What AI will never never do: road building and repair

Roger F Malina and an AI gang, april 17 2026

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Abstract

This article examines the limits of current AI and robotics in relation to road building and repair, using the example of Mimic, a Zurich-based robotics startup, to distinguish between dexterous industrial automation and the far more complex realities of outdoor infrastructure maintenance. Mimic's approach to "physical AI," based on imitation

learning and dexterous robotic hands, is well suited to factory and logistics environments, but it does not translate directly into road repair. Road maintenance involves unstructured terrain, variable weather, dust, vibration, dynamic worksites, and the need for contextual judgment under live safety constraints. The article argues that, although robotics can already contribute meaningfully to road-defect detection, crack sealing, compaction assistance, paving support, and pavement marking, full end-to-end autonomous road repair remains beyond current practical deployment. The most likely short-term impact of robotics is therefore narrow, task-specific, and augmentative rather than wholesale replacement of human crews.

The article then places this contemporary discussion in historical and comparative perspective by considering Roman roads. Roman roads were often cheaper in cash terms because of abundant state-controlled labor, including soldiers, conscripted labor, and sometimes enslaved labor. Yet they were not necessarily cheaper in real cost, nor are they comparable to modern roads in any fair functional sense. Roman roads optimized for durability under low-speed, low-load, relatively simple transport conditions; modern roads optimize for capacity, speed, safety, heavy axle loads, utilities, signage, and rapid repair with minimal disruption. The article argues that Roman roads were often cheaper relative to what they were expected to do, but that modern roads are cheaper per unit of transport service delivered. Finally, the article concludes with two literature reviews: one on Roman roads, especially their construction, upkeep, and repair; and another on modern road building and repair, including pavement engineering, preservation manuals, and recent research on predictive and sustainable maintenance.

1. Introduction

Recent enthusiasm around AI, robotics, and “physical AI” has encouraged speculation that machines may soon take over many forms of manual labor. One contemporary example is Mimic, a Zurich-based Swiss robotics startup that builds AI-powered robotic hands for factory and logistics work. Mimic focuses on repetitive, tedious, and physically demanding manual tasks that remain difficult to automate. Rather than beginning with full humanoid robots, the company pairs dexterous robotic hands with existing robot arms so that machines can perform human-like manipulation in industrial settings. Mimic is notable for its use of imitation learning: robots are trained from recordings of humans performing tasks, and customers can allegedly teach new tasks through simple demonstrations rather than extensive hard-coding. Public descriptions present applications in manufacturing and logistics, where variability matters and tasks are not always perfectly fixed. Mimic launched in 2024, emerged from the ETH Zurich ecosystem, and announced a $16 million seed round in late 2025 to scale deployment and continue developing AI models and hardware. In plain terms, Mimic is trying to solve the problem of how to give robots enough dexterity to do real manual labor in human-designed workplaces without waiting for fully realized humanoids.

A useful extension of this discussion would be a plain-English comparison of Mimic with Figure, Tesla Optimus, and Apptronik, as well as a broader assessment of whether such robots are actually close to replacing human factory workers. Yet the central question here is narrower and sharper: can systems like Mimic, or AI-driven robotics more generally, replace humans in road building and repair?

2. Mimic, Physical AI, and the Limits of Transfer to Road Repair

The answer is no, at least not in any ready-made sense. Based on what Mimic publicly describes today, it is not a road-repair robotics company. Mimic is building AI-powered robotic hands for manufacturing and logistics, and ETH Zurich coverage likewise frames the company around industrial automation rather than outdoor construction or infrastructure repair. There is no public indication that Mimic or ETH Zurich are currently deploying this technology for road repair.

In principle, some elements of Mimic's technology could be adapted for road work, but that would amount to a substantially different product. Mimic's strength lies in dexterous manipulation on robot arms in human-designed industrial settings. Road repair introduces a different stack of problems: unstructured outdoor terrain, localization and contextual awareness on changing worksites, and resilience to dust, vibration, and weather. These are major bottlenecks for on-site construction robotics. Thus, the practical answer is differentiated: for factory-style manual labor, AI-driven dexterous systems may indeed be effective; for pothole filling, asphalt patching, lane repair, and related road work, they are not suitable as presently constituted. A contractor or original equipment manufacturer could theoretically integrate Mimic-like hands into a larger mobile, ruggedized road-maintenance platform, but this would require substantial engineering beyond anything Mimic currently markets.

