Intelligent Transportation Systems Deployment Tracking Survey: 2023 Key Findings

Final Report

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16. Abstract

This report summarizes the key findings of the 2023 Intelligent Transportation Systems (ITS) Deployment Tracking Survey. From 1999 to 2020, the ITS Joint Program Office (JPO) used the ITS Deployment Tracking Survey on an ongoing basis to collect information about ITS deployment in a subset of metropolitan areas across the United States by surveying state and local transportation agencies. With this most recent 2023 ITS Deployment Tracking Survey, a new survey methodology was implemented, which greatly expanded the geographic coverage of the ITS Deployment Tracking Survey to include smaller urban and rural areas in addition to large metropolitan areas.

The 2023 ITS Deployment Tracking Survey was administered online from October 3, 2023 to January 19, 2024. The Freeway Management Survey was administered to all State DOT districts and toll authorities that manage freeways and achieved a response rate of 78 percent with 311 completed surveys. The Arterial Management Survey was administered to two distinct populations – State DOT districts managing arterials (response rate of 78 percent with 276 completed surveys) and local arterial management agencies (response rate of 47 percent with 423 completed surveys). The Transit Management Survey was administered to a sample of transit management agencies and achieved a response rate of 63 percent with 464 completed surveys.

The ITS JPO and other stakeholders may use the resulting data to inform strategic planning and investment decisions, identify opportunities to accelerate the deployment of ITS, establish baseline deployment for newer ITS technology deployments, document shifts in ITS deployment patterns and ITS market evolution, and identify opportunities for knowledge transfer and technical assistance.

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Acronyms

Acronym	Meaning
AV	automated vehicle
BIL	Bipartisan Infrastructure Law
CCTV	closed-circuit television
CV	connected vehicle
DMS	dynamic message signs
DOT	Department of Transportation
DTS	Deployment Tracking Survey
ESS	Environmental Sensor Stations
ICM	integrated corridor management
IIJA	Infrastructure Investment and Jobs Act
ITS	Intelligent Transportation Systems
ITS JPO	Intelligent Transportation Systems Joint Program Office
MPO	metropolitan planning organization
RWIS	Road Weather Information Systems
SME	subject matter expert
USDOT	United States Department of Transportation

Chapter 1. Introduction

Purpose of the Report

This report summarizes the **key findings** of the 2023 Intelligent Transportation Systems (ITS) Deployment Tracking Survey. The United States Department of Transportation's (USDOT) Intelligent Transportation Systems Joint Program Office (ITS JPO) administers surveys to freeway management, arterial management, and transit management agencies to track ITS deployment. The mission of the ITS JPO is to lead collaborative and innovative research, development, and implementation of ITS to improve the safety and mobility of people and goods. The ITS JPO's ITS Deployment Evaluation Program administers the ITS Deployment Tracking Survey with assistance from USDOT's John A. Volpe National Transportation Systems Center (Volpe).

The ITS JPO has been administering the ITS Deployment Tracking Survey to a subset of large metropolitan areas in the U.S. since 1999. **With this most recent 2023 ITS Deployment Tracking Survey, a new survey methodology was implemented, which greatly expanded the geographic coverage of the survey to include smaller urban[1] and rural areas.** The change in methodology reflects a need to (1) obtain a better understanding of ITS deployment nationwide and (2) obtain ITS deployment information from communities of all sizes, not just from large metropolitan areas.

The ITS JPO and other stakeholders may use the resulting data to inform strategic planning and investment decisions, identify opportunities to accelerate the deployment of ITS, establish baseline deployment for newer ITS technology deployments, document shifts in ITS deployment patterns and ITS market evolution, and identify opportunities for knowledge transfer and technical assistance.

Background

Since 1999, the ITS JPO has used the ITS Deployment Tracking Survey to collect information about the extent of ITS deployment in a subset of large metropolitan areas across the United States. The surveys were, and continue to be, administered to State and local transportation agencies, including freeway, arterial, and transit management agencies.

The ITS JPO initially developed the ITS Deployment Tracking Survey to track and manage progress made toward a ten-year ITS deployment goal announced by the U.S. Secretary of Transportation in 1996.[2] The Secretary's goal focused on tracking ITS deployment rates in large metropolitan areas. At the time, ITS was a relatively new set of technologies that tended to be deployed in large metropolitan areas to address congestion, safety, and other transportation issues experienced most acutely by the nation's largest cities. The surveys were conducted every 1-2 years during the initial ten-year goal measurement

[1] This term is used to refer to small metropolitan and micropolitan areas.

