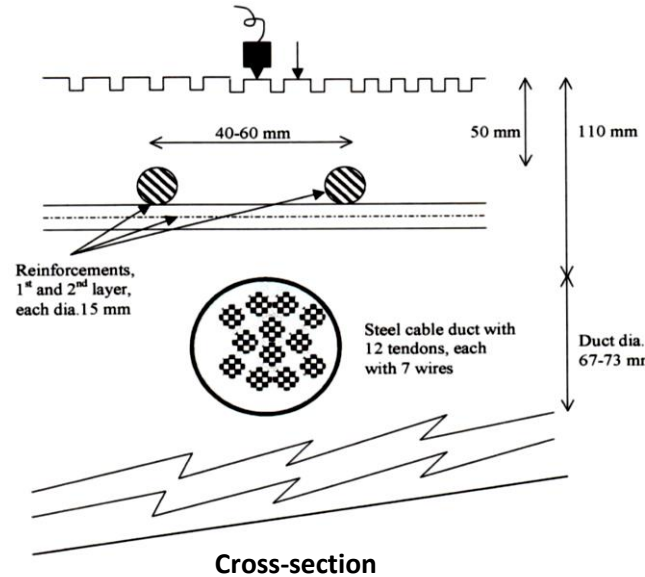


Fort Lauderdale bridge Florida, USA

Expected frequencies:

Solid duct: $f = C_p / 4T = 4000 \text{ m/s} / (4 \times 110 \text{ mm}) = 9.1 \text{ kHz}$, by reflection from the steel strands / tendons

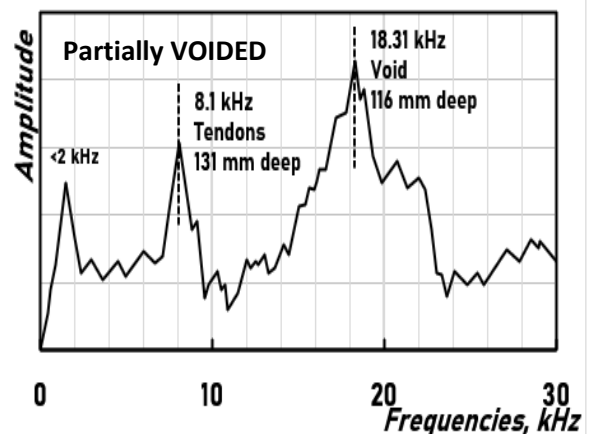
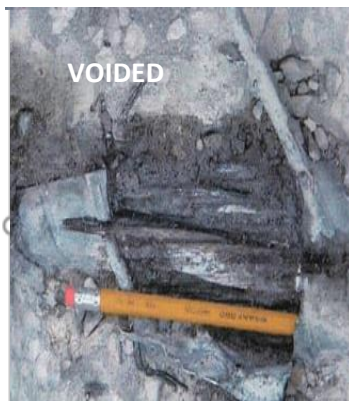
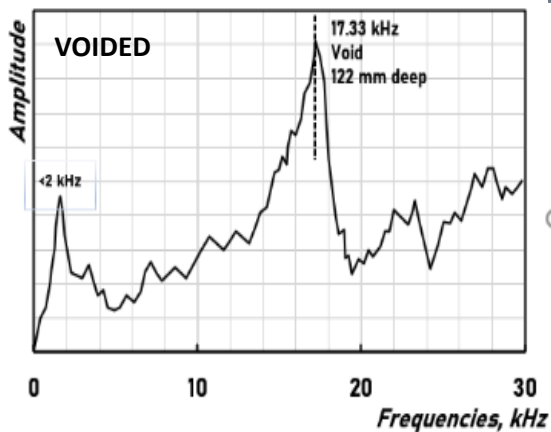
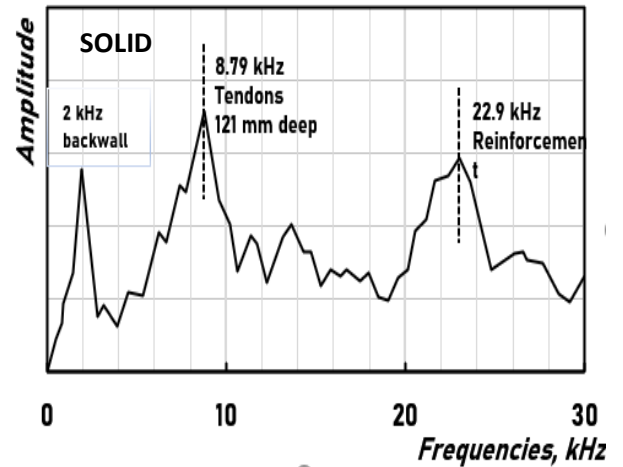
Voided duct: $f = C_p / 2T = 4000 \text{ m/s} / (2 \times 110 \text{ mm}) = 18.2 \text{ kHz}$ for an assumed $C_p = 4000 \text{ m/s}$ and a 110 mm depth to the duct, The actual frequencies found are illustrated below.



Types of signals found:

- SOLID**
- VOIDED**
- Partially VOIDED**

The actual P-wave speed could be back-calculated from $C_p = 2 \times T \times f = 2 \times 122 \text{ mm} \times 17.33 \text{ kHz} = 4228 \text{ m/s}$, using the $f = 17.33 \text{ kHz}$ found for the voided duct, if needed



1,200 impact-echo tests were made with 20 cm distance in between, on 6 randomly selected ducts. Two ducts were found to be fully injected, while the four others had voids at non-systematic locations, usually 1-2 m in length. Opening of the voided ducts confirmed the testing results. Interesting enough, water under pressure was present in the openings, and the strands / tendons were only slightly corroded as illustrated.