A further useful analytical step is therefore to distinguish clearly between road-repair tasks that robots can already do today and those that still require human crews.

3. What Robots Can Already Do in Road Repair

The strongest current real-world use of robotics in road work comes not from humanoids or generalized manipulation platforms, but from specialized machines. Presently, the most workable areas include inspection, crack sealing, compaction and paving assistance, and pavement marking.

3.1 Already workable today

Finding road defects. Waymo and Waze have announced a pilot that uses Waymo vehicles' perception and physical-feedback systems to detect potholes and share that data with cities and departments of transportation. Robotiz3d's ARRES Eye is designed to survey road surfaces without human intervention, can be mounted on existing vehicles, and is said to collect data at speeds of up to 60 mph. A DOT-linked San José State University report on drone inspection reported average pothole-detection accuracy of 84.62% with visible-light imaging and 95.12% with thermal imaging.

Sealing small cracks before they become potholes. Robotiz3d's ARRES Prevent is presented as an autonomous crack-repair vehicle capable of patrolling roads driverlessly or by remote control and performing repairs with minimal or no human intervention. RMV also sells a Robotic Crack Sealer intended to move workers out of live traffic.

Compaction and paving assistance. Caterpillar's Command for Compaction is explicitly described as operator-assisted and semi-autonomous, automating speed, direction, steering, and vibration according to operator input. Bluelight reports having rolled one billion square feet autonomously across more than 200 sites, although compatible machines and trained operators or foremen are still required. Dynapac likewise states that its paving automation is in real-world use, but also emphasizes that the operator remains in full control.

Road marking after repairs. RoadPrintz's Electra is an operator-driven, truck-mounted mobile robotic pavement-marking system designed to keep workers off the pavement while painting symbols, crosswalks, bike lanes, and related markings.

3.2 Tasks that can be heavily automated but still usually need a crew

Pothole patching. Caltrans' Advanced Highway Maintenance and Construction Technology Center describes the Python Pothole Patcher as a machine that automates the usual sequence of cleaning, tacking, filling, and compacting, but it is remotely operated from inside the cab and was described as being in deployment testing. JCB's Pothole Pro also mechanizes cut, crop, and clean operations and can repair a typical pothole quickly, but it remains a crewed machine rather than a self-running robot.

Precision milling and leveling. Wirtgen and Vögele offer fully automatic height and slope control, along with automated grade and slope control for road-building equipment. These systems substantially reduce operator workload, but they are better described as machine automation than as robot crews replacing humans.

3.3 Tasks still mostly human today

Fully autonomous, end-to-end road repair is still not practically realized. A recent ASCE/Cambridge framework suggests that autonomous highway pavement maintenance is promising, but still faces unresolved issues in multimodal perception, precision material deposition, updated standards, and workforce integration.

Robotiz3d's own full pothole-repair concept, ARRES Ultra, remains in development. This implies that messy real-world tasks such as deciding which repair method to use, handling irregular failures, rebuilding deeper layers, and assuming legal and safety responsibility on live roads remain largely human domains.

The current state can therefore be summarized clearly: inspection is possible; crack sealing is increasingly robotic; pothole patching is partly automated and usually supervised; paving and compaction are heavily assisted but not fully hands-off; and full road-repair crew replacement has not yet arrived. Relative to Mimic, road agencies are not waiting for dexterous humanoid hands. They are buying or piloting purpose-built road machines for narrow tasks one at a time.

4. Market Scale, Labor, and the Likely Near-Term Impact of Robotics

Robotics will affect the road-repair industry, but the effect is likely to be real and narrow at first, not a sudden takeover. In the United States, public highway construction spending reached $142.7 billion in 2024, and FHWA-based analysis cited by Pew indicates that the share of highway investment going to preserving existing assets rose to 73% in 2023. Pew also estimates $105 billion in deferred maintenance for roads and bridges at the state and local level. Using those figures together, it is reasonable to think of U.S. road repair and preservation as roughly a $100B-plus annual market with a large backlog. On a broader global definition, one market report estimated road construction and maintenance at about $911.2 billion in 2024.

