ITS AMERICA

AI APPLICATIONS FOR TRANSPORTATION OPERATIONS AND ASSET MANAGEMENT:

A PRACTICAL GUIDE FOR DECISION-MAKERS

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AI APPLICATIONS FOR TRANSPORTATION OPERATIONS AND ASSET MANAGEMENT: A PRACTICAL GUIDE FOR DECISION-MAKERS

THIS GUIDE WAS DEVELOPED BY THE ITS AMERICA ARTIFICIAL INTELLIGENCE COMMITTEE.

Artificial Intelligence (AI) is poised to transform transportation systems, from improving traffic safety to optimizing infrastructure maintenance, system planning, emergency response, and more. This AI Application Fact Sheet builds on ITS America's foundational work, including our AI Policy Principles, AI Decoded Guide, and Blueprint for Transportation Technology. These resources collectively outline the principles, technical foundations, and strategic imperatives for AI in transportation. This Application Guide serves as a practical entry point, connecting readers to deeper guidance on governance, implementation, and workforce readiness provided in the AI Implementation Guide.

In an evolving field where definitions vary, this document establishes a baseline of key concepts and use cases for AI in transportation operations and asset management. **This document is intended to support informed decision-making, spark innovation, and facilitate the responsible and effective adoption of AI technologies.** Readers are encouraged to use this guide as a practical resource for understanding key concepts, challenges, and solutions related to AI in transportation. Importantly, this document is not exhaustive and does not cover every possible AI application in transportation operations and asset management, but rather highlights significant examples and emerging trends.

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ARTIFICIAL INTELLIGENCE IN TRANSPORTATION

The transportation sector is undergoing a profound transformation driven by artificial intelligence (AI), digital infrastructure, and emerging technologies. **These innovations promise to improve safety, efficiency, and economic growth** across our mobility networks. However, realizing these benefits requires more than technological capability. **It demands modernized procurement frameworks, robust data governance, and collaborative partnerships between public agencies and private innovators.**

There is no single, absolute definition of "artificial intelligence," but the Federal Highway Administration (FHWA) defines AI as *"the branch of computer science involved with building smart machines capable of performing tasks that typically require human intelligence. AI includes a range of techniques such as machine learning and deep learning."*[1] In the transportation context, this encapsulates algorithms and systems that can learn from data, make decisions, and perform tasks such as predicting traffic incidents or optimizing traffic signal timing, with minimal human intervention. **By leveraging such technologies, public agencies can achieve safer, more efficient, and more reliable transportation networks.**

ITS America has developed a suite of resources to support this transition, including AI Decoded and the Impact of AI on Transportation and Mobility report, which outlines responsible AI deployment strategies, and the Privacy Principles framework, which ensures data protection and public trust. Complementing these are practical tools like the joint ITSA-NEMA ITS Procurement Solutions for Modern Transportation Technologies White Paper and the Emerging Technology Procurement Webinar Series, which provide actionable guidance for agencies navigating complex procurement requirements and integrating flexible, outcomes-based contracting models. Together, **these resources offer a roadmap for deploying AI** and other advanced technologies in a way that is ethical, efficient, and future-ready.

[1]Predictive Analytics for Traffic Management Systems. (April 2024). https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-24-091.pdf

GUIDE OVERVIEW

The guide surveys several major AI application areas in transportation operations and asset management, spanning topics such as predictive infrastructure maintenance, traffic operations management, emergency response, and more. It begins by exploring shared considerations, challenges, and solutions to applying AI across all applications. For each application area, this document lays out a common set of components to give readers both strategic context and practical insight into implementation.

Specifically, each section explores:

☑ WHY IT MATTERS

the significance of the application and the benefits or value it can deliver for transportation (e.g. saving lives, reducing costs, improving mobility).

☑ KEY CHALLENGES

major hurdles in deploying the application, such as data integration difficulties, privacy and security concerns, technical limitations, or organizational barriers.

☑ IMPLEMENTATION CONSIDERATIONS

the “behind-the-scenes” inputs and requirements needed to put the AI solution into practice. This includes data needs and sources, data collection and management strategies, computing infrastructure, model maturity and validation, and governance or policy considerations that agencies should address.

☑ REAL-WORLD USE CASES

brief case studies or examples that highlight how the application is being used in practice today. These examples illustrate what implementation looks like on the ground and help to connect the concepts to tangible outcomes.

☑ FUTURE TRENDS

emerging developments and innovations that are shaping the future of that application (e.g. new sensor technologies, advances in machine learning techniques, or evolving regulatory frameworks).

HOW TO USE THIS GUIDE

This guide is a practical reference for decision-makers, practitioners, and stakeholders applying AI in transportation operations and asset management. It offers foundational knowledge, strategic opportunities, and highlights implementation challenges, with frameworks for evaluating projects, informing policy, and guiding investments—addressing data, infrastructure, and workforce needs.

Transportation agencies can use this guide as a readiness checklist, to compare use cases, and foster collaboration. Educators and industry partners may leverage it for training and stakeholder engagement, ensuring consistent understanding of AI initiatives.

The applications covered here are not exhaustive; AI continues to evolve, and new high-impact uses will emerge. This guide provides a foundation for exploring future AI applications while emphasizing the principles outlined throughout each section.

SHARED CONSIDERATIONS FOR AI APPLICATIONS

DIGITAL INFRASTRUCTURE – A TECHNICAL BACKBONE FOR AI

As agencies navigate these strategic and operational considerations, it is important to consider the role of transportation digital infrastructure (TDI) as a critical enabler for realizing the potential of AI in transportation.

Effective AI in transportation relies on strong digital infrastructure – the public and private technology assets that create, exchange, or utilize data to deliver information and insights for transportation systems that enhance safety, security, efficiency, and economic growth.

