

Case 10.9. Testing a bridge plate with Impulse Response to determine the extent of ASR induced damage, Sweden

During renovation of the edge beams of an old bridge a few cores revealed the presence of horizontal cracks – typical for ASR (Alkali Silica Reactions). This kind of damage starts from the top of the plate and propagate down through the bridge plate and are therefore normally not discovered before the entire cross section of the bridge is cracked in the affected area – revealed by cracks and white precipitations on the soffit of the bridge.

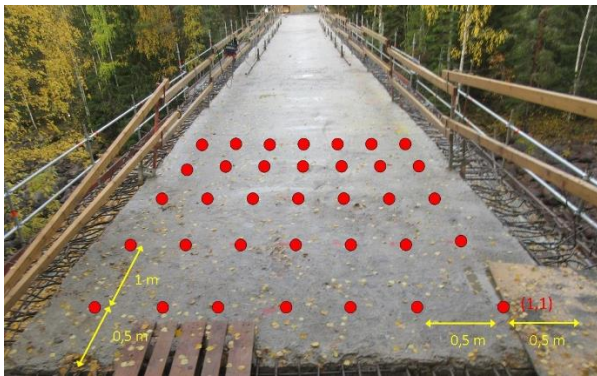


Fig. 1. Photo of bridge from east showing the beginning of the test grid.

Concerns of the condition of the bridge plate led to a request from the owner to make a thorough inspection. Using the Impulse-Response system testing were conducted on the entire bridge plate. The size of the plate is approx. 4 m x 50 m. Measurements were made in a grid with 7 “rows” across the bridge and 49 “columns” along the bridge, approximately 1 m apart. See red markings in Figure 1.

The results of the measurements are displayed in colour plots and interpreted on the following paragraphs.

- "Average Mobility" indicates the risk of shallow flaws – typically in a depth of approx. 0-100 mm. A value of >30 typically indicates the presence of flaws. The larger the number, the greater the risk. The scale is relative and is set for each individual structure.
- "Voids index" indicates the risk of deeper flaws – typically from approx. 100 mm and down. A value of >2 typically indicates the presence of a flaw. The larger the number, the greater the risk of a flaw. The scale is normally fixed.

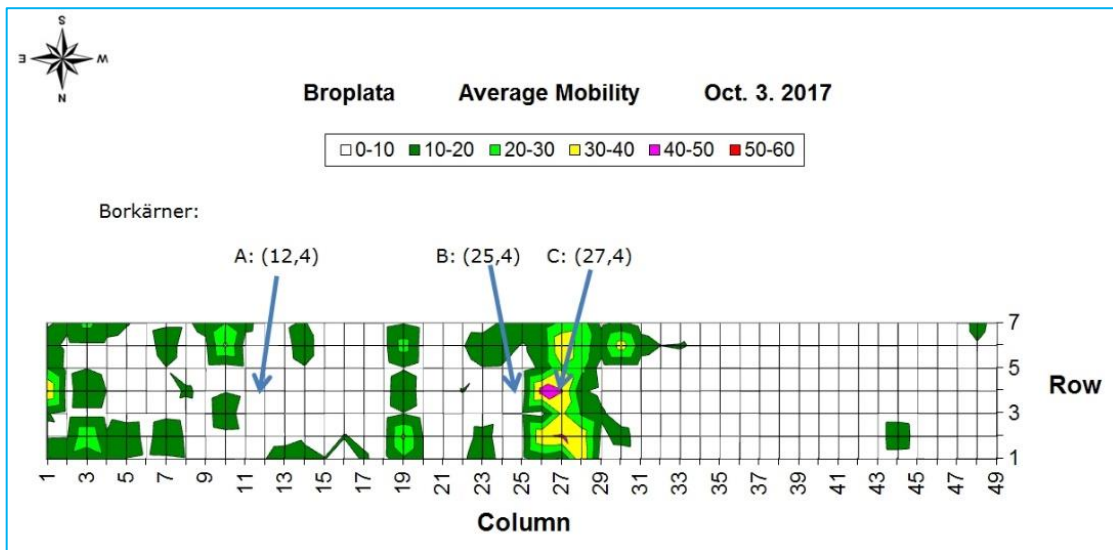


Fig. 2. Average Mobility plot.

The plots show additionally the location of 3 drilled cores:

- **Core A** sound area
- **Core B** at the edge of area with flaws
- **Core C** from an area with shallow flaws

On the data for Average Mobility (Fig. 2) data shows a delaminated area with shallow flaws in the middle of the bridge indicated by yellow and purple markings. In areas with light green, there is little risk of flaws. The remaining part of the plate is suspected to be in good condition.

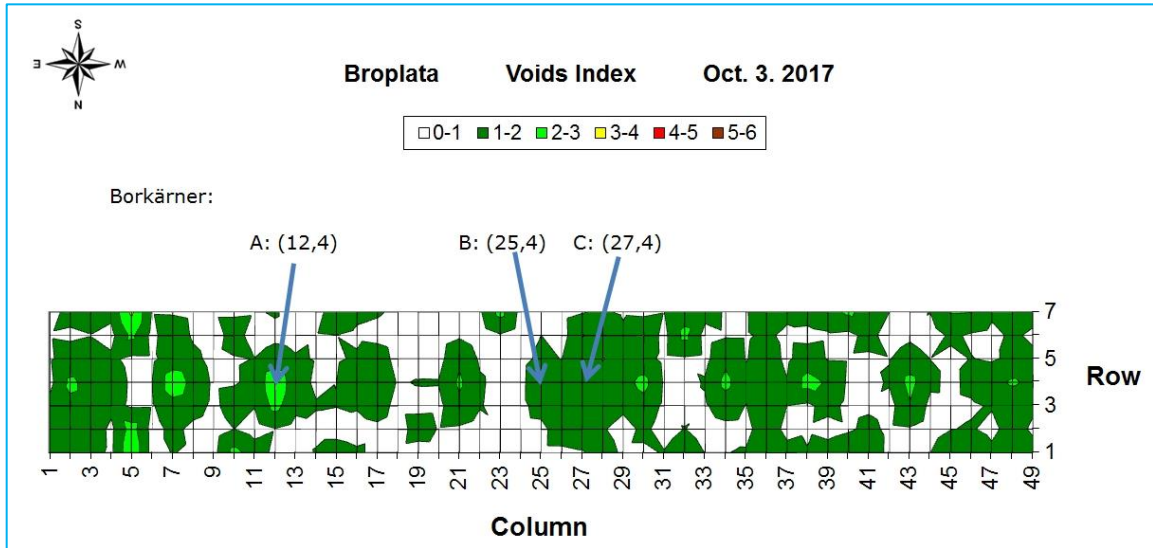


Fig. 3. Voids Index plot.

The data for the Voids Index (Fig. 3) show only a few weak indications of possible deeper minor flaws in the plate. The general conclusion is that there are no deeper flaws.

Cores for calibration

There are 3 drill cores listed as A, B and C, where the location is selected after the non-destructive testing has been completed. All cores are drilled to a depth of 150 mm. The site is selected as described below and a visual assessment of the condition of the individual core has been given:



Core A. Intact 100 mm long with few fine cracks.



Core B. Intact but with cracks around the aggregates and reinforcement.



Core C. Delaminated. Typical ASR-cracks.



Core C. Delaminated. Typical ASR-cracks