[2] U.S. Transportation Secretary Peña's goal stated that the 75 largest metropolitan areas should be outfitted with an integrated ITS infrastructure in the next ten years.

period. Following the ten-year goal period, which ended around 2007, the surveys were conducted less frequently, on a roughly 3-year cycle, and continued to monitor the deployment of ITS in a subset of large metropolitan areas across the country.

However, in the years following the goal period, it became clear that the ITS Deployment Tracking Survey no longer provided the most complete picture of the extent and nature of ITS deployment in the U.S. During this time, ITS technologies became more mainstream and, as such, were increasingly deployed outside of large metropolitan areas. The ITS JPO's Benefits, Costs, and Lessons Learned databases[3] showed increasing numbers of examples of ITS deployments in smaller urban (i.e., small metropolitan and micropolitan) and rural areas.

The ITS JPO's 2019 **Small Urban and Rural Transit Provider Survey** further demonstrated the high rates of deployment of some ITS technologies among smaller urban and rural transit providers.[4] Based on these trends, the ITS JPO determined that an update to the survey methodology was necessary to address these important gaps in survey coverage to better reflect a full range of communities and situations where ITS technologies are deployed.

The ITS JPO's ITS Deployment Evaluation Program began initial investigations into the development of a new survey approach and methodology following the 2016 ITS Deployment Tracking Survey. At that time, the ITS Deployment Evaluation Program began exploring potential sampling approaches with input from stakeholders, subject matter experts (SMEs), and survey statisticians. In 2022, a **Pilot Survey** of State Departments of Transportation (DOT) and smaller urban and rural local arterial management agencies was conducted to test the new sampling approach. The **Pilot Survey** showed that smaller urban and rural local arterial management agencies were willing and able to participate in the ITS Deployment Tracking Survey.

The ITS JPO decided to execute its new survey methodology starting with the 2023 ITS Deployment Tracking Survey, thereby expanding its geographic coverage to include smaller urban and rural areas in addition to large metropolitan areas. The methodology for each survey type (Freeway Management, Arterial Management, Transit Management) is highlighted below:

- **Freeway Management Survey**
  - Surveys all State DOT districts[5] and Toll Authorities that manage freeways.[6]

[3] For more information about the ITS Benefits, Costs, and Lessons Learned Databases, see: https://www.itskrs.its.dot.gov/.

[4] See: https://www.itskrs.its.dot.gov/deployment/othersurveys_surta_2019.

[5] A few State DOTs refer to their agencies as "regions" or "divisions" rather than districts. For ease of reporting and consistency, the term "district" is used throughout this report.

[6] Freeways are controlled access roads, such as interstates and other freeways and expressways (i.e., functional classifications 1 and 2 per the Federal Highway Administration's Highway Functional Classification). https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/section00.cfm.

- **Arterial Management Survey** (two distinct populations)
  - **Arterial State DOT Survey**: surveys all State DOT districts that manage arterial roads.[7]
  - **Local Arterial Management Survey:** surveys a random sample of places and counties of varying population size (i.e., across metropolitan, micropolitan and rural areas) that manage arterial roads.

- **Transit Management Survey**
  - Surveys a random sample of transit agencies across large urban, small urban and rural areas from the National Transit Database (NTD).[8]

In addition to providing more comprehensive data about the extent of ITS deployment nationwide, the new ITS Deployment Tracking Survey methodology positions the ITS JPO to also baseline and, over time, track the growing pipeline of ITS projects that are currently being (and will be) deployed as a result of the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL).[9] Grant programs established under the BIL provide numerous funding opportunities for a wide variety of projects in communities of all sizes and location types. Several of the BIL grant programs offer opportunities to fund ITS deployments to help communities solve their transportation challenges.

Key Findings Summary

A summary of key findings is presented in this section.