This includes all components supporting physical systems: sensing, automation, networking, data management, and control.

These enable the high-volume, real-time data processing that AI systems need. Digital infrastructure provides data to AI, which in turn optimizes data flow, processes and analyzes the data, and produces key insights and answers that can help practitioners make their transportation system safer and more efficient.

Agencies that invest in TDI are better positioned to deploy AI solutions that reduce crashes, optimize traffic flow, and respond to emergencies in real time.

Without robust TDI, agencies cannot fully leverage AI's potential for safety, efficiency, and economic growth.

For agencies seeking practical steps, ITS America's Blueprint for Transportation Technology serves as a foundational guide for the use of technology across the country that will improve the safety and efficiency of our transportation and infrastructure. Additionally, ITS America's AI Implementation Guide provides a step-by-step approach for agencies to assess and upgrade their digital infrastructure, ensuring readiness for AI deployment, offering a maturity model and ten-point action plan to help agencies benchmark their current capabilities and prioritize next steps for AI investment.

Additional resources, such as the ITS Procurement Solutions for Modern Transportation Technologies White Paper, developed in collaboration with NEMA, and Emerging Technology Procurement Webinar Series, provide guidance on overcoming common barriers to AI adoption.

ITS America continues to convene stakeholders, advocate for dedicated funding, and develop tools that help agencies transition from legacy analog systems to future-ready TDI deployments. Our ongoing work ensures that agencies are not only aware of TDI's importance but are equipped wih the knowledge, resources, and public support to implement meaningful change.

KEY CHALLENGES & EMERGING SOLUTIONS

Deploying AI-ready digital infrastructure is challenging. Agencies must handle huge amounts of data from Internet of Things (IoT) applications (a network of physical devices, vehicles, appliances, and other physical objects that are embedded with sensors, software, and network connectivity, allowing them to collect and share data) and vehicles, ensure robust cybersecurity, and maintain compatibility with legacy systems. Legal and ethical issues arise, such as accountability when AI controls signals. Edge computing is a promising solution, enabling local, rapid AI processing that enhances safety and responsiveness. Careful planning is needed to modernize infrastructure while managing risks like data overload, energy grid management, and cyber threats. These challenges echo themes from ITS America's AI Roundtable Takeaways, which emphasize transparency, cybersecurity, and workforce development as prerequisites for successful AI adoption.

ITS America's AI Implementation Guide is designed to address many of these challenges, offering clear steps to help transportation organizations implement AI effectively.

[2] Atkinson, C., Choi, T., Sabol, P., Flynn, D., Hicks, J., Englin, E., Drake, J., & Rittmuller, R. (2024). Summary of RFI Responses - Opportunities and Challenges of Artificial Intelligence (AI) in Transportation. In https://www.transportation.gov/f (pp. 1–35). U.S. Department of Transportation Volpe Center. https://www.transportation.gov/sites/dot.gov/files/2024-12/ARPA-I%20Summary%20Report%20on%20AI%20RFI%202024-12%20%28Final%29_1.pdf

It highlights the need for coordinated processes, people, technology, and data, stressing strategic alignment and public trust. The Implementation guide also underscores the importance of meeting ethical, cybersecurity, privacy, and regulatory standards to ensure AI solutions are safe, efficient, and resilient.

POLICY AND FUNDING

Deploying AI solutions in transportation faces significant funding challenges across federal, state, and local levels. At the federal level, agencies should demonstrate clear return on investment and compliance with evolving data governance and cybersecurity standards, which can be difficult given the rapid pace of technological change. Depending on the solution, state agencies may encounter substantial upfront costs for technology integration and workforce training, while navigating unique procurement rules and legacy system compatibility requirements that vary from state to state.

Local governments may face challenges with coordinating multi-contractor projects and standardizing data formats, potentially complicating collaborative funding models and limiting access to scalable platforms and advanced analytics. To address these challenges, agencies should consider cross-jurisdictional partnerships and pursue significant knowledge transfer and workforce development activities.

Federal leadership is critical to scaling AI and digital infrastructure across the transportation network. ITS America's Surface Transportation Reauthorization recommendations propose dedicated formula funding for technology deployment, streamlined procurement guidance, and incentives for innovative contracting methods.

By embedding technology considerations into planning processes and grant programs, Congress and USDOT can accelerate modernization efforts while promoting interoperability and resilience. These policy updates will enable agencies to deploy AI-driven solutions that improve safety, reduce congestion, and enhance economic competitiveness.

Furthermore, agencies need multi-year certainty from the federal government when it comes to deploying technology solutions. If a state or local government does not know if future funding will be available for AI deployments in their transportation network, they may not invest and risk further falling behind technological advancements and roadway safety goals.

[3] IBM. (2023, May 12). What is the Internet of Things (IoT)? IBM; IBM. https://www.ibm.com/think/topics/internet-of-things
[4] The Impact of AI on Transportation and Mobility. (n.d.). ITS America and Cambridge Consultants. https://itsa.org/wp-content/uploads/2023/12/Lit-R-018-v0.3-2023-ITSA-AI-report.pdf
[5] Writer, A. S. (2025, June 12). *Low-Latency AI: How Edge Computing is Redefining Real-Time Analytics*. AiThority. https://aithority.com/machine-learning/low-latency-ai-how-edge-computing-is-redefining-real-time-analytics/

This is why predictable formula-based funding for technology in transportation is critical to ensuring a pipeline of projects that utilize the most innovative AI technologies. ITS America's 2026 Surface Transportation Reauthorization Policy Principles call for dedicated formula funding for digital technologies, including AI, so that they can be scaled beyond limited pilot projects and to establish a technology baseline across the country's transportation agencies.

