Prevent Collapse of Concrete Balconies with Non-destructive Testing

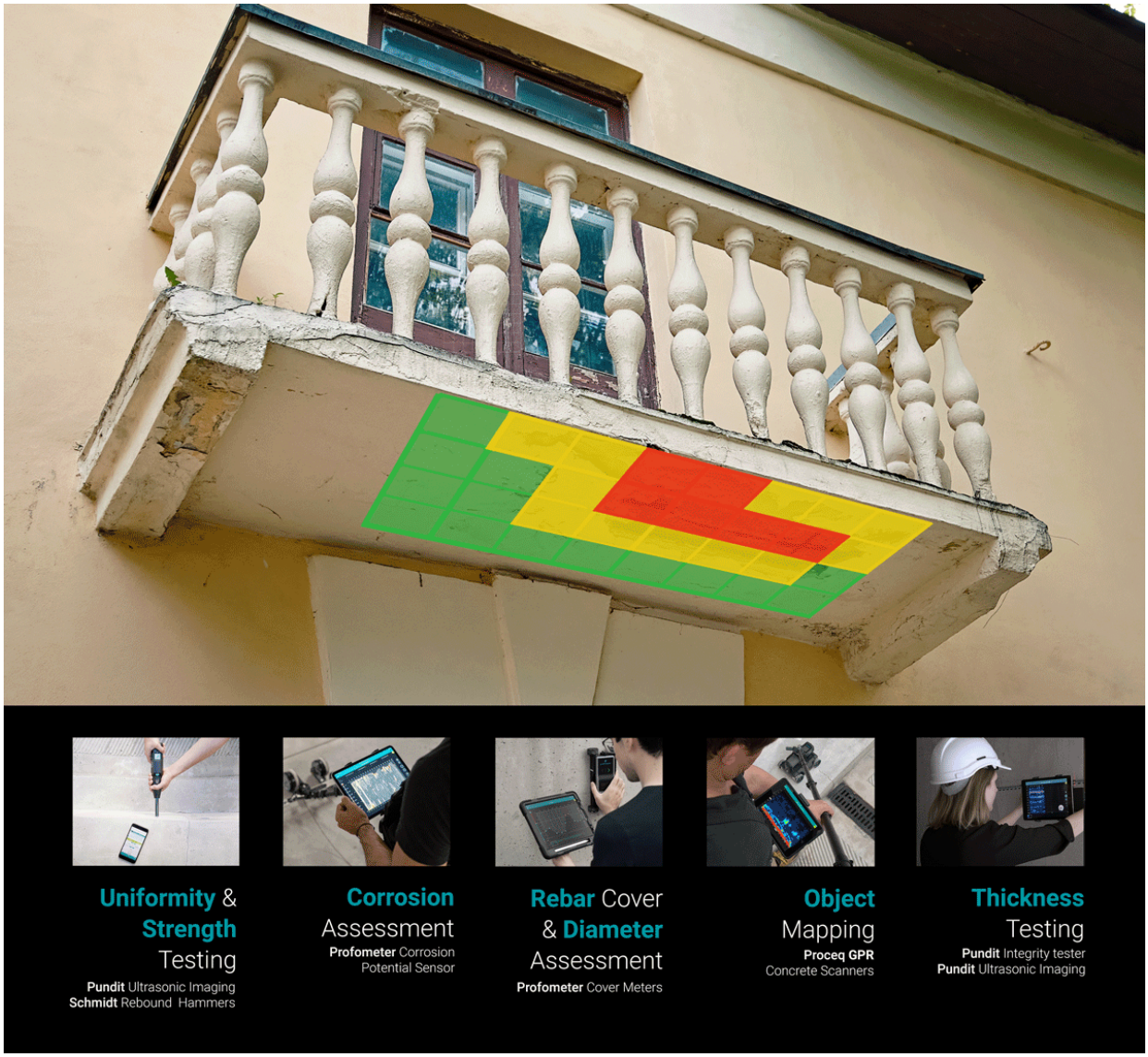
Discover the crucial factors affecting the structural intregrity of balconies and how to assess them effectively

Over the past few years, incidents in France have tragically highlighted the potential dangers of aging concrete balconies. These structures, once symbols of modern living, have become a cause for growing concern. As concrete buildings age, they undergo a natural process of degradation. Reinforced steel within the concrete can corrode, leading to structural deterioration and, ultimately, collapse.

