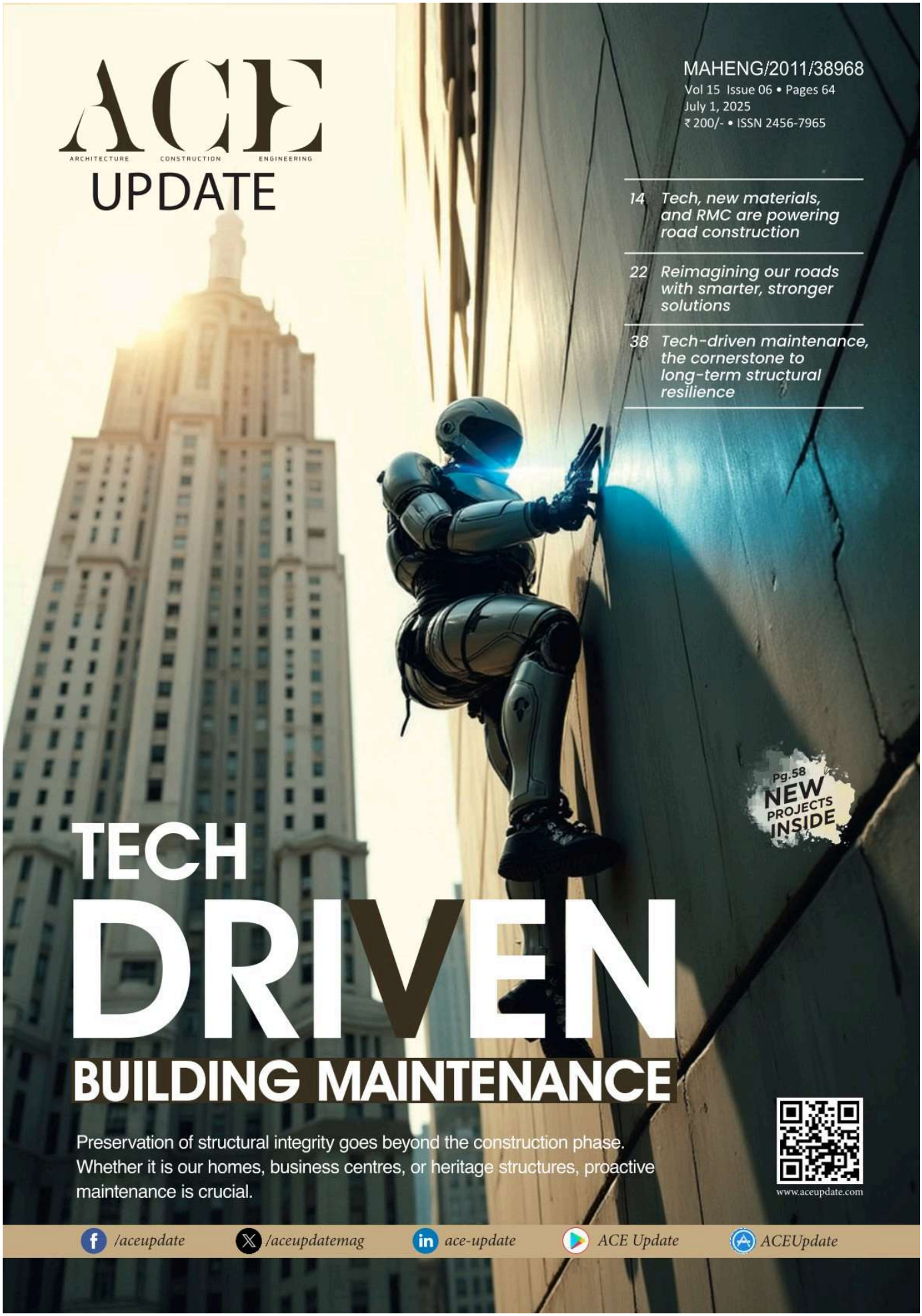
ACE
ARCHITECTURE CONSTRUCTION ENGINEERING
UPDATE

MAHENG/2011/38968
Vol 15 Issue 06 • Pages 64
July 1, 2025
₹ 200/- • ISSN 2456-7965



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TECH DRIVEN BUILDING MAINTENANCE

Preservation of structural integrity goes beyond the construction phase. Whether it is our homes, business centres, or heritage structures, proactive maintenance is crucial.

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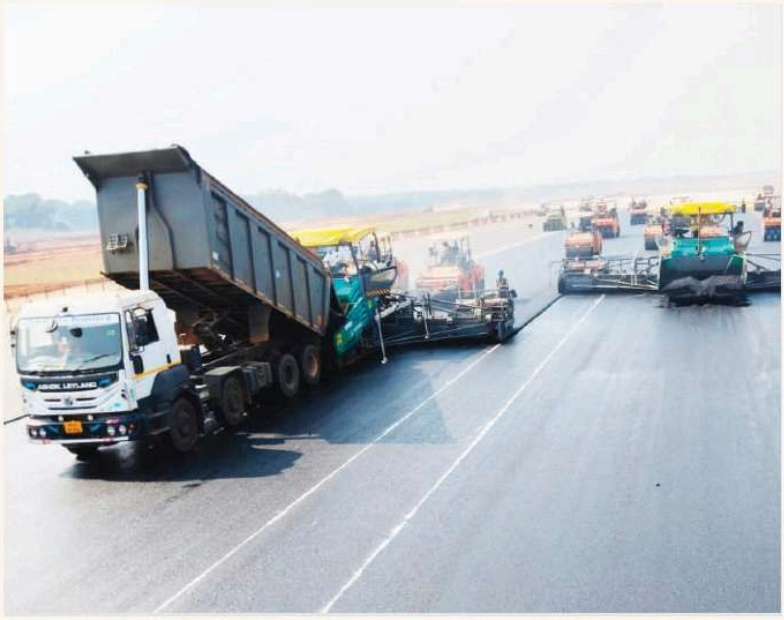
Tech, new materials, and RMC are powering road construction

"Sustainable road construction is about more than materials—it's about smarter design, predictive maintenance, and risk-sharing approaches that balance durability, user comfort, and environmental responsibility."

