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POTHoles: HOW ENGINEERS ARE WORKING TO FILL IN THE GAPS

Potholes are a perennial problem. They are dangerous to road users, and the damage they cause to vehicles can be hugely expensive. The cost of repairing them is also vast. But still they appear, and reappear, in countless places. So why do these pesky crevices pose such a difficult challenge? And is there any light at the end of this pothole-filled tunnel?

Potholes often begin as imperceptible microscopic cracks in the road surface. Bad weather, poor drainage and heavy traffic can all cause that surface to loosen and wear away.

At the moment, where and when these microscopic cracks will appear is hard to determine. But in the future, it is likely that high precision measuring techniques will be able to predict the time and location that potholes will appear. To repair the road before potholes, grow, machines will be installed into autonomous vehicles, cleaning out the damaged areas and filling them in again



Self-healing roads

The development of new types of road material, such as “self-healing” asphalt, something they are investigating at the Nottingham Transportation Engineering Centre, could reduce the necessary frequency of repairs – and hopefully help turn potholes into a distant memory.

Asphalt roads are composed of mineral aggregates that give structural stability, and bitumen, a viscous liquid that binds the other materials together. When cracks appear in the road, bitumen drains into the cracks and fills them. The problem is that bitumen is a very viscous liquid at normal temperatures, and the healing of the cracks can take weeks. With regular traffic, the rate of crack growth may occur at a faster rate than they are filled – allowing potholes to form.

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To accelerate the “healing” of the road, they are exploring the addition of tiny capsules containing asphalt rejuvenators such as sunflower oil, or tall oil, a byproduct of paper production.

The idea is that when roads start to crack, the capsules break open and release the oil within, softening the surrounding asphalt. This helps the asphalt stick back together more swiftly, effectively filling in cracks and preventing small defects from deteriorating. With this idea, we expect to delay the first potholes by at least five years, reducing the need for maintenance and all the troubles that come from it, such as slow traffic and travel delays.

Warming things up

Another solution being investigated at Brunel University – which could save a fortune – is the use of infrared heat to make repairs cheaper and longer-lasting.

Wet weather, combined with cycles of freezing and thawing, dramatically accelerates pothole development – and many repairs fail prematurely. This is because the traditional way to repair potholes with heat is to inject them with boiling hot asphalt. But if the road is cold, the temperature of the repair material falls significantly, creating weaker bonds with the surrounding material.

https://www.youtube.com/watch?v=k41hp669X_g

-K Sri Bindu

Assistant Professor

EXOSKELETONS

The tech trend to watch 8in 2020 is the use of exoskeletons. The potential benefits this can afford to a construction site's workforce are obvious.



Laborers can carry more load than their fragile human bodies would normally be able to cope with, and if it is widely adopted, it would largely increase the safety of construction sites. For construction companies, this will dramatically improve their bottom line by reducing the number of laborers needed on-site as well as reduce lost man-hours from injury.

"ABI Research predicts the robotic exoskeleton market alone will reach \$1.8 billion in 2025, up from \$68 million in 2014. This year, about 6,000 suits will be sold, mainly for rehabilitation. By 2025, ABI expects to see about 2.6 million on the market." - Constructible.

But they may ultimately lose out to robots and 3D printing alternatives as exoskeletons still rely on a human operator at their heart. That being said, they might offer the perfect compromise between labor unions who will inevitably try to protect their member's jobs from becoming obsolete.

But they are yet to significantly infiltrate the industry. Perhaps 2020 will be the year they make it?

-K Harish Babu
Assistant Professor

CHRONOS CHROMOS CONCRETE

Turn up the heat and this concrete will tell you the time



A trio of UK-based product designers has developed a method for incorporating dynamic patterns, numbers, and text into concrete surfaces. Chris Glaister, Afshin Mehin, and Tomas Rosén have figured out that by incorporating thermochromatic pigment and wire heating technology into a standard concrete mix, the color of concrete can be changed. With the use of microprocessor control devices, the color-changing pattern can be precisely manipulated to form complex patterns and even information displays, such as dot-matrix clocks. While Chronos Chromos Concrete is not yet commercially available, the material is being used in several projects, including a 40x78-inch information display in the entrance hall of a new building in London.

-G Priyanka
Assistant Professor

WALLED PAPER

The world's heaviest wallpaper. At first glance, walls constructed with Walled Paper precast concrete may appear to be covered with decorative paper, but the complex, ornate patterns are actually cast into the surface of the concrete panel. UK-based Concrete Blond can cast more than 50 standard patterns and virtually any custom design into architectural precast panels for interior and exterior cladding, flooring, and surface applications. The patterns can be cast with a textural depth of 1/64 to 3/16 inch on to three types of concrete: Brutalist gray, Victoriana black, and Portland white.

--J Divya
Assistant Professor

SOLID POETRY

Don't forget to water your concrete. Developed by Dutch designers Frederik Molenschot and Susanne Happle, Solid Poetry is a concrete tile that reveals a pattern when wet. The detailed patterns are created by carefully applying surface treatment to the finished concrete surface that darkens when exposed to water or humid air. Solid Poetry is ideal for floors, walls, and surfaces in environments that encounter frequent humidity changes, such as poolside's, gardens, bathrooms, and saunas.



-K Srimukha
Assistant Professor

ARTIFICIAL INTELLIGENCE (AI)

The construction industry is already seeing the implementation of artificial intelligence on the job site with the use of robotics for tasks like bricklaying and autonomous equipment that can operate and complete tasks without the need for human interaction. One of the best emerging trends in civil engineering.

AI can benefit construction projects through increased safety, improving workflows, and getting jobs done faster and better. It can also identify when information or pieces are missing and ask questions and use the data it collects.

-M Sai Ganesh
Assistant Professor

CLOUD & MOBILE TECHNOLOGY

Mobile technology isn't just for games anymore. Apps are becoming more of the norm in actual construction. The increased portability of tablets and smartphones allows for greater communication and the ability to work from anywhere.

Integrating this type of technology into your current processes can be much simpler and require a smaller upfront investment while still providing major benefits and boosting productivity in your day to day processes.

Mobile technology can help to save time and keep the project moving forward faster by providing real-time monitoring, updates, and making information available between the job site and the office.

Companies can easily access the latest revisions to plans or report a problem to the project manager off-site. One of the best emerging trends in civil engineering.

Just a few years ago most people either didn't know or couldn't explain what a cloud operating system was. Today, this is no longer the case. In fact, most mobile devices can leverage cloud technology from anywhere, at any time.

There are many great advantages to this, including storing almost limitless amounts of information that you can then share instantly with the touch of a button. This is much less expensive too – about one-tenth of what sharing old technologies cost.

Since the cloud-based business phone system is accessible from anywhere you have an internet connection you can expect it to become a mandatory part of the construction industry in the future, especially if you want to remain competitive.

- Ch.Sri Varma