Can Self-Healing Concrete Provide the Solution?

ADRIN SARWAR

Bangladesh is in the midst of a remarkable urban transformation. From the capital of Dhaka to emerging cityscapes across the nation, construction is the drumbeat of progress. Yet, this rapid growth comes with a significant challenge: the durability of our infrastructure. Concrete, the backbone of the modern world. Over time, small cracks caused by environmental stress, heavy loads, and chemical exposure can widen, allowing water to seep in and wear down the steel reinforcement within. This leads to costly repairs, reduced structural lifespan, and potential safety hazards. For a nation building its future, this is a critical vulnerability.

Concrete that heals itself

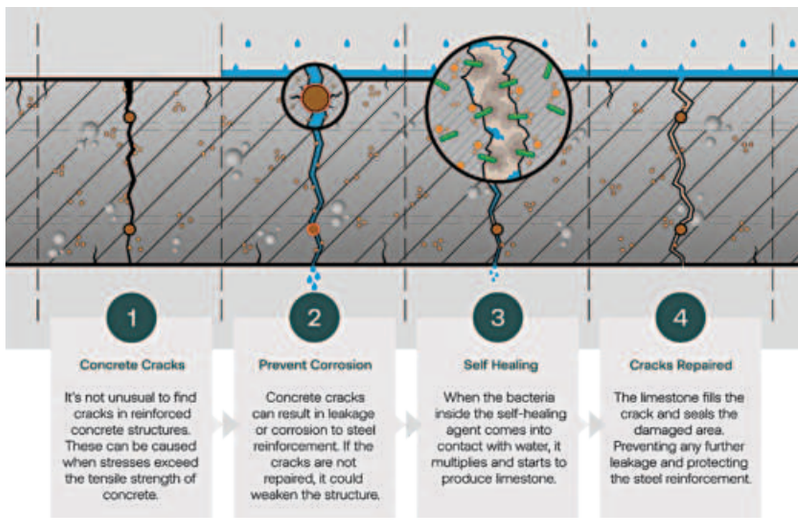
Imagine a material that can heal its own wounds, much like human skin. Such is the promise of self-healing concrete. It is a game-changing innovation that redefines construction. The technology works in two primary ways. The first is autogenous healing, a natural but limited ability of unhydrated cement to react with water and seal very fine cracks.

The more advanced method is autonomous healing. The most promising approach involves embedding specific dormant bacteria within the concrete mix along with their food source (often calcium lactate). When a crack forms and water enters, the bacteria is awaken. They consume the nutrients and, through their metabolic process, produce calcium carbonate, also known as limestone. This meticulously fills the crack, sealing the damage and restoring the concrete's integrity. This autonomous repair system can seal cracks up to 0.8mm wide, preventing water ingress and stopping small problems from becoming major structural failures.

Sensicon, a partner of Basilisk, a Dutch startup that specialises in the development of self-healing concrete solutions for infrastructure projects, produces a self-healing concrete, Sensicrete. The product was invented by Henk Jonkers, a microbiologist and professor at Delft University of Technology. It can be used in any concrete structure that is susceptible to water or moisture exposure, for example, concrete tunnels and sea defence walls. Sensicrete is made from a standard concrete mix with a self-healing agent added to it. The agent contains a dormant bacterium; once cracks appear and the bacteria come into contact with water, they produce limestone and seal the cracks. The exact healing process is shown below.

Extending Lifespan

By autonomously repairing cracks, the concrete prevents water, chemicals, and salts from penetrating the structure.This stops the corrosion of internal steel reinforcement.The result is a significantly extended lifespan for buildings, bridges, and other infrastructure. In fact, structures built with self-healing concrete require far fewer repairs and less ongoing maintenance over their lifetime. While the initial material cost may be higher, the long-term savings from eliminating expensive manual crack injections and repairs are substantial.



SOURCE: **SENSICON.CO.UK**

Waterproofing and Enhanced Safety

The self-healing process makes the concrete inherently waterproof. As cracks seal themselves, they prevent water from passing through. For structures like basements, tunnels, and water tanks, expensive and labour-intensive waterproof coatings or membranes often become unnecessary. This not only saves on initial construction costs but also removes a potential point of failure, as membranes can tear or degrade over time. Some advanced self-healing composites are designed to be more flexible than traditional concrete. It allows them to bend slightly under stress before fracturing.

Projects Using Self-Healing Technology

While the technology is still gaining widespread adoption, it has been successfully demonstrated in several high-impact projects globally. Construction company Heijmans Infra used self-healing concrete to build a pilot project, a railway underpass in Rijen, the Netherlands, for the first time. In this pilot project, construction company Heijmans used self-healing concrete to build a railway underpass wall in the Netherlands. The key innovation was using the concrete's ability to automatically repair its own cracks to justify a major design change, they successfully reduced the amount of horizontal steel reinforcement by 35%.

The concept of self-healing concrete is relatively new and is still under research in most parts of the world, including the UK. But there have been many successful trials of this new technology in laboratories as well as real-world applications. Basilisk has successfully used self-healing concrete in several commercial projects. For example, they extended the lifespan of a bus lane by 15 years using their product, Basilisk Liquid Repair System ER7. Situated in Schiphol Airport, the bus lane was showing a large number of cracks along the entire route. As of now, there are no large-scale public projects documented in Bangladesh.

The Bangladeshi Context

The drive for smarter construction materials is already taking root in Bangladesh. Academic institutions are exploring innovative solutions tailored to local needs. Moreover, the Housing and Building Research Institute (HBRI), has long been a pioneer in researching and promoting alternative and sustainable construction materials. Their work in areas like eco-friendly blocks sets a crucial precedent for adopting next-generation technologies like self-healing concrete, aligning with the national goal of building sustainable and affordable housing.