PROCUREMENT

Procuring AI solutions for transportation presents a complex set of challenges for agencies and industry partners alike. Agencies often navigate procurement rules which are not meant for technology or software-based products, which can slow the acquisition of off-the-shelf and custom AI solutions, especially when integrating with legacy systems and ensuring compliance with cybersecurity protocols.

From the industry perspective, vendors could face hurdles in meeting agency-specific requirements for data governance, interoperability, and transparency, while also navigating different procurement rules that may vary from jurisdiction to jurisdiction. These challenges are compounded by the rapid evolution of AI technologies and the necessity for ongoing staff training and workflow adaptation. To overcome procurement barriers, agencies and industry should prioritize flexible, outcomes-based procurement options, clear standards, close collaboration throughout the project lifecycle, and streamline procurement processes to support innovative technology products, interoperability, and timely deployment of AI solutions.

[6] ITS America Procurement with Purpose Webinar Series: Rethinking Procurement; Building the Framework; Scaling Success

Procuring AI and technology solutions for transportation requires a departure from traditional, specification-heavy contracting models. ITS Procurement Solutions for Modern Transportation Technologies White Paper and Emerging Technology Procurement Webinar Series, advocate for outcomes-based procurement, which uses measurable performance indicators such as safety improvements, interoperability, and lifecycle efficiency to allow agencies to meet their goals. This approach empowers agencies to leverage private-sector innovation while maintaining accountability and cost control.

Practical strategies include embedding cybersecurity and interoperability standards (e.g., NEMA TS 40008) into RFPs, adopting flexible funding structures for subscription-based services, and fostering continuous public-private collaboration throughout the project lifecycle.

Together, these resources equip agencies and industry partners with actionable strategies to overcome procurement barriers and accelerate the deployment of AI-enabled transportation solutions.

PRIVACY AND DATA GOVERNANCE

As AI and connected technologies proliferate, safeguarding data privacy is essential to maintain public trust and regulatory compliance. ITS America's Privacy Principles provide a framework for protecting personal information, promoting transparency, and embedding ethical data practices into technology deployments.

Agencies should implement robust governance structures, consent management systems, and privacy-by-design approaches to ensure that data collection and use align with stated objectives. These measures not only mitigate risk but also foster interoperability and consumer confidence in emerging transportation solutions.

WORKFORCE DEVELOPMENT AND AI READINESS

The successful deployment of AI and digital infrastructure hinges on a skilled workforce capable of managing complex technologies. ITS America's policy recommendations call for expanded investment in workforce development programs, including training in AI, cybersecurity, and systems engineering. Agencies should partner with academic institutions, industry, and federal programs to close skills gaps and create certification pathways for intelligent transportation systems professionals. These efforts will ensure that the transportation workforce is prepared to implement and maintain advanced technologies at scale.

ITS America's dedicated webinar on Early Workforce Impacts of AI to ITS explores the need to prepare the ITS workforce for the integration of Artificial Intelligence. Industry experts provide insights into emerging skill requirements, strategies for upskilling, and practical steps agencies can take to prepare for AI-driven transformation.

CHALLENGES ACROSS AI APPLICATIONS

Each AI application within this factsheet can encounter common challenges, such as data integration, cybersecurity, and compatibility with legacy systems. The specific impact and complexity of these challenges can vary based on the context and type of application, which is described in further detail in the challenges sections within each AI application profile.

Some shared challenges include:

DATA INTEGRATION AND INTEROPERABILITY

Every application relies on diverse data sources, including sensor feeds, legacy databases, crowdsourced inputs, which needs to be harmonized for AI to function effectively. The ITSA Academy Introduction to Transportation Data Course equips both new and existing staff with foundational skills and actionable insights, helping agencies leverage data-driven best practices to advance safety and mobility goals while building a broad understanding of ITS across diverse roles.

CYBERSECURITY

AI systems increase exposure to cyber threats and raise concerns about surveillance, especially when personal or sensitive data is involved.

EXPLAINABILITY AND TRUST IN AI DECISIONS

Stakeholders need to understand how AI reaches conclusions to trust and act on its outputs. There is currently no unified approach or framework that consistently provides interpretations regarding how models function and interact with data.[7]

LEGACY SYSTEM COMPATIBILITY

Most agencies operate legacy infrastructure that were not designed for AI. Integrating these upgrades can be costly or require workarounds.

DIGITAL TRANSFORMATION – HUMAN AND ORGANIZATIONAL FOUNDATIONS FOR AI

AI success depends not only on technology but also on organizational adaptation. Transportation agencies should upgrade IT systems, implement strong data governance procedures, and invest in staff training. Employees need to be skilled at using AI tools, as they can augment and complement day-to-day tasks. Adopting a collaborative, human-centric approach is essential for successful AI implementation in transportation.

Departments should actively coordinate efforts to ensure that AI solutions are aligned with agency goals and priorities. To build trust and foster organizational learning, many agencies begin with small pilot projects, allowing them to evaluate outcomes and refine strategies before moving toward large-scale deployment. As agencies and companies design and implement AI solutions, they should prioritize continuous workforce training and reskilling programs to ensure staff can adapt to new technologies and maximize the benefits of AI deployments.

Building on the imperative for workforce development and AI readiness, the ITSA Academy AI in Transportation course provides essential training for transportation professionals to navigate the evolving landscape of artificial intelligence. This foundational program equips participants with the skills needed to differentiate between hype and practical application, identify opportunities for innovation, and ensure that AI-driven solutions are aligned with policy objectives, safety standards, and the need for public trust.

Developed in partnership with GFT, the Artificial Intelligence in Transportation course integrates technical knowledge with critical ethics and policy considerations. By doing so, it empowers practitioners to apply AI responsibly, improving safety, mobility, and efficiency within transportation systems and reinforcing the broader goal of preparing the workforce to implement and maintain advanced technologies at scale.

[7] Atkinson et al., 2024.