The insidious nature of concrete deterioration lies in its often invisible progression. Cracks, spalling, and other visible signs may be late indicators of more severe underlying issues. By the time these symptoms appear, significant damage may have already occurred. This is where non-destructive testing (NDT) emerges as a valuable tool in preventative maintenance. This application note describes the various NDT methods to ensure the safety and longevity of concrete balconies.

How to check the safety of concrete balconies with NDT

NDT is a collection of techniques used to evaluate the properties of materials, components, or systems without causing any damage. For concrete balconies, NDT offers a powerful way to assess their structural integrity. There are several NDT methods to check the health and strength of concrete balconies. For the most comprehensive assessment, these methods should be used in combination to gain the full picture.



Assess the uniformity and compressive strength of the concrete

Firstly, it is crucial to assess the uniformity and compressive strength of the concrete balcony. Start by dividing the area up into small cells for measurement and test each cell with a rebound Hammer Schmidt OS8200 or an ultrasonic pulse echo imaging system like the Pundit PD8050. From the uniformity testing, you can then identify the location with the lowest test result which means the weakest area of the concrete slab. From there, one might consider taking cores for compressive strength estimation according to EN13791 standards.

The compressive strength of concrete can be easily measured using a Schmidt rebound hammer. The rebound value correlates to the concrete's compressive strength, providing a rapid assessment of its condition. By comparing rebound values to established standards, it’s possible to achieve accurate estimation of the concrete compressive strength.

Measure concrete thickness

The next step is to measure concrete slab thickness in different areas. Measuring the thickness of concrete is useful for assessing the overall condition of the balcony and identifying potential delaminations or voids. It will also give you a hint if the concrete is not homeogenic and can indicate any hidden cracks.

Thickness testing can be done with the PD8050 ultrasonic pulse echo imaging system, or with wave velocity technology using a device like the Pundit PI8000. These NDT methods give immediate results on the iPad, so you can easily assess, analyze and share the results with colleagues and stakeholders.

Inspect rebar cover & diameter

Another vital step for balcony health checks is rebar cover inspection. Concrete cover is an important factor for the safety and longevity of balconies as insufficient levels of cover can lead to higher probability of corrosion. Cover meters like the Profometer PM8000 are used to accurately determine the depth of concrete cover over reinforcing steel bars.

The PM8000 helps to identify areas where corrosion might be a concern due to low concrete cover and rapid carbonation. This PM8000 is used by placing the sensor on the concrete surface and taking measurements at regular intervals to determine the location and diameter estimation of the rebar. By mapping the rebar location and cover depth, engineers can identify areas that are more susceptible to corrosion.

Gain a comprehensive overview of the reinforcement layout

Knowing the exact rebar placement within concrete slab empowers targeted inspections of areas prone to corrosion, such as edges and corners. Poor positioning of reinforcements may reduce load-bearing capacity and cause structural failure. To gain a comprehensive picture of the reinforcement layout, including the deep rebar not found with the cover meter, ground penetrating radar (GPR) technology is used as an effective solution.

The Proceq GP8000 GPR, for example, generates detailed, visual representations of the shallow and deep rebar with a single pass of the antenna. With the results immediately viewable on the iPad in high resolution, crucial decisions can be made faster. Simply move the GPR along the concrete to reveal the reinforcement beneath. It is also possible to develop a Deterioration Map using any Proceq GPR and GPR Insights post-processing and analysis software. This map helps to identify areas of the balcony with a high probability of being deteriorated.

Discover areas with high probability of active corrosion

Early detection of corrosion is crucial for preventing structural failure. Thankfully this is made much easier and faster with technologies like half-cell potential. Using a half-cell potential meter like the Profometer PM8500, it is possible to see areas with high probability of corrosion.

Identify corrosion hotspots with a quick area scan using the unique wheel electrode and see the results in an easy-to-understand heatmap on the iPad. Cell by cell, you can see which areas are likely to have active corrosion. You can also compare the results from the PM8000 cover meter, as the areas with low cover often match areas with corrosion likelihood.

Gain peace of mind for your housing

The tragic events in France underscore the urgent need for a more proactive approach to concrete balcony safety. Regular NDT inspections should be incorporated into a long-term maintenance plan to monitor the balcony's condition and detect potential issues early. By doing that, asset owners can implement targeted repair or reinforcement measures, significantly reducing the risk of collapse and potentially saving lives.

For asset owners and engineers, investing in NDT is not merely an expense; it's an investment in safety, peace of mind, and long-term value.