Freeway Management Survey

- Nearly all freeway management agencies are deploying ITS technologies, and some mature technologies show widespread adoption.
- A large majority of freeway management agencies are deploying one or more ITS safety systems technologies. Notably, no single safety systems technology has widespread adoption.
- Freeway management agencies deploy a variety of ITS technologies at work zones; more than half deploy dynamic message signs, portable dynamic speed feedback signs, or portable closed-circuit television.
- State DOT districts with a large urban area tend to deploy ITS at higher rates on freeways compared to districts without a large urban area.
- There are opportunities for increasing deployment of surveyed operational strategies on freeways.

[7] The survey defines arterials as all uncontrolled access roads, such as principal arterials, minor arterials, collectors, and local roads (i.e., functional classifications 3 through 6 per the Federal Highway Administration's Highway Functional Classification). See: https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/section00.cfm.

[8] The NTD is a legislative requirement (see Title 49 U.S.C. 5335(a)). This statute requires that recipients or beneficiaries of grants from the Federal Transit Administration (FTA) under the Urbanized Area Formula Program (§5307) or Other than Urbanized Area (Rural) Formula Program (§5311) submit data to the NTD (see: https://www.transit.dot.gov/ntd).

[9] See: https://www.transportation.gov/bipartisan-infrastructure-law.

Arterial Management Survey

- Pedestrian warning systems and speed feedback signs are the two most commonly deployed ITS safety systems on arterials.
- ITS are widely deployed at signalized intersections.
- State DOT districts managing arterials are significantly more active in deploying ITS on arterial roads compared to local arterial management agencies.
- For a number of ITS technologies, local arterial management agencies in large metropolitan areas have significantly higher rates of adoption than local arterial management agencies in smaller urban and rural areas.

Crosscutting Findings from the Freeway and Arterial Management Surveys

- External data sources are widely used for freeway and arterial management, particularly among State DOT districts, and these data serve multiple purposes.
- Freeway management agencies are significantly more likely than arterial management agencies to use vehicle probe data, including agency-deployed technology and/or purchased data. The percentage that purchases vehicle probe data exceeds the percentage that deploys vehicle probe readers, with the exception of local arterial management agencies.

Transit Management Survey

- Across all transit management agencies, the most widely deployed ITS technologies are automatic vehicle location, computer-aided dispatch and scheduling, and mobile data terminals, though deployment rates vary by mode.
- For many ITS technologies, there are significant differences by area type; ITS deployment rates are highest among transit agencies in large urban areas.
- Less than half of transit management agencies have adopted electronic fare payment, while cash and physical tickets/tokens/vouchers (i.e., with no embedded technology) are the two most accepted fare media among surveyed transit management agencies.
- More than 40 percent of transit management agencies reported using one or more ITS data standards.
- Just over 40 percent of transit management agencies provide an open data feed, mostly for fixed route service, and large majorities of transit agencies with an open data feed provide static as well as real-time information to the public.

Crosscutting Findings from the Freeway, Arterial, and Transit Management Surveys

- Freeway management agencies and State DOT districts managing arterials lead the way with respect to the deployment of telecommunications technologies, with large majorities deploying fiber optic cable and cellular (LTE-4G); whereas transit agencies use a greater mix of wired and wireless telecommunications technologies.
- While deployment of connected vehicle (CV) and automated vehicle (AV) technologies is relatively low across all surveyed agencies, one fourth or more of freeway management agencies and State DOT districts managing arterials are planning for the deployment of CV technologies.
- Future plans to expand/upgrade ITS or invest in new ITS vary by surveyed agency types.

Chapter 2. Methodology

This chapter describes the ITS Deployment Tracking Survey methodology for the Freeway Management Survey, Arterial Management Survey, and Transit Management Survey.[10]

Sample Development

With the 2023 ITS Deployment Tracking Survey, a new survey methodology was implemented, which greatly expanded the geographic coverage of the survey beyond large metropolitan areas to include smaller urban and rural areas. The change in methodology enables the ITS JPO to obtain an understanding of ITS deployment nationwide, including from communities of all sizes. Sample development for each survey is described below.

Freeway Management Survey

The 2023 Freeway Management Survey is a census of all State DOT districts and toll authorities managing freeways (i.e., controlled access roadways).

Arterial Management Survey

The 2023 Arterial Management Survey was administered to two distinct survey populations – (1) State DOT districts managing arterial roads and (2) local arterial management agencies (also referred to as local agencies in this report). While these two populations were asked the same set of survey questions, they required different sampling approaches.