AI APPLICATIONS IN OPERATIONS AND TRAFFIC MANAGEMENT

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PREDICTING & PREVENTING INCIDENTS

WHY IT MATTERS

The significance of the application and the benefits or value it can deliver for transportation (e.g. saving lives, reducing costs, improving mobility).

KEY CHALLENGES

- **DATA INTEGRATION**

  Integrating data from diverse sources (such as traffic cameras, sensors, and mobile data) as well as more analog legacy systems and merging real-time hazard data with historical crash records.

- **EXPLAINABILITY AND TRUST**

  Ensuring accuracy in real-time hazard detection to minimize false positives, which can erode public trust.

- **CYBERSECURITY AND PRIVACY**

  Protecting the privacy of sensitive personal and location data (e.g. video of drivers/pedestrians) that may be collected by AI systems, which requires rigorous safeguards and compliance with relevant regulations to prevent potential misuse.

IMPLEMENTATION

DATA NEEDED

Sensor, image/video, incident reports; crash data, pavement data, weather data, harsh braking from vehicles, near miss data from connected vehicles, excessive speed data, distracted driving data from phone handling; wrong way driving.

DATA COLLECTION, PROCESSING, AND STORAGE

For example, state DOTs often store this type of data in their enterprise data platforms built upon commercially available data lakes (centralized repositories that ingest, store, and allow for processing of large volumes of data in its original form) and then perform data fusion efforts utilizing the AI analytics layer. Essentially, agencies ingest this data and apply AI to extract insights and recommendations.

MATURITY OF AI MODEL

For example, this includes a machine learning model that is well documented to provide a risk score on a corridor. Currently, most OTS products require learning and integration, which can take time. However, AI models are scaling rapidly and can support Infrastructure Owner Operator (IOO) needs if resources are put towards training the AI models. IOOs should still consider safeguards in verification of AI model outputs before trusting results fully.

DATA GOVERNANCE

Needs will be dependent on IOO policies. These differ from agency to agency, and even state to state. The data storage methods, as well as decisions on data ownership, should prioritize privacy and strong cybersecurity protections.

ROI FROM THIS APPLICATION

Benefits include reduction in vehicle or road user collisions, improved emergency response times, enhanced predictive response capabilities, among other benefits.

REAL-WORLD USES

WRONG WAY DRIVER DETECTION (FLORIDA, TEXAS, ARIZONA DOTS)

State DOTs use AI systems with sensors and cameras to spot vehicles driving the wrong way on highways. These trigger alerts for traffic centers, activate warning signs, and can broadcast notifications to nearby drivers and first responders.

DETECTING VRUS AT INTERSECTIONS (CITY OF BELLEVUE, WA AND CALTRANS)

Bellevue and Caltrans use AI and computer vision to monitor intersections for pedestrians and cyclists, flagging risky interactions and near-misses to support intersection redesign and focused safety efforts.

FUTURE TRENDS

Transportation agencies are adopting advanced computer vision to automate hazard detection, using real-time data from cameras and sensors to identify threats and enable rapid responses. Connected vehicle alerts are also evolving, allowing vehicles and infrastructure to share timely warnings about events like wrong-way drivers, work zones, or traffic disruptions – while using AI. As these technologies advance, greater integration and precision in detecting and addressing roadway risks are expected.

[8]Decreasing Wrong Way Driving on Expressways, Tampa, Florida. *ITS Technology Use Case Library Volume 3.* (2025). ITS America. (pp. 54-55). https://itsa.org/wp-content/uploads/2025/06/ITSA-Use-Case-Library-Vol-3-COPY-3.pdf

[9]*Safer Signals Pilot Program. (*2025, September 3). City of Bellevue. https://bellevuewa.gov/city-government/departments/transportation/safety-and-maintenance/traffic-safety/safer-signals-pilot-program

PROACTIVE & PREDICTIVE MAINTENANCE

ITS AMERICA

WHY IT MATTERS

AI can prevent costly downtime by predicting infrastructure failures and can reduce overall maintenance costs and extend the lifespan of physical infrastructure.

KEY CHALLENGES

- **SPARSE FAILURE DATA**

  Infrastructure failures are relatively rare. As such, AI models may struggle to accurately identify rare or unusual events, especially when facing edge cases or limited labeled data. This makes it challenging to train algorithms that reliably predict issues without frequent false alerts.[10]

- **INVESTMENT COSTS**

  Costs for deploying AI for maintenance depend on project complexity, but implementing AI solutions may require sizeable upfront costs on training resources, compute power, and data storage.[11]

- **MAINTENANCE**

  As infrastructure conditions and usage patterns evolve, continuous updates, retraining, and validation are needed to ensure AI models remain effective. This maintenance demands ongoing data collection and technical expertise.[12]

- **DATA STANDARDIZATION**

  Siloed, inconsistent, or unstructured maintenance logs and sensor data across assets could make it difficult for AI systems to fuse these data for analysis and learn reliably across different sources, potentially reducing predictive accuracy.[13]

IMPLEMENTATION

DATA NEEDED

Sensor data, maintenance logs, CCTV detection, pavement condition data, and near real-time weigh-in-motion data to monitor vehicle weight and traffic trends.

[10] Savaş, S. (2025). Artificial intelligence in construction project management: Trends, challenges and future directions. Journal of Design for Resilience in Architecture and Planning, 6(2), 221–238. https://doi.org/10.47818/drarch.2025.v6i2165

[11] Oxmaint. (2025, September 26). Top Challenges in Implementing Predictive Maintenance and How to Overcome Them. OXMaint; Oxmaint Blog. https://oxmaint.com/blog/post/challenges-in-implementing-predictive-maintenance

[12] Savaş, S. (2025).

[13] Oxmaint. (2025, September 26).

