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ATTN: Docket No. DOT-OST-2024-0049

Re: Opportunities and Challenges of Artificial Intelligence (AI) in Transportation

The American Society of Civil Engineers (ASCE) is grateful for the opportunity to provide comments on Artificial Intelligence (AI) in transportation to the Department of Transportation's (DOT) Advanced Research Projects Agency – Infrastructure (ARPA–I). AI is emerging as a significant and multifarious presence across many sectors of infrastructure and industry, and ASCE commends ARPA–I for seeking comments on this subject. The perspective offered in this document is in response to a request for information (RFI) published by DOT on May 3.

Founded in 1852, ASCE is the nation's oldest engineering society. ASCE represents more than 160,000 members of the civil engineering profession in 177 countries. As the professionals who design, plan, construct, and maintain transportation infrastructure, ASCE's members are uniquely positioned to suggest considerations associated with innovative solutions such as AI. The consideration, testing, and deployment of science and technology solutions is a fundamental part of the engineering profession. AI-driven solutions have the potential to enhance safety, streamline workflow processes, increase automation, improve asset management, and offer project stakeholders actionable insights for effective documentation, collaboration, and coordination on their projects. ASCE views it as a privilege to offer input on this timely subject.

ASCE was a strong supporter of the Infrastructure Investment and Jobs Act (IIJA), which provided a substantial investment in our nation's infrastructure and authorized ARPA–I. ASCE is a proponent of protecting public safety, ensuring resilience, and maintaining infrastructure through asset management, life-cycle cost-based planning, and innovative technologies. We believe ARPA–I can improve transportation infrastructure through its support of scientific and technological solutions.

ASCE recognizes AI has already been applied in a variety of areas, including transportation, manufacturing, and homeland security. ASCE's Transportation & Development Institute (T&DI) has an Artificial Intelligence in Transportation Committee, which maintains an interest in all topics relevant to AI applications in transportation systems. Additionally, ASCE is in the process of approving a policy statement on AI and engineering responsibility.

We stand ready to answer any questions or lend additional feedback as the agency conducts this information collection process. For these comments, ASCE would like to provide input on the **questions presented by DOT in the RFI** and discuss the importance of **safe, reliable, and accessible data associated with AI technology and digital infrastructure.**

Responses to DOT's specific questions

The RFI presented five specific questions to prompt feedback. ASCE would like to provide responses to each of the questions, listed below.

- *Question 1: Current AI Applications in Transportation. What are the relevant current or near-term applications of AI in transportation?*
    a) AI is currently being applied in several areas relevant to road infrastructure, which includes pavements, bridges, sidewalks, and culverts. For example, AI algorithms are used to predict pavement performance by analyzing historical data, traffic patterns, and environmental conditions. These predictive models help transportation agencies plan maintenance activities more effectively, potentially reducing costs and extending the lifespan of infrastructure components. Additionally, AI-driven image analysis systems, using data from drones, mobile devices, and stationary cameras, are employed to detect and classify various types of distress in pavements and bridges, such as cracks, potholes, and surface wear. These systems can provide real-time monitoring and early detection of issues, enabling prompt and targeted maintenance interventions.
    b) Pertaining to traffic operation and safety-related studies, many other data-driven approaches (AI and machine learning algorithms) have been developed to do real-time traffic prediction on roads or over networks, accounting for factors such as speed, travel time, and volume. Additionally, AI applications in traffic safety, such as traffic crash prediction, have attracted much interest.
- *Question 2: What are the future potential opportunities in transportation that AI can facilitate?*
    a) In the future, AI has the potential to revolutionize road infrastructure management through automated maintenance recommendations. By integrating AI with infrastructure management systems, agencies can receive predictive maintenance schedules that optimize repair timing and methods, thereby maximizing the efficiency of resource allocation. AI can also enhance the capabilities of connected vehicles equipped with advanced sensors, enabling them to communicate real-time condition data of pavements, bridges, and culverts to transportation agencies. This data can be used to dynamically update maintenance plans and ensure safer, more reliable infrastructure. Moreover, AI can contribute to sustainability efforts by assessing the environmental impacts of different materials and maintenance strategies, promoting the adoption of greener practices.
    b) AI has the potential to promote proactive traffic management and control. For example, AI can detect traffic anomalies in a timely manner and help predict non-recurrent traffic congestion, upon which proactive traffic control strategies, such as dynamic lane control, can be developed. In addition, advanced AI technologies may also help develop more efficient traffic control and operations, such as cooperative

traffic signal control and dynamic speed limits on a road or across a network. Those AI-empowered innovations have the potential to significantly improve traffic performance in all aspects.

