Integrating non-destructive testing into the infrastructure inspection process

Cold climates, frequent salting and heavy use threaten the reliability of bridges and roads that Canadians rely on every day. And with municipalities responsible for covering 60% of their costs, coming up with the funds necessary each year to rehabilitate or replace aging infrastructure is an ongoing challenge.

This poster illustrates how non-destructive technology such as Ground Penetrating Radar (GPR) rounds out an infrastructure inspection program and provides a substantive dataset on the subsurface conditions of roads and bridges. This data can be used to calibrate results from widely spaced core sampling and fill in information gaps that exist between core locations. The results are more informed decision-making and a reduction in the amount of destructive sampling required which subsequently leads to lower costs and less service disruptions.

A Traditional Condition Assessment Process

1 Data is collected through visual inspection

Inspectors check the general condition of the bridge or road and visually examine each component close up. The inspector looks for any surficial concerns with concrete or steel materials such as splitting, cracking, erosion and other defects. Required repairs are documented. Results are often dependent on the operator's training, interpretation or level of experience.

2 Locations for destructive testing are identified

Based on the results of the visual inspection, areas of potential distress are marked and locations for further destructive testing (core sampling) are identified. Sampling is typically discrete and widely spaced.

3 A core sampling program is carried out

A section of the road or bridge is closed and a series of cores are collected. Cores are generally drilled in a straight line and are evenly spaced. Their locations are also mapped with a GPS.

Limitation: *Destructive testing can fail to capture a representative profile of the road or bridge. Furthermore, coring can be detrimental to pavement, particularly when construction is delayed. Costs are driven up by the fact that cores require patching once the testing is complete.*

4 Core samples are sent to the laboratory for further testing

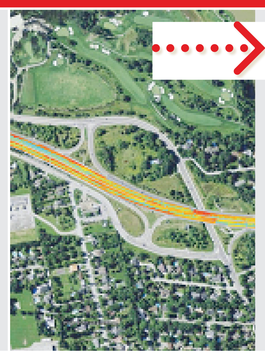
Once extracted, core samples can be further analyzed to check for cracks and estimated chloride content in concrete, determine overall strength and measure asphalt thickness, layers, etc.

Limitation: *Core samples are often widely spaced and it is assumed that data residing between discrete points is consistent, but this is not always the case.*

A Condition Assessment Involving Non-Destructive Testing

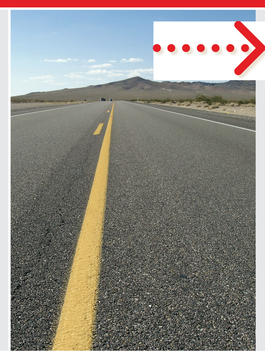
2 A survey is conducted using Ground Penetrating Radar (GPR)

When a road has been repaved, anomalies can exist deep below the surface that may go unnoticed such as voids in the concrete. GPR allows anomalies to be captured by transmitting high frequency radio waves into the structure and analyzing the reflected velocity and energy to create a profile of the subsurface features. The survey is generally carried out at posted speeds, without the need for service disruptions or traffic control.



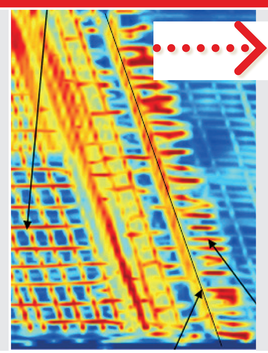
3 Locations for destructive testing are targeted based on the results of the GPR survey

The results of the visual inspection are combined with GPR data to select locations for coring based on evidence of distress or abnormalities.



4 A core sampling program is carried out

Fewer cores are required because data collected by the GPR fills in information gaps and provides new insights into subsurface conditions. The GPR data can also be saved and referenced years down the line when the infrastructure is re-inspected.



5 Core samples are sent to the laboratory for further testing and the results are calibrated with GPR data for new insights

Core sample results are calibrated with the GPR data to verify accuracy and supply project stakeholders with a wealth of additional insights into existing anomalies beneath the surface. The combination of these datasets provides a complete picture of subsurface conditions.

Project stakeholders can visualize deterioration and rebar corrosion along with the position of post tension cables and other subsurface features. Combined with data acquired through destructive testing and visual inspection, a substantive dataset is supplied that supports a better understanding of lifecycle costs and the effectiveness of maintenance efforts throughout the aging process.

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