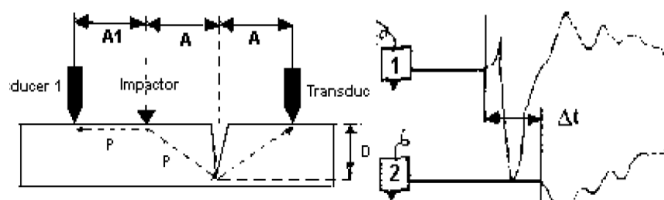


NDTitans in action

Case 8.7 Crack depth estimation with Impact-Echo on a bridge deck in Medaryville, USA



A concrete overlay cast over the existing deck of a bridge located in Medaryville, Indiana, USA, exhibited generalized cracking. The available documents and drawings showed that the thickness of the overlay was specified to be 1- $\frac{3}{4}$ ", however, after drilling some cores, the thickness was found to be up to 6" in some areas.

The cracking was evenly distributed along the length of the bridge, even in both ends of the bridge where the overlay had different conditions. There was concern about knowing how deep the cracks were in order to make decisions on the best way to solve the problem.

Impact-Echo tests with the **Germann Instruments DOCTer** system were carried out to quickly estimate the average depth of the cracks and avoid having to drill too many cores.

The P-stress wave velocity in the concrete was first measured with two displacement transducers placed at a certain distance. With this value, the transducers were positioned as shown in the bottom right picture with a distance $A = 50$ mm. The P-wave produced by the impactor travels on the surface to transducer 1 but cannot pass the surface opening crack, so it travels down along the side face of the crack, it is refracted at the bottom of the crack and returns as a tension wave to transducer 2. The geometry of the travel paths and the time

intervals measured with the transducers allow calculating geometrically the estimated depth of the target crack.

The testing was divided into two locations. The average depth of cracking was found to be 59 ± 9 mm in location 1 and 85 ± 7 mm in location 2.

Two cores were taken to corroborate the results and the actual measured depth matched reasonably well with the results obtained. In the top right photo, the crack is 65 mm deep while Impact-Echo calculated 67 mm in that particular point.

In the second core, the crack was long enough to reach one rebar of the existing reinforcement and this exhibited corrosion despite the fact that Impact-Echo did not detect delamination at that depth.

It was confirmed that the DOCTer test system based on the Impact-Echo method, using two displacement transducers on the surface, offers a reliable estimation of the depth of surface opening cracks once the P-wave speed has been measured.

Testing and reporting by **NDTitan apprentice Andrea Godoy**