- *Question 3: What are the current or future challenges of AI in transportation, including risks presented by the use of AI in transportation and potential barriers to its responsible adoption?*
    a) Data: One significant challenge in applying AI to road infrastructure management is ensuring the availability and quality of data needed for training and validating AI models. Incomplete or poor-quality data can lead to inaccurate predictions and suboptimal maintenance recommendations.
    b) Model development: AI technologies need to be developed by integrating transportation domain knowledge to ensure trustworthiness, such as reliability, resilience, and transferability.
    c) Integration to existing system: Integrating AI technologies with existing infrastructure management systems poses technical and operational challenges, requiring substantial investment in infrastructure and training. The initial costs associated with implementing AI solutions can be high, and there is a need for skilled personnel to manage and interpret AI outputs effectively. Addressing these barriers is crucial for the responsible and effective adoption of AI in infrastructure management.
- *Question 4: What are the opportunities, challenges, and risks of AI related to autonomous mobility ecosystems, including software-defined AI enhancements?*
    a) AI offers significant opportunities for enhancing infrastructure management through connected vehicles equipped with advanced sensors. These vehicles can provide real-time data on the conditions of pavements, bridges, culverts, and traffic signals, enabling transportation agencies to monitor and manage these structures continuously and respond promptly to emerging issues. AI also provides strong technologies for enhancing driving behaviors and mobility, such as timely traffic prediction and smart navigation, which can help people avoid traffic congestion. Intelligent cruise control and Advanced Driver Assistance Systems (ADAS) can help promote safe driving. However, this integration also presents challenges, such as ensuring data security and privacy, managing the vast amounts of data generated, and developing standards for data sharing and interoperability, as well as resisting cyberattacks. There are also risks associated with the reliability of AI systems in critical applications, necessitating robust testing and validation protocols to ensure their safe and effective operation in real-world conditions.
- *Question 5: Comment on any other considerations relevant to the development, challenges, and opportunities of AI in transportation that have not been included in the questions above.*
    a) Long-term data collection is essential for improving AI models for infrastructure management as well as traffic management and operations. Establishing comprehensive data collection programs will provide the necessary historical and real-time data to enhance model accuracy and reliability. Collaboration across sectors, including government agencies, academic institutions, and private

companies, is crucial to advance AI applications in infrastructure management. These collaborations can foster innovation, share best practices, and address common challenges. Additionally, developing regulatory frameworks to ensure AI assurance, such as the safe and ethical use of AI in infrastructure management, will be critical. These frameworks should address issues such as data privacy, security, and the equitable deployment of AI technologies.

Access to trustworthy datasets

While the application of AI technology offers the promise of improved efficiency and effectiveness to transportation processes, these qualities cannot be achieved without access to high-quality, highly trusted information. The creation of and access to vast multi-format data stores (known as data lakes and data lake houses) is essential to the ultimate success of AI in transportation. However, these stores have in the past presented legal, regulatory, technical, and institutional challenges. Absent these data resources, information may be subject to content scraping, which is when automated bots download and extract information from a website. This process may result in bots indiscriminately ingesting inaccurate, misleading, or biased information, leading to analytic results that may be dangerously wrong in often subtle and hard-to-detect ways.

DOT must take the lead in ensuring that this data is properly curated before training datasets are irreversibly corrupted and rendered unreliable. On ARPA–I's list of potential areas for funded research and development, ASCE appreciates the inclusion of AI assessment and assurance tools and the creation of datasets for AI and AI-enabled systems across all modes of transportation. DOT brings credibility to this process and has the responsibility to coordinate this vital task. Access to accurate, unambiguous data is critical and must precede any serious widespread deployment of AI technology in transportation. This RFI and its responses provide a timely mechanism and a unique opportunity to scope, plan, and design the data foundations upon which AI-dependent applications will be constructed.

Digital infrastructure needs and requirements

With ARPA–I's focus on new technologies, the agency has an opportunity to improve our country's digital infrastructure in addition to its physical systems. ARPA-I defines digital infrastructure as the "sensing, computation, automation, networking, connectivity, data management, analysis, optimization, control, and virtual elements that underpin our physical transportation infrastructure." Digital infrastructure is one area that will likely be impacted by the deployment of AI tools.

A crucial component to digital infrastructure is data. While many new technologies focus on hardware and software, attention also needs to be paid to the quality and robustness of the data used by these systems. Multi-disciplinary data standards development collaborations are critical to establishing a functional digital infrastructure. Standards related to data object definitions and metadata among public and private databases are essential for the effective communication of critical real-time and archival transportation data to operators and system users.

Conclusion

ASCE has expressed support for the aims ARPA–I seeks to achieve, and we are grateful for the opportunity to submit input on AI in transportation. AI technologies are powerful and prevalent, and we recognize that they will have an impact on transportation infrastructure. We look forward to serving as a source of information and are prepared to answer any questions as DOT collects input.