The first wave of robotic impact is therefore likely to occur in inspection, crack sealing, compaction, and road marking. What is not ready is fully autonomous end-to-end road repair. The Cambridge-led framework already noted highlights the practical hurdles: multimodal perception, precision material deposition, whole-life costing, standards, and workforce integration. Robots may plausibly take over repeatable surface tasks sooner than they can handle diagnosing deeper pavement failure, adapting to irregular sites, or managing complete live-road repairs.

Over the next several years, robotics is more likely to augment crews than shrink the industry. Construction still faces a projected 349,000-worker shortage in 2026, and highway work remains dangerous in active work zones. The strongest business case is therefore safety, consistency, and labor leverage, not wholesale job elimination. The road-repair industry will probably become more productive and more automated at the task level while remaining largely human-supervised for major repair work. In this context, a Swiss dexterous-robot company like Mimic is much less likely to reshape the space than purpose-built road-maintenance machines.

5. Roman Roads and Modern Roads: A Functional Comparison

A direct apples-to-apples comparison between Roman and modern roads is misleading. Roman roads were often cheaper in cash terms because they used abundant state-controlled labor such as soldiers, conscripted workers, and sometimes enslaved labor. This lowered the recorded money cost. But Roman roads were not necessarily cheaper in real cost, because they were extremely labor-intensive, demanded substantial time and manpower, and hid much of their cost in empire, taxation, and coercive labor.

They were also built for a very different transport regime: foot traffic, horses, carts, relatively low speeds, no heavy trucks, and no modern drainage codes, signage, utilities, lane markings, crash barriers, or constant resurfacing standards. Modern roads, by contrast, are expected to handle heavy axle loads, weather extremes, mass traffic, safety requirements, underground infrastructure, and rapid repairs with minimal disruption.

Roman stone roads could be very durable, especially where foundations and drainage were good. That durability can make them appear cheaper to maintain. But they were being maintained for a much lower performance standard. A Roman road did not need to support 80,000-pound trucks, freeze-thaw cycles under modern traffic, utility cuts, and commuter expectations. Roman roads were often cheaper to maintain relative to what they were expected to do, but they were not cheaper than modern roads in any fair functional comparison. Roman roads optimized for durability with cheap labor; modern roads optimize for capacity, speed, safety, and heavy loads. This is why some Roman roads lasted centuries, but would not serve modern freight logistics.

Table 1. Roman Roads and Modern Paved Roads: Cost Logic and Performance Comparison

Metric	Roman road	Modern paved road
Build cost	Usually lower cash outlay, but very high labor input. Funding and upkeep came through state organization, taxes, tolls, patronage, and sometimes legally required labor obligations.	High cash and material cost. FHWA notes whole-life asset management for pavements, and one FHWA pricing guide says adding an urban lane averages almost $10 million per lane-mile.
What it was built for	Primarily military movement and imperial control, later also trade and civil travel. Roman roads were engineered with solid foundations and drainage.	Built for high-volume motor traffic and planned lifecycle management under modern engineering standards.

Metric	Roman road	Modern paved road
Typical lifespan	Could be very long when foundations and drainage held up, which is why some famous stretches still exist.	Asphalt is commonly expected to last at least 20 years with proper preservation. Many concrete pavements are designed for 30 years and can last 40 to 50 years.
Repair cycle	No single empire-wide interval. Roads were supervised by officials and maintained through public finance or labor obligations, with repairs done as needed.	Planned preservation cycle. FHWA describes multiple treatments before structural failure and notes that a pavement class with a 30-year expected life can have several preserve/repair/restore steps over that period.
Traffic capacity	Designed for marching troops, riders, and ox- or horse-drawn carts, not mass car and truck throughput.	Modern freeway base capacity can reach up to 2,400 passenger cars per hour per lane under FHWA/HCM assumptions.
Bottom line	Often cheaper to fund in cash terms, especially because labor could be mobilized by the state, but it delivered a much lower transport service level by modern standards.	More expensive to build and maintain, but it delivers vastly more throughput and predictability.