A Wiser Investment for the Future

Although self-healing concrete has a higher initial cost, its long-term economic and environmental benefits are significant.

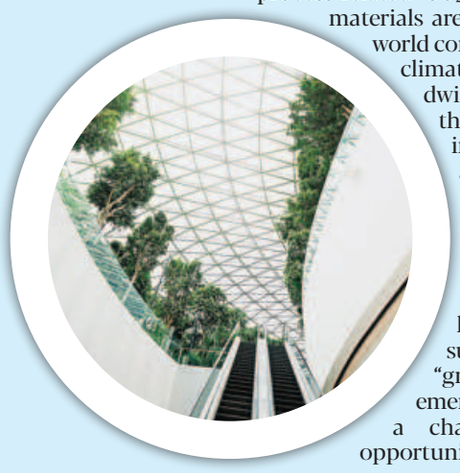
By dramatically reducing the need for maintenance and repairs, it extends a structure's lifespan, making it a more cost-effective solution over time. This extended life also lowers the demand for new cement production, a major source of CO2 emissions, thereby reducing the material's overall carbon footprint.

CARBON TO CONSERVATION
The Promise of Green Construction

Green construction isn't just about lowering emissions. It is about building a future that lasts.

TASNIM TABASSUM

Cities are expanding rapidly, transforming skylines and reshaping the way people live, work, and connect. Yet the very structures that define modern life are also among the biggest contributors to climate change. According to the United Nations Environment Programme (UNEP), the buildings and construction sector accounts for roughly one-third of global energy demand. Around 37% of energy- and process-related CO_2 emissions when materials are included. As the world confronts escalating climate pressures and dwindling resources, the construction industry stands at a pivotal crossroads. Here, the concept of green construction, which is also known as sustainable or "green building," emerges as both a challenge and an opportunity.



WHAT "GREEN CONSTRUCTION" REALLY MEANS

Green construction encompasses design and delivery approaches that reduce environmental impact throughout a building's lifecycle. This includes site selection that protects ecosystems, low-embodied-carbon materials, efficient HVAC systems, water-saving measures, and on-site waste reduction. According to the U.S. Green Building Council, it is not a single technology but a whole-system mindset focused on durability, reuse, low operating costs, and occupant health.

THE NUMBERS THAT MATTER

Operationally, buildings consume about 30% of the world's final energy and produce roughly a quarter of energy-related emissions. When emissions from materials such as cement and steel are included, the sector's share rises toward the high-30s percent range. Those figures underline why decarbonising both new construction and the existing stock is essential to meet climate targets.

PROVEN TACTICS WITH MEASURABLE RETURNS

Many green measures deliver rapid, verifiable returns. High-performance insulation, improved glazing and efficient heating, ventilation and cooling can cut energy use dramatically; renewable energy integration further reduces operating emissions. On water, low-flow fixtures, greywater reuse, and rainwater harvesting are standard, measurable approaches. Evidence from certified projects shows meaningful performance gains — for instance, large samples of LEED-certified buildings report average energy reductions and water savings compared with conventional peers. Still, results vary by climate, operation and certification rigor, so careful measurement is essential.

WHY GREEN BUILDINGS MAKE ECONOMIC SENSE

Beyond environmental benefits, green buildings often outperform conventional ones financially over the medium term. Savings on energy and water lower operating costs; healthier indoor environments can raise productivity and lower absenteeism; and market demand increasingly premiums sustainably built assets. While some green technologies add modest upfront cost, many interventions, particularly when integrated early, pay back through lower bills and higher asset value. According to the World Green Building Council, survey data and market studies have repeatedly shown positive business cases for green retrofits and new green projects.

THE BIG CHALLENGE

A stubborn reality is that most buildings that will exist in 2050 already stand today. Retrofitting these assets — often built with carbon-intensive materials like conventional cement and steel — is therefore mission-critical. Innovations in low-carbon materials, circular-economy reuse, and phased retrofit strategies are scaling up, but policy support, skilled labour and financing mechanisms must catch up to unlock the full potential.

LOCAL RELEVANCE: OPPORTUNITIES FOR BANGLADESH

For rapidly urbanizing countries like Bangladesh, green construction is both a resilience and affordability strategy. Bangladesh is also embracing green construction and sustainable technologies in the building sector. One example is InnStar Limited, a real estate and construction company that focuses on green-certified, technologically advanced projects. Their developments prioritize sustainability through initiatives such as rainwater harvesting, recycling wastewater from toilets, tree plantation, pavements equipped with motion-sensor lights that only activate when vehicles are present, and garages with electric vehicle charging stations.

Pratik Sengupta, AGM of InnStar, stated, "If you only think 2–4 years ahead, green construction may seem more expensive than traditional methods. But when you consider the future, what we are leaving for the next generation, how sustainable the project is, and how it contributes to the environment, green construction makes complete sense. It no longer appears costly when you view it as an investment in the future."

A PRACTICAL ROADMAP FORWARD

Policymakers, developers, and building owners can accelerate green construction by requiring or incentivizing energy performance disclosure, prioritizing retrofits of high-use buildings, supporting low-carbon materials and whole-life accounting, and expanding skills training for sustainable practices. Combining clear regulations with financial incentives and technical assistance will make green construction the norm rather than the exception. Beyond lowering emissions and operating costs, sustainable buildings create healthier, more resilient communities. With the right strategies, the construction sector can transform from a major carbon contributor into a key driver of climate solutions, one building at a time.