Arterial State DOT District Survey

The 2023 Arterial State DOT District Survey is a census of all State DOT districts managing arterial roads (also referred to as arterials in this report), which are roads with uncontrolled access.

[10] Separate reports have been developed for each survey (Freeway, Arterial, Transit) and are posted on the Deployment Statistics webpage (see: https://www.itskrs.its.dot.gov/deployment/2023DTS). These reports contain more detailed information about the survey methodology used for each survey.

Local Arterial Management Survey

The 2023 Local Arterial Management Survey is a stratified random sample of places and counties of varying population size that manage arterial roads. The term “places” is used by the Census to define cities, towns, villages, townships, and boroughs. “Place” agencies together with “county” agencies are referred to collectively as “local agencies” in this report.

In developing the sampling frame, a minimum population threshold of 5,000 was set for both places and counties using 2020 Census definitions. The sampling frame excluded unincorporated places and counties which prior research indicated do not play a role in arterial management. Prior to developing the arterial local sampling frame, the largest places (population of 600,000 or higher) and counties (population of 950,000 or higher) were drawn with certainty (i.e., automatically included in the sample) and are referred to as the “certainties” in this report. The decision to select certainties ensured that the largest metropolitan areas are included in the sample, as it was expected that they are most likely to be deploying a range of ITS, and it allows the survey to preserve some continuity with the historical Deployment Tracking Survey data.

The resulting sampling frame, which consisted of 9,329 local agencies, was then stratified by metropolitan, micropolitan and rural census designations and then further sub-stratified by county and place population. A total of 1,030 local agencies were sampled.

Transit Management Survey

The 2023 Transit Management Survey is a stratified random sample of transit agencies from the NTD that operate vehicles.

In developing the sampling frame, transit agencies in rural areas were required to have more than 10 vehicles to be eligible.[11] The sampling frame excluded private-for-profit corporations as these are not transit agencies managing public transportation. Prior to developing the transit sampling frame, the largest transit agencies (with 900 or more vehicles) were drawn with certainty (i.e., automatically included in the sample). The decision to select certainties ensured that the largest transit agencies are included in the sample, as it was expected that they are most likely to be deploying a range of ITS, and it allows the survey to preserve some continuity with the historical Deployment Tracking Survey data.

The resulting sampling frame, which consisted of 1,376 transit agencies, was then stratified by large urban, small urban, and rural area types. The NTD reports agencies that are located in urban areas, rural areas, or are tribal agencies.[12] Tribal transit agencies and agencies in rural areas were combined into the rural area type for the purposes of this survey. Urban agencies were split into agencies in large urban areas (population greater than 200,000) and small urban areas (population of 200,000 or less) using their urbanized area population. A total of 740 transit agencies were sampled.

[11] The Government Accountability Office (GAO) used this criterion in its 2015 survey of small urban and rural transit providers (see: https://www.gao.gov/assets/gao-16-638.pdf). GAO based this threshold decision on discussions with industry associations and a survey pretest. The ITS JPO adopted this same eligibility criterion in its 2019 Small Urban and Rural Transit Survey and the 2023 Transit Management Survey.

[12] Urban transit providers were identified as recipients of FTA’s Urbanized Area Formula Grants, while rural transit providers and Tribes were identified as sub-recipients of the FTA’s Non-urbanized Area Formula Grants (see: https://www.transit.dot.gov/ntd).

Contact Development

Following the identification of each agency (i.e., State DOT districts, local arterial management agencies, and transit management agencies), the survey team identified a survey contact for each agency. This process involved online research to find an appropriate point of contact (such as a State DOT district ITS engineer, county engineer, local public works director, or transit agency executive director), as well as the collection of other relevant information (e.g., whether the agency appeared to manage ITS).

Using the contact information available (either a specific contact or general agency phone number or email), the survey team reached out to every agency via email to describe the survey's purpose and agency eligibility criteria (e.g., agency must manage freeways in the case of the Freeway Management Survey or arterials in the case of the Arterial Management Survey) and to confirm the contact's suitability to respond to the survey. If the contact confirmation process revealed that an agency was ineligible, it was removed from the sample.

Agencies that did not respond to the initial email received up to four phone calls coupled with follow-up emails to identify a suitable point of contact.