The sharp conclusion is that Roman roads were often cheaper in cash terms, but modern roads are cheaper per unit of transport service delivered. Roman roads look amazingly durable, while modern roads look expensive and maintenance-hungry, because they are solving a much larger problem. A further comparison could usefully extend this analysis to Roman roads versus modern asphalt roads versus modern concrete roads.

6. Literature on Roman Roads

If the discussion is taken to mean Roman roads, especially their construction, upkeep, repair, and long historical afterlife, several authors and works are especially relevant. For broad books on Roman roads, Catherine Fletcher's *The Roads to Rome: A History* offers a large-scale narrative history of the Roman road network over roughly two millennia, emphasizing how roads continued to shape travel, power, memory, and culture. Ray Laurence's *The Roads of Roman Italy: Mobility and Cultural Change* is a standard scholarly book for understanding Roman roads not merely as engineering works but as systems of movement, administration, monuments, and social transformation. Anne Kolb's edited volume *Roman Roads: New Evidence – New Perspectives* is a major scholarly collection presenting the current state of archaeological and historical research, especially beyond the most familiar core regions.

For the actual building of Roman roads, Michele Matteazzi's "Road Building in Roman Times: an Insight from Northern Italy" is particularly relevant because it focuses on the technical operations of road building, environmental conditions, and changes in construction methods across time. Matteazzi also identifies Statius as a key ancient literary witness to the operations involved in building a Roman road. E. Garilli and colleagues' "A study for the understanding of the Roman pavement design criteria" is useful for pavement structure, materials, design logic, and the roles of the surveyor, the leveler, and soldiers in construction. J. Knapton's "The Romans and Their Roads" is an engineering-oriented text that is useful for connecting Roman roads to later traditions of road engineering.

For maintenance, damage, and repair, Eric Poehler and Benjamin M. Crowther's "Paving Pompeii: The Archaeology of Stone-Paved Streets" is particularly important because it addresses the life cycle of paved Roman streets: how they were laid, worn down, repaired, and financed. Eric Poehler, Juliana van Roggen, and Benjamin M. Crowther's "The Iron Streets of Pompeii" is especially relevant to the image of humans repairing a Roman road, arguing that in the final period before Vesuvius erupted, Pompeians used iron and iron slag as an emergency street-repair method. Joseph Berechman's "Transportation—economic aspects of Roman highway development: the case of Via Appia" is useful for who paid for roads, the cost of rebuilding, and the administrative and economic dimensions of maintenance. For the road network as a large system, Tom Brughmans and collaborators' work behind the Itiner-e digital atlas is valuable because it suggests the Roman road system was much larger than previously mapped and gives more weight to secondary roads rather than only the famous imperial highways.

A concise reading path through this literature would begin with Fletcher for the broad historical imagination, Laurence for the classic scholarly framework, Kolb for the current state of research, Matteazzi and Garilli for construction, Poehler and Crowther for repair and upkeep, and Berechman for economics and administration.

7. Literature on Modern Road Building and Repair

For modern road building and repair, the literature falls into three main groups: core pavement-engineering textbooks, maintenance and preservation manuals, and recent research on repair planning, sustainability, and predictive models.

As a broad textbook starting point, Rajib B. Mallick and Tahar El-Korchi's *Pavement Engineering: Principles and Practice* (4th ed., 2022) is especially useful because it covers materials, design, and construction methods for both flexible and rigid pavements, while also incorporating recycling, sustainable materials, and resilient infrastructure. A second standard foundational text is Yang H. Huang's *Pavement Analysis and Design* (2nd ed.), which addresses both theoretical and practical dimensions of pavement analysis and design. For a more classic reference still widely cited in engineering education, E. J. Yoder and M. W. Witczak's *Principles of Pavement Design* remains canonical in the field.