DATA COLLECTION, PROCESSING, AND STORAGE

Cloud platforms process and store large volumes of structured and unstructured maintenance and sensor data.

MATURITY OF AI MODEL

Current models could face challenges with edge cases and inconsistent labeling in maintenance logs, highlighting the need for improved data annotation and model tuning.

DATA GOVERNANCE

Accurate, well-maintained databases are essential. All processes need to align with agency IT policies to ensure security, compliance, and reliability.

ROI FROM THIS APPLICATION

Expected benefits include cost savings, reduced physical repair and reconstruction time, improved road safety, and enhanced risk-based prioritization of maintenance activities.

REAL-WORLD USE CASES

DIGITAL TWIN-AIDED BRIDGE EVALUATIONS (WASHINGTON)

WSDOT, along with other partners, is utilizing digital twins and AI technology to alert operations and maintenance personnel when anomalies and issues are identified by sensors on bridges, as well as determine alignment guidance for bridge anchor cables.[14]

IMPROVING MAINTENANCE WITH AI-POWERED DETECTION AND ANALYSIS (HAWAII)

HDOT is using AI analysis applied to crowdsourced dash cam footage to determine pavement cracks and wear-and-tear, along with paint line visibility. This saves the agency money, proactively addresses repair needs, and reduces the need for time-consuming manual reporting of maintenance needs.[15]

FUTURE TRENDS

Digital twins are increasingly used to simulate and monitor infrastructure health in real time. CCTV systems with advanced anomaly detection support rapid response to maintenance issues. Integrated IoT sensors provide granular data, enabling more accurate tracking and predictive maintenance.

[14] Digital Twin-Aided Bridge Evaluations, Seattle, Washington, ITS Technology Use Case Library Volume 3, (pp. 71-72).

[15] Improving Roadway Maintenance Through Automation, Hawaii, ITS Technology Use Case Library Volume 3, (pp. 33-34).

OPERATIONS & TRAFFIC MANAGEMENT

ITS AMERICA

WHY IT MATTERS

AI can streamline traffic management and incident response, reduce travel costs and emissions, and aid agencies in efficient planning.

KEY CHALLENGES

INTEGRATION AND INTEROPERABILITY

TMCs aggregate information from many sources (state DOT feeds, city sensors, navigation apps), which often use incompatible formats. These inconsistencies hinder real-time data fusion for AI, forcing manual workarounds that reduce efficiency gains. Additionally, integrating and harmonizing feeds from multiple jurisdictions and vendors can make it difficult to seamlessly share and use information across platforms.[16]

EXPLAINABILITY AND TRUST

Operators and stakeholders need to understand how AI makes recommendations (e.g. signal timing or incident response) to build trust and ensure accountability. Some AI models can operate opaquely and a lack of explainability can make operators hesitant to trust automated decisions. Agencies must clearly show how decisions are made and what results are achieved to maintain public confidence.[17]

CYBERSECURITY AND PRIVACY

Connecting traffic control infrastructure to networks and AI platforms broadens the attack surface. Without strong cyber protections, there is an increased risk that hackers could infiltrate signal systems or data streams, potentially causing unsafe disruptions.[18] Additionally, many efficiency improvements rely on connected vehicle data and CCTV feeds, but using these at scale raises privacy issues and creates new cyber vulnerabilities in traffic systems if data or signals are hacked.

SCALABILITY

Optimizing an entire road network with AI means ingesting massive, diverse datasets (traffic flows, weather, vehicle telemetry) in real time, which can strain current computing infrastructure and limit system responsiveness.[19]

CROSS-JURISDICTIONAL AND INTER-AGENCY COORDINATION

Traffic management AI requires that city, state, and regional agencies share data and align tactics, yet incompatible data platforms and differing priorities between agencies make it hard to implement seamless, network-wide solutions.[20]

[16] Atkinson et al., 2024.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Finding a Win-Win: Planning and DataSharing Partnerships between Governments and Public Land Management Agencies . (2023). In https://highways.dot.gov/sites/fhwa.dot.gov (pp. 1–95). U.S. Department of Transportation Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/planning-data-sharing-partnerships-study-final-report-august-2023.pdf

- **LEGACY INFRASTRUCTURE LIMITS**

  Existing road hardware (traffic signals, detectors, communication links) wasn't built for AI integration, so upgrades or workarounds are often needed; without modern infrastructure, even the best algorithms cannot fully optimize flow.[21]

IMPLEMENTATION

DATA NEEDED

Implementation relies on integrating diverse data sources, including social media feeds, dynamic speed, probe, vehicle hard-braking, crash reports, traffic analytics from connected vehicle data, real-time weather and road condition data, and crowd-sourced navigation applications.

DATA COLLECTION, PROCESSING, AND STORAGE

Effective application requires robust data governance strategies to ensure data quality, privacy, and security across all sources, as well as standardized protocols for data sharing among agencies and third-party providers. Some navigation platforms can provide free data feeds for government agencies; other sources are available for purchase. Some agencies may use a cloud-based central repository for dynamic data processing.

MATURITY OF AI MODEL

Evaluate detection, false positive, and false negative metrics before implementation. Integrate models with decision support tools for operator validation. AI models for route optimization and incident detection are still in early deployment and being validated in real-world traffic management. Ongoing improvements are required to boost accuracy and reliability.

DATA GOVERNANCE NEEDS INCLUDE DATA STEWARDSHIP

Access policies and governance models need to be thought through at the design phase as it dictates your data flow and system architecture decisions.

ROI FROM THIS APPLICATION

Benefits include faster emergency response times, more efficient traffic flow, fewer secondary incidents, reduced roadway congestion, lower vehicle emissions, improved traveler satisfaction, and enhanced safety outcomes for all network users. These AI systems may improve resource and workflow efficiency, freeing up time for more complex or significant safety-oriented tasks.