Data Collection and Processing

Survey Questionnaire

The 2023 Deployment Tracking Surveys are a modified version of the 2020 survey. One key change between 2020 and 2023 is that the questions about ITS coverage (i.e., number of freeway miles covered by X technology) were either transformed into an adoption question (i.e., whether the agency has adopted the technology) or were eliminated (if an adoption question already existed) due to their high respondent burden and data reliability issues. Another key change was the addition of several new questions on CV and AV technologies, as questions about these emerging technologies had not been asked in an ITS JPO survey effort since 2019. The major topic areas covered by each survey type are listed in Table 1.

Table 1. Topics in 2023 Deployment Tracking Survey

Category	Freeway Survey	Arterial Survey	Transit Survey
Safety-related ITS (ITS safety systems, work zone ITS, ITS for road weather management, automated enforcement, ITS for incident detection and verification)	X	X	-
Real-time Data Collection (e.g., roadside infrastructure, vehicle probes, external data sources)	X	X	X
Traffic Signal Management Technologies	-	X	-
Telecommunications	X	X	X
Connected Vehicle and Automated Vehicle Technologies	X	X	X
Integrated Corridor Management	X	X	X

Category	Freeway Survey	Arterial Survey	Transit Survey
Traffic Management: Freeways (e.g., managed lanes, ramp metering, Transportation Systems Management and Operations (TSMO) Plans)	X	-	-
Traffic management: Arterials (e.g., parking management, TSMO Plans)	-	X	-
Traveler Information and Open Data Feeds	X	X	X
Transit Management Technologies and Strategies	-	-	X
Transit Agency Partnerships and Fare Media	-	-	X
Regional (or State) ITS Architecture	X	X	-
Agency Coordination and Data Sharing	X	X	-
ITS Cybersecurity	X	X	X
Maintenance of ITS Devices	X	X	X
Future ITS Deployment	X	X	X

Other substantive changes to the questionnaire were largely driven by the input of subject matter experts (SME). In addition, minor modifications were made to some questions to improve clarity. New response options were also added to some questions, based on either common respondent input to open-ended responses in the 2020 survey, or the need to include ITS technologies thought to be relevant to smaller urban or rural areas (e.g., wildlife crossing warning systems). Another noteworthy change to the survey questionnaire was the increased use of definitions (via “hover boxes”) for ITS technologies and other terms to assist respondents in filling out the survey.

Respondent Dashboard

An online personalized dashboard (see Figure 1) was developed to administer the Deployment Tracking Survey to each respondent. The online dashboard provided details on the survey effort, including information about the survey sponsor, frequently asked questions, and the survey contractor’s privacy policy. The online dashboard also allowed respondents to download a PDF version of the survey questionnaire(s) and included unique links to access their survey(s). Some individual respondents were assigned two or more surveys, as they represented multiple State DOT districts and/or more than one type of survey (e.g., freeway and arterial).