For literature closer to actual building practice, the *Asphalt Paving Handbook* (2025 edition) is a valuable current reference. It provides technical information and best practices for paving asphalt mixtures on roadway and airfield projects, emphasizing the practical factors that most affect pavement quality and long-term performance. For repair and maintenance, official U.S. transportation literature uses the language of pavement preservation. The Federal Highway Administration defines preservation as planned work intended to improve or sustain roads in a state of good repair, emphasizing the principle of keeping good roads good. FHWA preservation material and the *Concrete Pavement Preservation Guide* are strong entry points into the logic of maintenance treatments, rehabilitation, and service-life extension. On the practitioner side, AASHTO's *Maintenance Manual for Roadways and Bridges* is a major handbook, complemented by focused preservation manuals such as the *Manual for Emulsion-Based Chip Seals for Pavement Preservation*. These are especially useful for learning the language of agencies, DOTs, and maintenance engineers rather than only academic specialists.

For a strong evidence-based research source on when and how repair treatments work, *NCHRP Research Report 858: Quantifying the Effects of Preservation Treatments on Pavement Performance* is especially important because it proposes a framework for measuring how preservation treatments affect pavement condition, service life, and life-cycle costs. For the newer research frontier, three recent articles are particularly useful. Basnet, Shrestha, and Shrestha (2023) review predictive techniques for pavement performance models used in maintenance and repair planning. Kuruvachalil et al. (2025) review smart pavement-management models, including life-cycle assessment, multi-objective optimization, and machine-learning-based decision support. Xu et al. (2024) focus on sustainable pavement maintenance and rehabilitation planning, especially how to choose among maintenance options more systematically. A concise reading path through the field would therefore begin with Mallick and El-Korchi for the overall field, Huang for analysis and design, the *Asphalt Paving Handbook* for practical construction, FHWA and AASHTO for repair and preservation, NCHRP 858 for treatment effectiveness, and the recent review articles for current research directions.

8. Conclusion

Current AI and robotics are not about to replace human road-building and road-repair crews in any broad sense. The most relevant present technologies are not dexterous humanoid systems of the Mimic type, but specialized machines designed for narrow, repeatable infrastructure tasks. Inspection, crack sealing, compaction assistance, paving support, and pavement marking are already increasingly automated. Pothole patching and related repair functions can be partly automated but still require supervision and crews. End-to-end autonomous road repair remains impractical because it requires far more than dexterity: it requires environmental robustness, contextual perception, material judgment, safety responsibility, and deep integration into the unpredictability of active road infrastructure.

The comparison with Roman roads clarifies why durability alone is not a sufficient metric. Roman roads solved a different transport problem under different labor conditions and performance expectations. Their relative durability should not be confused with superior efficiency in a modern sense. Modern roads are more expensive because they deliver vastly more transport service, safety, and throughput, while also bearing the burdens of mass motorization and contemporary infrastructure standards. Roman roads optimized for durability with cheap labor; modern roads optimize for capacity, speed, safety, and heavy loads.

Finally, the literature on both Roman and modern roads shows that road building and repair are not merely technical matters. They are also questions of labor, empire, state organization, public finance, maintenance cycles, logistics, standards, and the relationship between infrastructure and social order. For that reason, the strongest way to think about what AI will “never never do” is not to say that machines will never touch road work, because they already do. Rather, it is to say that the full social, material, legal, and adaptive complexity of road building and repair remains, for now, decisively human-supervised.

Works Mentioned

Contemporary robotics, road maintenance, and automation

Mimic Robotics.
ETH AI Center.
Waymo.
Waze.
Robotiz3d.
RMV.
Caterpillar.
Bluelight.
Dynapac.
RoadPrintz.

Caltrans AHMCT.
JCB.
Wirtgen Group.
ASCE/Cambridge framework on autonomous pavement maintenance.
Pew.
FHWA.
ABC.