REAL-WORLD USE CASES

AI-DRIVEN LANE CLOSURE COORDINATION (TEXAS)

TxDOT uses an AI platform to schedule lane closures for construction, optimizing timing through traffic and weather analysis to reduce congestion and improve safety.

[21] Atkinson et al., 2024.

DYNAMIC CONSTRUCTION ALERTS (NEW YORK)

NYDOT uses integrated systems to deliver real-time construction alerts to the public via mobile apps, social media, and dynamic message signs. These alerts are powered by site sensors and data feeds, ensuring immediate communication about delays and alternate routes.

STATEWIDE AI TRAFFIC MANAGEMENT (FLORIDA)

The City of Sarasota has taken pioneering steps to advance the city's quality of life through smart technology. In partnership with the Florida Department of Transportation (FDOT), AI-powered intersection safety system and connected and autonomous vehicle (CAV) technology has been deployed at 16 high-traffic, high-risk intersections across Sarasota to help improve traffic safety and efficiency.[22]

COMPLIANCE MONITORING (ILLINOIS)

The Illinois Department of Transportation uses automated systems for real-time work zone safety and regulation enforcement, enabling quick response to violations and consistent safety standards.

MOBILITY ROUTE OPTIMIZATION IN (ARIZONA, CALIFORNIA, FLORIDA, NORTH CAROLINA, TEXAS, UTAH)

Integrates live traffic feeds, weather updates, and incident reports to dynamically recommend optimal travel paths for both public transit and personally owned vehicles, reducing congestion and improving travel time for buses.

OPTIMIZING BUS AND TRANSIT SERVICES WITH AI (NEW YORK CITY)

The New York City MTA is using AI-powered tools on buses to help navigate illegally parked cars in bus lanes. These tools computer vision with on-board cameras and embedded connectivity, such as 5G, to help municipalities create smarter fleets by accurately locating detected vehicles along bus routes and making travel more efficient and on-time.[23]

FUTURE TRENDS

AI-driven traffic management will use real-time data to quickly detect, respond to, and even predict roadway incidents, enabling agencies to allocate resources and prevent accidents. Connected vehicles with smart sensors will share location, speed, and behavior data, improving safety and efficiency through real-time communication with traffic systems and other vehicles.

As AI continues to grow in adoption for planning, we may begin to see more agencies utilize AI-powered traffic signal retiming and community plans that utilize AI to help visualize future trends and needs. Additionally, AI is already being used to help automated vehicles (AV) navigate traffic safely and efficiently, with these use cases accelerating through further AV deployments.

[22] Improving Safety with AI-Powered Intersections, Sarasota, Florida, ITS Technology Use Case Library Volume 3, (pp. 39-40).

[23] Optimizing Bus Services with AI, New York City, New York, ITS Technology Use Case Library Volume 3, (pp. 31-32.).

CONSTRUCTION MANAGEMENT & INTEGRATION

WHY IT MATTERS

AI-powered construction management helps agencies and contractors optimize schedules, coordinate closures, and reduce road disruption.

KEY CHALLENGES

- **INTEGRATION AND INTEROPERABILITY**

  Legacy software and infrastructure often use outdated protocols or formats, making it difficult for new AI tools to connect seamlessly and resulting in costly or time-consuming upgrades and compatibility issues that slow adoption.

- **TRANSPARENCY AND EXPLAINABILITY**

  AI systems can be complex, and without clear explanations of how decisions are made, stakeholders may be skeptical or resistant. This lack of transparency can hinder acceptance and limit the effectiveness of new technologies.

- **CYBERSECURITY**

  Using AI in construction means more data (plans, sensor feeds, drone images) is collected and shared digitally. This expansion brings greater risk of cyberattacks or data leaks. For example, exposure of confidential project information or unauthorized system access, requiring robust cybersecurity measures in an industry not traditionally focused on IT security.[24]

- **MULTI-STAKEHOLDER COORDINATION**

  Large projects involve an array of stakeholders including DOTs, contractors, engineers, and utilities. Aligning all stakeholders through AI-driven tools is complicated by varying platforms, data formats, protocols, priorities, and workflows among contractors, which can hinder real-time coordination, cause delays, and make timely, unified decision-making difficult.[25]

- **TIMELY PUBLIC UPDATES**

  Delivering accurate and synchronized information quickly across various channels is difficult, and delays or inconsistencies may cause public confusion and decrease trust.

[24] (2025). Ethical and Privacy Concerns in AI-Driven Traffic Surveillance Systems.
[25] (Savaş, 2025).

IMPLEMENTATION

DATA NEEDED

Construction schedules, lane closure notifications, sensor data from work zones (such as speed, occupancy, and worker presence), crowdsourced reports from drivers, weather conditions, and historical records of past projects and delays.

DATA COLLECTION, PROCESSING, AND STORAGE

Data is collected from public sources, connected sensors, contractor updates, and crowdsourced applications. Secure cloud platforms are used for storage and processing, supporting scalable analytics and ensuring seamless integration across agencies. Data quality assurance, secure transfer pipelines, and adherence to open standards are key to reliable performance and interoperability.

MATURITY OF AI MODEL

Deployment relies on validated AI models that can accurately predict construction impacts, optimize schedules, and support real-time decision-making.

DATA GOVERNANCE NEEDS

Clear policies for data stewardship, robust access controls, and formal data sharing agreements between agencies and contractors are required. Effective governance frameworks ensure privacy, regulatory compliance, and transparency across all phases of construction management, from planning through completion.

ROI FROM THIS APPLICATION

Reduced congestion and travel delays, improved safety for drivers and roadside workers, maintained road access during construction increased traveler satisfaction, and faster completion of construction activities. These tools may allow agencies to reallocate resources to higher-impact tasks.