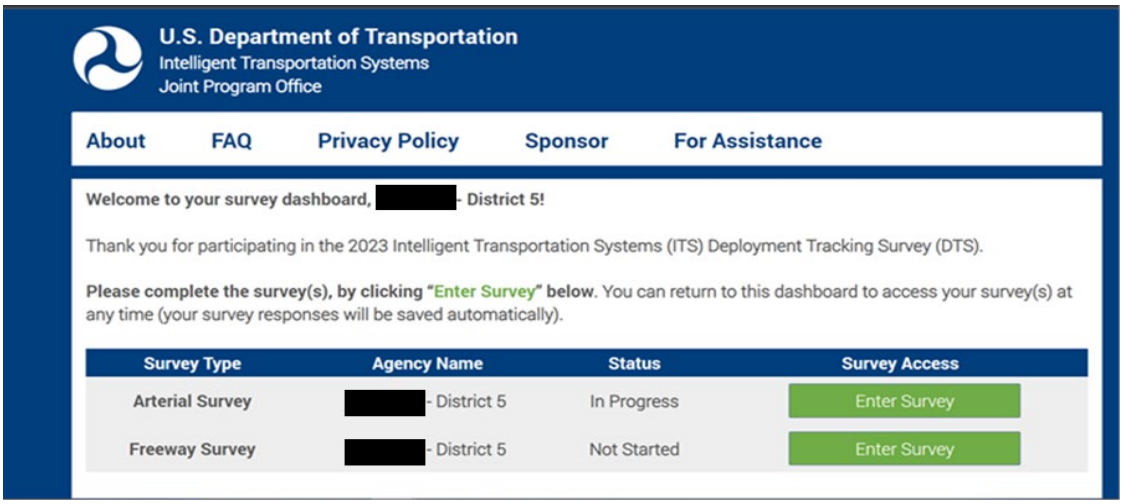


Figure 1. Example Personalized Survey Dashboard

Survey Administration

To test the functionality of the survey process, including the online survey instruments and dashboard, the survey invitation was sent to a small subset of freeway, arterial, and transit agencies (i.e., soft launch) on October 3, 2023, prior to the full launch of the Deployment Tracking Survey. The full launch occurred on October 5, 2023.

Multiple reminder efforts were undertaken to encourage survey response from October 2023 to January 2024. The survey was closed on January 19, 2024. Table 2 shows the number of completed surveys and response rates for each survey type.

Table 2. Survey Response Rates

Survey	Eligible Sample[13]	Number of Completed Surveys	Response Rate
Freeway Survey	400	311	78%
Arterial State DOT District Survey	355	276	78%
Arterial Local Agency Survey	896	423	47%
Transit Survey	733	464	63%

[13] During contact confirmation and survey administration, some agencies were deemed ineligible because they did not meet the survey's eligibility criteria (see Sample Development). As a result, the final number of eligible sample is smaller than the number originally sampled.

Data Cleaning and Weighting

The survey data went through an extensive review and cleaning process, and open-ended responses were reviewed and coded into existing response categories as appropriate. The survey team consulted with USDOT SMEs to ensure that write-in responses were accurately recoded.

The Freeway Survey and the Arterial State DOT District Survey did not require any data weighting; design weights were not applicable because each of these surveys was a census, and non-response weighting was not needed due to high response rates (i.e., there was no significant non-response bias).

The data from the Local Arterial Agency Survey and the Transit Survey required data weighting. The purpose of design weights is to account for the sample design used when selecting a sample. They are calculated as the inverse of the probability of selection for each sampled unit, except “certainty” agencies were assigned weights of one (1) and removed from further calculations. Design weights were then adjusted to account for nonresponse bias. This involved calculating adjustment factors in each of the strata cells, defined as the sum of the weights for the full eligible sample divided by the sum of the weights for the respondents. In a final step, the weights were scaled to sum to the number of responding agencies for each survey.

Chapter 3. ITS Deployment Tracking Survey Key Findings

This chapter summarizes the key findings from the 2023 ITS Deployment Tracking Survey.

Key Findings for the Freeway Management Survey

This section summarizes key findings from the Freeway Management Survey, which was distributed to State DOT districts and toll authorities managing freeways. Findings are presented for all 2023 respondents (i.e., a total of 311 respondents). Where applicable, subgroup findings are also presented. These analyses highlight significant differences based on:

- **Agency type:** State DOT districts compared to toll authorities
- **Population groups:** State DOT districts with at least one large urban area compared to State DOT districts without a large urban area. A large urban area is defined as places[14] with populations greater than 100,000 or counties with populations greater than 950,000.

In comparing differences across subgroups, significance testing was performed at a significance level of 0.05, with a 95 percent confidence level.

The key findings for freeway management agencies include:

- Nearly all freeway management agencies are deploying ITS technologies, and some mature technologies show widespread adoption.
- A large majority of freeway management agencies are deploying one or more ITS safety systems technologies. Notably, no single safety systems technology has widespread adoption.
- Freeway management agencies deploy a variety of ITS technologies at work zones; more than half deploy *dynamic message signs*, *portable dynamic speed feedback signs*, or *portable closed-circuit television*.
- State DOT districts with a large urban area tend to deploy ITS at higher rates on freeways compared to districts without a large urban area.
- There are opportunities for increasing deployment of surveyed operational strategies on freeways.