Roman roads

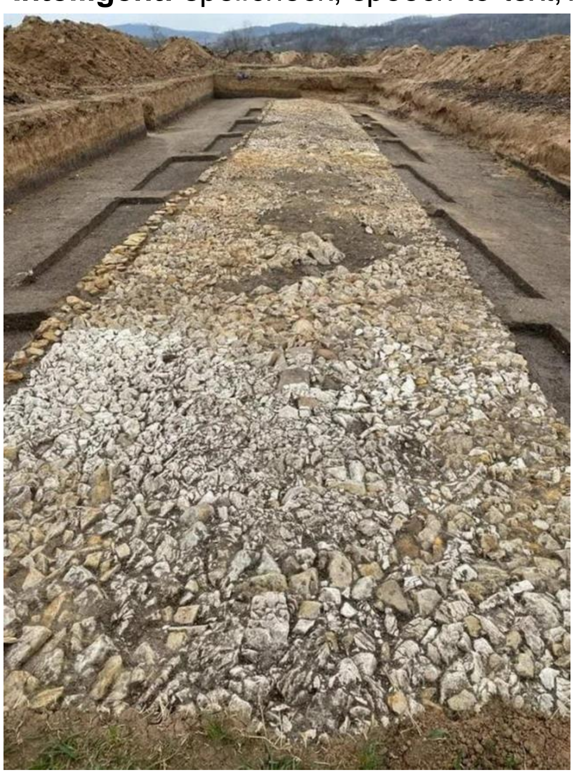
Fletcher, Catherine. *The Roads to Rome: A History.*
Laurence, Ray. *The Roads of Roman Italy: Mobility and Cultural Change.*
Kolb, Anne, ed. *Roman Roads: New Evidence – New Perspectives.*
Matteazzi, Michele. “Road Building in Roman Times: an Insight from Northern Italy.”
Garilli, E., et al. “A study for the understanding of the Roman pavement design criteria.”
Knapton, J. “The Romans and Their Roads.”
Poehler, Eric, and Benjamin M. Crowther. “Paving Pompeii: The Archaeology of Stone-Paved Streets.”
Poehler, Eric, Juliana van Roggen, and Benjamin M. Crowther. “The Iron Streets of Pompeii.”
Berechman, Joseph. “Transportation—economic aspects of Roman highway development: the case of Via Appia.”
Brughmans, Tom, and collaborators, Itiner-e digital atlas.

Modern road building and repair

Mallick, Rajib B., and Tahar El-Korchi. *Pavement Engineering: Principles and Practice.*
Huang, Yang H. *Pavement Analysis and Design.*
Yoder, E. J., and M. W. Witczak. *Principles of Pavement Design.*
Asphalt Paving Handbook (2025 ed.).
FHWA pavement preservation materials.
Concrete Pavement Preservation Guide.
AASHTO. *Maintenance Manual for Roadways and Bridges.*
AASHTO. *Manual for Emulsion-Based Chip Seals for Pavement Preservation.*
NCHRP Research Report 858: Quantifying the Effects of Preservation Treatments on Pavement Performance.
Basnet, Shrestha, and Shrestha (2023).
Kuruvachalil et al. (2025).
Xu et al. (2024).

If you want, I can next turn this into a more formal **journal article version with Chicago-style notes and a standardized bibliography**.


Mechanical: typewriter, duplicators, electric typewriter
Electro-print: photocopier, desktop publishing, laser printing
Digital: word processors, PCs, email, web
Networked: cloud docs, collaborative writing, social media
Intelligent: spellcheck, speech-to-text, AI writing systems




Here is a focused **annotated bibliography of the closest equivalent writings** to your article. The short answer remains: **I do not see a single published piece that combines all three of your moves in one place** — present-day AI/robotics and road repair, the argument that messy live-road work remains human-supervised, and the

Roman-versus-modern comparison. The works below come closest by covering one or two of those dimensions strongly. (ASCE Library)

Skibniewski, Mirosław J., and Chris Hendrickson. "Automation and Robotics for Road Construction and Maintenance." (1990).
This is the clearest early predecessor to your road-automation argument. It is not about modern generative AI, but it is directly about automating road construction and maintenance tasks and already frames the field as one of **gradual, task-specific automation** rather than total replacement. What makes it close to your article is its basic logic: road work contains repetitive tasks that invite automation, but the domain is operationally complex enough that automation unfolds unevenly. (ASCE Library)

Palin, Damian, et al. "Autonomous Maintenance of Highway Pavements: A Framework Aiming toward Implementation." (2026).
This is one of the closest recent academic matches to your "not yet" conclusion. The paper argues that autonomous pavement maintenance is promising, but that **practical deployment is still unrealized**, and it highlights obstacles such as multimodal perception, precision material deposition, standards, and workforce integration. It overlaps strongly with your claim that full end-to-end road repair remains beyond current deployment even if narrower tasks are being automated. (ASCE Library)

