Concrete evaluation – NDT techniques

BRE provide a professional evaluative consultancy with allied technical services for determining the extent, severity and cause of concrete deterioration, whilst providing advice on remedial measures.

Prior to treating any structure showing signs of distress it is vital to establish the cause of any defects.

The testing and monitoring of structures can locate and identify the various defects that can occur in structures and allow a rational engineering assessment to be made of the need for repair and maintenance. Testing can determine whether the distress is attributed to the deterioration of the concrete of other materials, direct corrosion of the reinforcement in concrete, or to corrosion of metallic components.

Objectives of the assessment include:

- To establish and record the current physical and functional condition of the structure
- To identify likely future problems and the approximate timing of those problems.
- To determine and measure the type and extent of the maintenance needs.
- To establish a history of material performance.
- To provide feedback to design, construction and maintenance engineers.

A range of NDT techniques can be used to assess various aspects of the structure. A summary of the application of the NDT techniques is shown overleaf.
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<tr>
<th>Properties</th>
<th>Available test methods</th>
<th>When to use</th>
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| Integrity and structural performance | – Visual inspection  
– Delamination survey  
– Impact-echo survey  
– Ground penetrating radar (GPR) survey | When likely delamination or spalling is suspected, or when areas of delaminating or spalling have been identified. When voids are suspected. |
| Concrete properties affecting durability and deterioration | – Cement content and type  
– Chloride and sulfate profiles  
– Ultrasonic pulse velocity survey  
– Alkali-aggregate reaction  
– Petrographic examination  
– Apparent volume of permeable voids (AVPA) | Dependent on purpose – to determine internal factors and origin of cracking (such as in the case of AAR and DEF), to assist in determining concrete strength and durability, to identify and assess extent of chemical deterioration mechanisms, such as sulfate, acid sulfate or soft water (leaching) attack. |
| Location of reinforcement | – Ground penetrating radar (GPR) survey  
– Covermeter survey | When cover issues exist and when knowledge of cover is required as input for other assessments. |
| Corrosion of embedded steel | – Carbonation depth  
– Chloride profile  
– Corrosion potential (electrochemical, half-cell)  
– Concrete resistivity  
– Corrosion rate measurements / linear polarisation  
– Concrete breakout / reinforcement inspection | When condition of steel reinforcement needs to be known. Visual inspections may have identified significant cracking, rust staining and moisture ingress issues. |
| Concrete strength | – Pullout  
– Compressive strength  
– Tensile strength  
– Rebound hammer | To determine concrete strength or an indication of concrete strength. |
| Steel structure deterioration | – Visual inspection  
– Dye penetrant testing  
– Magnetic particle testing  
– Ultrasonic testing  
– Radiographic testing  
– Eddy current  
– Tensile testing  
– Hardness / rebound testing  
– Microstructure testing | When corrosion is identified on welds or weld defects are suspected. When thickness or properties of steel needs to be determined. When ‘work hardening’ or brittleness is suspected. When general corrosion or environment-assisted cracking is suspected. |

BRE plans and executes complete deterioration investigations, which its experts then use to obtain a thorough understanding of potential deterioration mechanisms and the strengths and limitations of investigative techniques.

Contact Us

If you want to find out more about BRE’s work in this area or discuss how we can support your project, please email enquiries@bregroup.com or call 0333 321 8811.