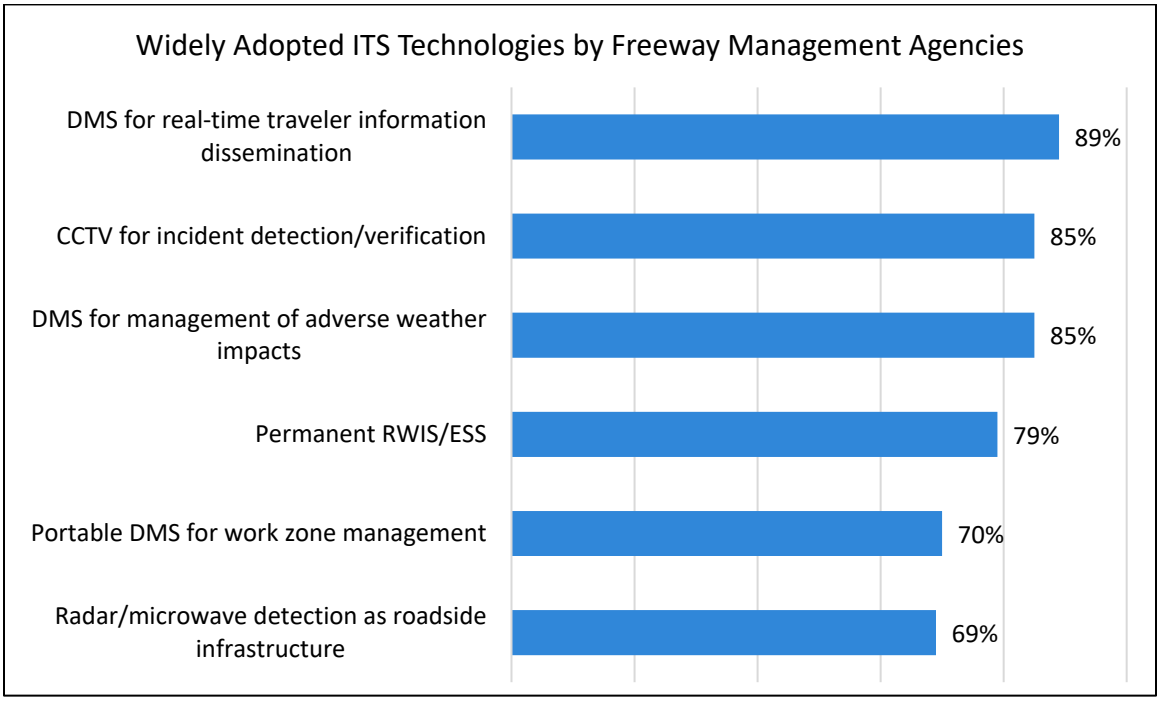
[14] For the purposes of reporting, “place” is used to describe all incorporated areas, such as cities, towns, villages, townships, and boroughs.

Key Finding: Nearly all freeway management agencies are deploying ITS technologies, and some mature technologies show widespread adoption.

Nearly all freeway management agencies deploy one or more of the surveyed ITS technologies. As shown in Figure 2, the most widely adopted ITS technologies by freeway management agencies include:

- *Dynamic message signs (DMS)*[15]
  - For real-time traveler information dissemination
  - For management of adverse weather impacts
  - For work zone management (i.e., *portable DMS*)
- *Closed-circuit television (CCTV)* for incident detection/verification
- *Radar/microwave detection* as roadside infrastructure
- *Permanent* Road Weather Information Systems (RWIS) or Environmental Sensor Stations (ESS)

These mature ITS technologies have become mainstream, as reflected in the high percentage of agencies that are willing to invest in and deploy them.