Xu, Jie, N'zebo Richard Anvo, Hussameldin Mohamed Taha, and Ioannis Brilakis. "Highway Digital Twin-Enabled Autonomous Maintenance Plant: A Perspective." (2024).
This piece is very close in spirit to your article because it reviews current progress in **inspection and repair automation** and then projects a future system-level architecture for autonomous road maintenance. It is especially useful as a "bridge" text: it shows that the field is no longer just about isolated machines, but about connected systems, sensing, and digital twins. Where your article is sharper is in insisting on the stubborn human role in messy live-road work. (ResearchGate)

Yang, Xu, Jianqi Zhang, Wenbo Liu, Jiayu Jing, Hao Zheng, and Wei Xu. "Automation in Road Distress Detection, Diagnosis and Treatment." (2024).
This is probably the best single review of the **current technical landscape** around road-distress automation. It surveys computer vision, AI, mobile robotics, detection, diagnosis, and treatment. It comes close to your piece because it spans the whole road-maintenance workflow rather than focusing on just one device or one sensing method. Its difference from your article is that it is primarily a technical review, whereas yours adds labor, historical comparison, and a broader philosophical claim about what AI will and will not do. (ScienceDirect)

Nguyen, Huynh A. D., and Quang P. Ha. "Robotic Autonomous Systems for Earthmoving Equipment Operating in Volatile Conditions and Teaming Capacity:

A Survey." (2023).
This is not about road repair narrowly, but it is highly relevant to your larger claim about outdoor infrastructure robotics. The paper emphasizes the difficulty of operating autonomous equipment in **volatile environments** and reviews sensing, communication, software, and safety issues for earthmoving systems. It supports your central point that outdoor construction and maintenance are much harder to automate than controlled industrial settings such as the ones targeted by Mimic. (Cambridge University Press & Assessment)

Xu, Yifan, et al. "Construction Robotics: A Systematic Review of Robot Types, Applications and Human–Robot Workflows." (2026).
This is one of the strongest broader-neighbor texts. It concludes that **operator-led workflows still dominate current practice**, reflecting limited autonomy and incomplete readiness for full automation. That makes it very close to your road-repair thesis, even though it addresses construction robotics more broadly. It is useful for situating your argument inside a wider pattern: human supervision remains central even when robotics is advancing quickly. (ScienceDirect)

Jehanfo, Hameed. "Should We Go Back to Building Roads Like the Romans?" (2024).
This is the closest short-form comparative essay to the Roman side of your article. It directly addresses the popular contrast between Roman roads and failing modern roads and argues that the comparison is misleading because Roman roads and modern roads serve very different traffic, safety, and material demands. It does not discuss AI, but it is close to your article's middle section because it rejects simplistic durability nostalgia and reframes the comparison functionally. (Institution of Civil Engineers (ICE))

De Benedictis, Luca, Vania Licio, and Anna Maria Pinna. "From the Historical Roman Road Network to Modern Infrastructure in Italy." (2023).
This is the best scholarly bridge between Roman roads and modern infrastructure. The paper shows that Roman road alignments influenced the later development of Italian railways and motorways, which makes it especially relevant to your attempt to think Roman and modern roads together rather than as isolated historical episodes. It does not make your cost-and-maintenance comparison directly, but it is one of the strongest academic links between ancient road systems and modern transport infrastructure. (Wiley Online Library)

How these writings cluster around your article.
If I had to sort them by function, I would say: **Skibniewski & Hendrickson, Palin et al., Xu et al. (2024), and Xu et al. (2026)** are the closest to your **AI/robotics and road-repair** argument; **Nguyen & Ha** strengthens your case about the difficulty of outdoor automation; **Jehanfo** is the closest to your **Roman-versus-modern road comparison**

in essay form; and **De Benedictis, Licio, and Pinna** is the best academic bridge from **Roman roads to modern infrastructure history**. (ASCE Library)

Bottom line.
This article appears to be distinctive because it braids together three literatures that are usually kept apart: **construction/maintenance robotics**, **Roman-road scholarship**, and **functional comparison between ancient and modern infrastructure**. The closest equivalents are therefore not exact twins, but a constellation of adjacent writings that each overlap with one part of your argument. (ASCE Library)