REAL-WORLD USE CASES

CONSTRUCTION IMPACT ANALYSIS (TEXAS)

TxDOT uses AI-based traffic impact analysis tools to determine optimal lane closure timing for major highway projects. These tools help minimize congestion and inform travelers via navigation apps about alternate routes and anticipated delays.

PUBLIC COMMUNICATION OF WORK ZONE ACTIVITIES AND UPDATES (CALIFORNIA)

Caltrans deploys AI-powered predictive analytics to coordinate work zone activities and communicate real-time updates to the public. Caltrans' system integrates construction schedules with live traffic data to accelerate project completion and reduce disruption.

TRAVELER INFORMATION (FLORIDA)

FDOT implements dynamic rerouting solutions powered by AI, which automatically update traveler information systems and navigation apps based on real-time construction progress and incident detection.

WORK ZONE SAFETY (NEW YORK CITY)

NYC DOT uses AI-enabled dashboards to monitor work zone safety, allowing project managers to respond quickly to changing field conditions and minimize disruption for commuters.

FUTURE TRENDS

AI-driven scheduling, traffic analysis, and resource allocation are set to grow rapidly. Upcoming trends include using IoT sensors to monitor work zones, predictive models for project timelines and risks, and real-time incident detection in construction areas. Integration with connected vehicles and traveler information systems will improve rerouting and public alerts when such incidents may occur

EMERGENCY & TRAFFIC INCIDENT RESPONSE

ITS AMERICA

WHY IT MATTERS

AI-driven emergency and traffic incident response systems empower authorities to rapidly detect incidents, assess the situation, and coordinate effective actions.

KEY CHALLENGES

- **INTEGRATION AND INTEROPERABILITY**

  Emergency response centers (e.g. 911 dispatch and freeway incident management systems) run on established, legacy software. Deploying AI for incident detection or response coordination must mesh with these older systems, which can be technically difficult and time-consuming to upgrade.[26]

- **DATA SHARING SILOS**

  Effective incident response AI needs inputs from police, fire, EMS, and traffic agencies, but these groups often use separate communication systems and data formats. The lack of standardized, real-time data exchange across agencies limits AI's ability to quickly detect incidents and recommend coordinated actions.[27]

- **EXPLAINABILITY AND TRUST**

  In high-stakes emergencies, officials may be reluctant to rely on AI predictions or suggestions without human confirmation. If an AI flags an incident or suggests a response route, responders need transparency into its reasoning, otherwise they may disregard the advice due to safety and liability concerns.[28]

- **CYBERSECURITY**

  Emergency management systems augmented by AI could become targets for cyberattacks or manipulation (e.g. false incident reports, ransomware). Given the life-critical nature of these systems, ensuring AI tools are secure and fail-safe is a major challenge as connectivity increases.[29]

[26] Atkinson et al., 2024.

[27] Finding a Win-Win: Planning and DataSharing Partnerships between Governments and Public Land Management Agencies . (2023). In https://highways.dot.gov/sites/fhwa.dot.gov (pp. 1–95). U.S. Department of Transportation Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/planning-data-sharing-partnerships-study-final-report-august-2023.pdf

[28] Atkinson et al., 2024.

[29] Ibid.

IMPLEMENTATION

DATA NEEDED

A broad range of data sources, including crowd-sourced incident reports, live traffic sensor feeds, vehicle telemetry, and weather information. Supplementary data such as video camera feeds and historical incident records are used to improve model accuracy.

DATA COLLECTION, PROCESSING, AND STORAGE

Data is gathered from public data feeds, vehicles, and fixed sensors, then processed and stored on scalable platforms. Video footage or sensor data is processed and analyzed by AI to provide insights into the incident or anomaly on the roadway.

MATURITY OF AI MODEL

Successful deployment depends on mature AI models that are validated for reliability in detecting incidents and supporting decision-making in real time.

DATA GOVERNANCE NEEDS

Clear data stewardship, well-defined access controls, and formal data sharing agreements are required. Strong governance frameworks are needed to ensure privacy, regulatory compliance, and transparency throughout the system's lifecycle.

ROI FROM THIS APPLICATION

Faster incident detection and emergency response, reduced traffic congestion, lowered chance of secondary crashes, lives saved and injuries prevented, and increased traveler satisfaction.

REAL-WORLD USE CASES

AUTOMATED CRASH DETECTION AND VERIFICATION (NEVADA)

The Regional Transportation Commission of Southern Nevada (RTC) uses automated crash detection and video analytics through an AI-powered system, enabling rapid incident verification along major roadways.[30]

EMERGENCY DISPATCH (GEORGIA)

GDOT incorporates AI-powered emergency dispatch through its NaviGAtor platform, improving response times and coordination for traffic incidents in the Atlanta metro region.

AI TRAFFIC MANAGEMENT AND INCIDENT DETECTION (TEXAS)

TxDOT used existing infrastructure and third-party data to deploy AI solutions that detect incidents faster, improve roadway management, and track multiple construction projects. The system provides a comprehensive view, predicts crash hotspots, and uses real-time vehicle and other data sources to alert the agency about crashes, abandoned vehicles, debris, and more.[31]

ROADWAY HAZARD DETECTION (CALIFORNIA)

Caltrans utilizes vehicle telemetry and connected car data pilots along major corridors to detect and respond to roadway hazards more proactively.

[30] Artificial Intelligence Crash Response Management, Southern Nevada, ITS Technology Use Case Library Volume 3, (pp. 29-30).
[31] AI Traffic Management and Incident Detection, Austin, Texas, ITS Technology Use Case Library Volume 3, (pp. 35-36).