In this interaction, R.K. Bansal from L&T Construction delves into the key drivers of sustainable road construction, the role of technology in predictive road maintenance, and why RMC is redefining road construction in India.



What innovative construction techniques, practices, and materials are driving sustainable road construction in India?

To build sustainable roads in India, we focus on two key aspects: structural and functional. Structural sustainability is achieved by using durable and alternative materials and techniques to ensure that roads last longer. Functional sustainability, on the other hand, involves innovative practices to enhance user comfort. Beyond these, true sustainability also means balancing business goals with social responsibility—innovations that increase costs or deplete natural resources fall short.

R.K. Bansal
Executive Vice President & Head – Transportation Infrastructure, L&T Construction.

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Sustainable materials are currently on the rise in road construction, including polymers, waste plastic, and crumb rubber. On the technology and practices front, ground improvement methods are being used to strengthen existing soil, thereby reducing the need to haul suitable soil from far away. Stabilising existing asphalt, using cold mixes instead of hot mixes to lower the carbon footprint, and employing intelligent spreaders, pavers, and compactors to monitor quality during construction are gaining ground. Additionally, laser sensors, wider pavers, and paving in the echelon improve both road longevity and riding comfort for users.

Asphalt roads are prone to damage due to extreme heat, which can lead to cracks and accelerated deterioration. As a top player, what methodologies must be undertaken during construction to mitigate such challenges?

With rising temperatures due to global warming, asphalt roads face significant challenges, as pavement temperatures are consistently higher than that of the surrounding air. Bitumen, a key component in asphalt, softens under high heat; additionally, constant traffic loading causes the aggregate and bitumen mix to behave anomalously, which accelerates oxidation, leading to cracks and other forms of distress. To address these issues, we at L&T are adopting advanced techniques and modifiers to enhance the viscoelastic properties of asphalt, reduce its sensitivity to temperature changes, increase its softening point, and slow down the oxidation of bitumen. These measures help create more durable roads that can better withstand extreme heat and heavy use.

Can you throw some light on how technology is driving the construction and predictive maintenance of roads in India?

Technology is transforming road construction and maintenance in India, with predictive maintenance

being the cornerstone of sustainable infrastructure. The key to effective predictive maintenance lies in robust data collection and analysis. We use vehicles equipped with laser instruments and cameras to capture real-time data on road conditions at set intervals. By integrating this data with machine learning and AI, we can proactively identify potential issues and schedule maintenance before major damage occurs, ensuring longer-lasting roads and more cost-efficient upkeep.

How does India's diverse weather influence the choice of material for road construction?

Undoubtedly, it is our responsibility to conserve natural resources for future generations to use. Considering that India experiences various types of weather conditions, materials and technologies are chosen accordingly to ensure the longevity of roads; for example, emulsion technology for colder climes and modified bitumen for regions that experience hot and rainy climates.

Can self-healing roads spearhead the future of indian highways?

Self-healing asphalt is an asphalt mix produced by adding additives such as steel wool, bentonite powder, or bitumen solvent oils encapsulated in capsules. However, this technology is still in its nascent stage, and there is no proven record or demonstration yet of improvement in the structural performance of pavements, except for crack healing. Self-healing asphalt has limitations in terms of the width of the crack and the depth of its fill. It needs a source of either heat or water to activate itself. The deterioration of asphalt or a crack on pavements can be due to several reasons. Self-healing is superficial and will only work on the surface of the road, not addressing deep cracks. There is a need to study and research this subject more before Indian Highways can adopt it. Currently, there is no technological or commercial advantage to this technology.

How is RMC turning out to be a preferred choice in road construction compared to traditional methods?

Ready-mix concrete (RMC) is the preferred material in road construction due to its technical, economic, and operational advantages over traditional site-mixed concrete, which include superior quality and consistency (controlled production and consistent mix design), time and labour efficiency (faster construction and reduced manpower); environmental benefits (reduced waste and dust); and technical compatibility (high-performance mixes).

However, risk management is critical for sustainable construction and requires ongoing assessment and mitigation. The B2B model, like RMC supply, thrives on "risk sharing" between stakeholders. While the industry has adopted RMC for cement concrete, the use of hot and cold asphalt mixes as RMC remains underexplored and requires a deeper understanding. Asphalt mixes have more variables, including diverse ingredient sources, which complicate their fresh and hardened properties compared to cement concrete, often referred to as "artificial rock" for its rigid, hardened state. Asphalt, even when hardened, remains flexible, adding complexity. In contrast, certain developed countries and those in the Middle East have successfully adopted RMC for asphalt production by enforcing stringent specifications that tightly control the ingredients and mixing processes. There is a lot to explore in these practices to advance RMC asphalt applications further.