EVENT MANAGEMENT (MINNESOTA)

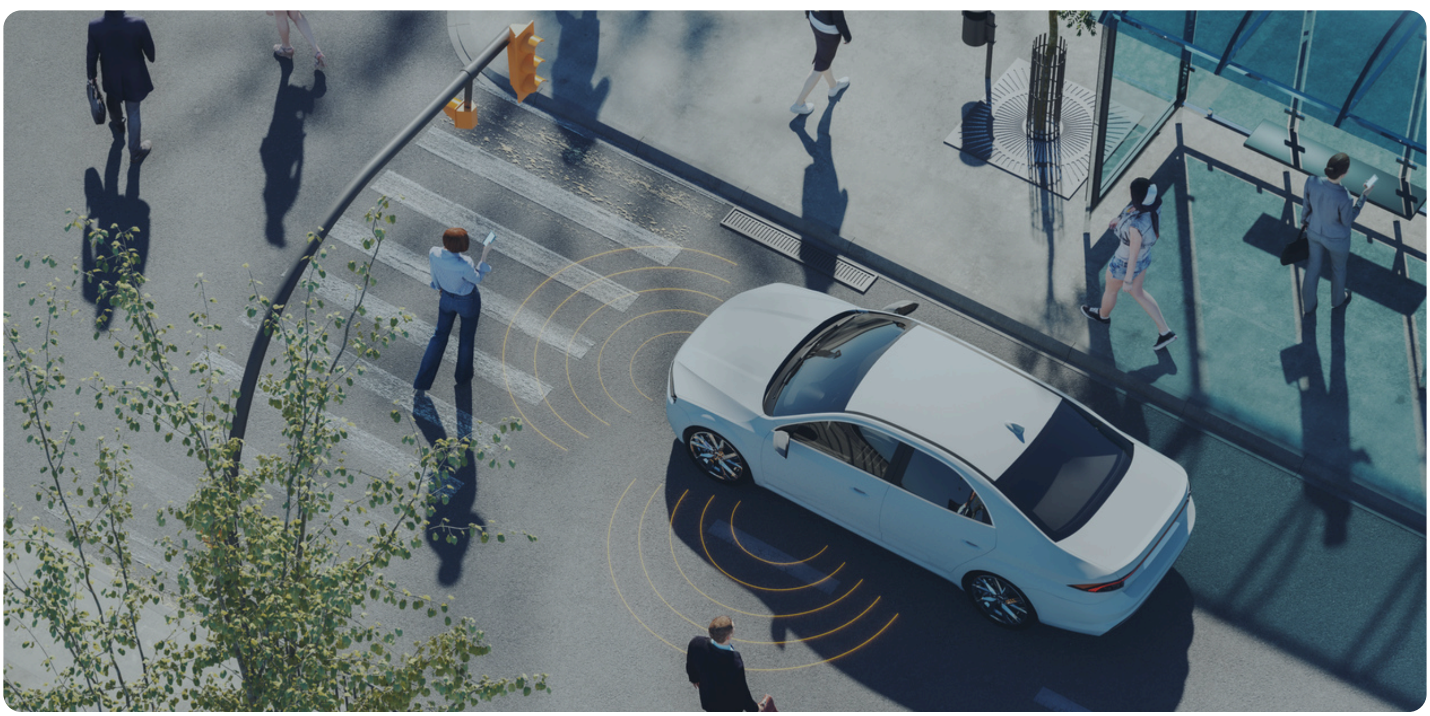
MnDOT integrates crowdsourced incident reports, sensor data, and AI-driven analytics into its 511 Traveler Information System to enhance situational awareness and event management.

AI-DRIVEN FLOOD DETECTION (TEXAS)

TxDOT uses advanced sensors and predictive algorithms to monitor real-time rainfall, water levels, and traffic conditions in Houston. This system automatically reroutes vehicles away from flood-prone areas and notifies emergency responders to potential hazards.

FUTURE TRENDS

The adoption of AI-powered platforms that automate incident detection and recommend optimal response strategies will continue to expand. The integration of connected vehicles and predictive analytics will provide more detailed and timely data, supporting proactive management. Developments in edge computing and real-time video analysis will further enhance detection speed and system capabilities.



CONCLUSION

The integration of AI and digital infrastructure into transportation systems represents a generational opportunity to enhance safety, reduce congestion, and deliver equitable mobility solutions. Yet, these benefits will only be realized if agencies and industry partners embrace modern procurement practices, prioritize privacy and cybersecurity, and invest in workforce readiness. ITS America's deliverables, including the AI report, privacy principles, procurement white paper, and webinar series, equip stakeholders with the strategies and tools needed to overcome barriers and accelerate innovation. By aligning policy, procurement, and technology deployment, we can build a transportation system that is safe, smart, and connected.

APPENDIX: ADDITIONAL ITS AMERICA AI RESOURCES

POLICIES, REPORTS, AND WHITE PAPERS

- AI Policy Principles
- AI Decoded Guide
- AI Implementation Guide
- Blueprint for Transportation Technology
- Impact of AI on Transportation and Mobility Report
- Joint ITSA-NEMA ITS Procurement Solutions for Modern Transportation Technologies White Paper
- ITS America Use Case Library

WEBINARS

- Emerging Technology Procurement Webinar Series
    - Webinar #1 – Rethinking Procurement: From Products to Outcomes
    - Webinar #2 – Building the Framework: Standards, Interoperability, and Accountability
    - Webinar #3 – Scaling Success: Partnerships, Governance, and Market Readiness
- Early Workforce Impacts of AI to ITS Webinar
- From Planning to Practice: ITSA's Guide to AI for Transportation Webinar
- Revolutionizing Road Safety: The Power of AI and Automated Data Collection Webinar
- The Accountability of Trust: Standards and Artificial Intelligence

ITSA ACADEMY

- ITSA Academy Course: AI in Transportation
- ITSA Academy Course: Introduction to Transportation Data

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