2023 Freeway Survey Q1,Q14-Q16, Q18, Q19; (n=311) *Source: USDOT*

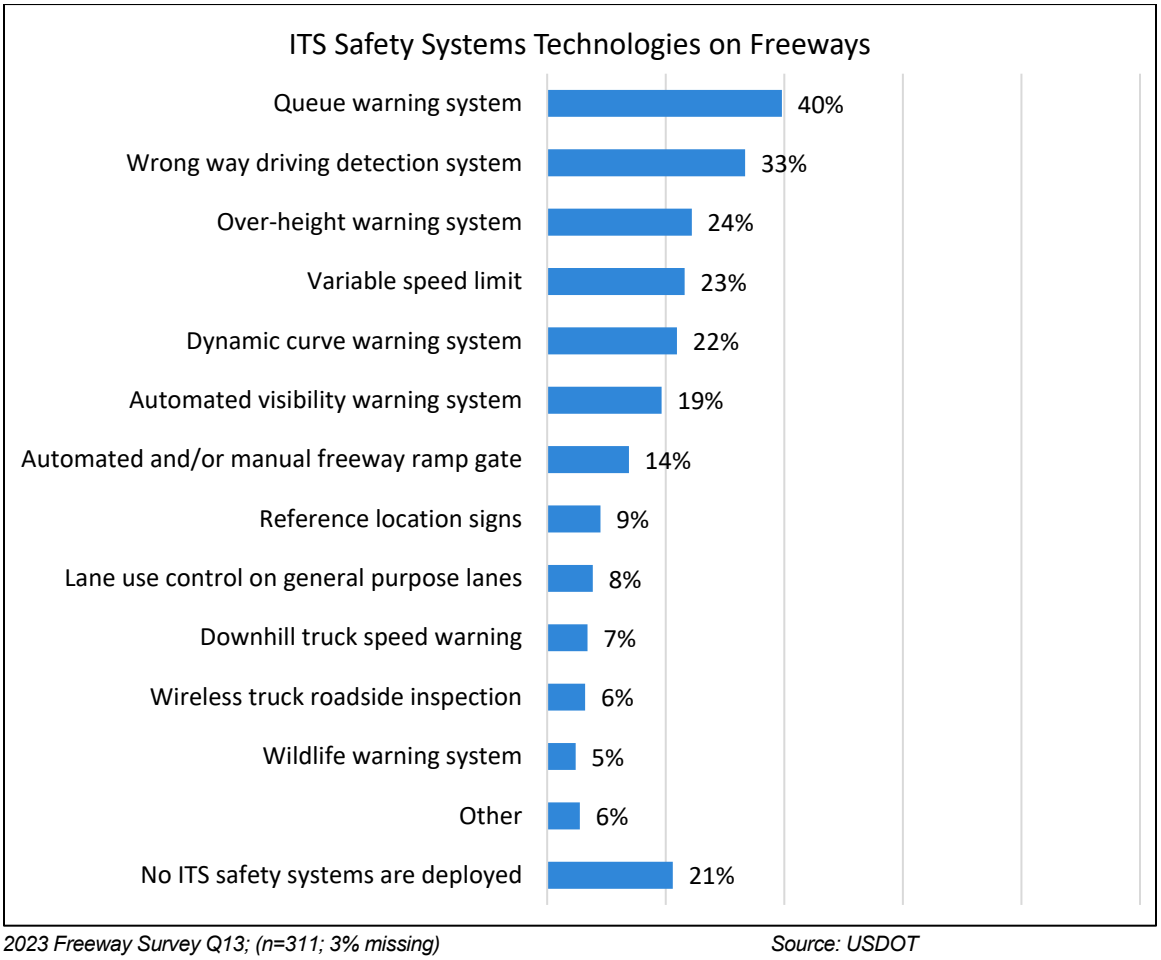
Figure 2. Widely Adopted ITS Technologies by Freeway Management Agencies

[15] DMS was included as a response option in multiple survey questions, including real-time traveler information dissemination methods, management of adverse weather impacts, and work zone management (the latter specified portable DMS as the response option).

Key Finding: A large majority of freeway management agencies are deploying one or more ITS safety systems technologies. Notably, no single safety systems technology has widespread adoption.

Among all freeway management respondents, 76 percent reported deploying at least one surveyed ITS safety systems technology. Freeway management agencies deploying ITS safety systems use an average of 2.8 safety systems technologies. However, no single ITS safety system technology is used by a majority of freeway agencies, which suggests that freeway management agencies have a variety of needs with respect to roadway safety and use a wide variety of safety systems technologies to meet those needs.

Figure 3 shows *queue warning systems* (40 percent) are the most deployed safety systems by responding freeway management agencies. *Wrong way driving detection systems* (33 percent) are deployed by one third of respondents, while less than one fourth (24 percent) deploy any of the other surveyed ITS safety systems. In addition, about one fifth of freeway management agencies reported *no ITS safety systems are deployed* (21 percent). These findings suggest that there may be opportunities for increasing the rates of deployment of ITS safety systems by freeway management agencies.



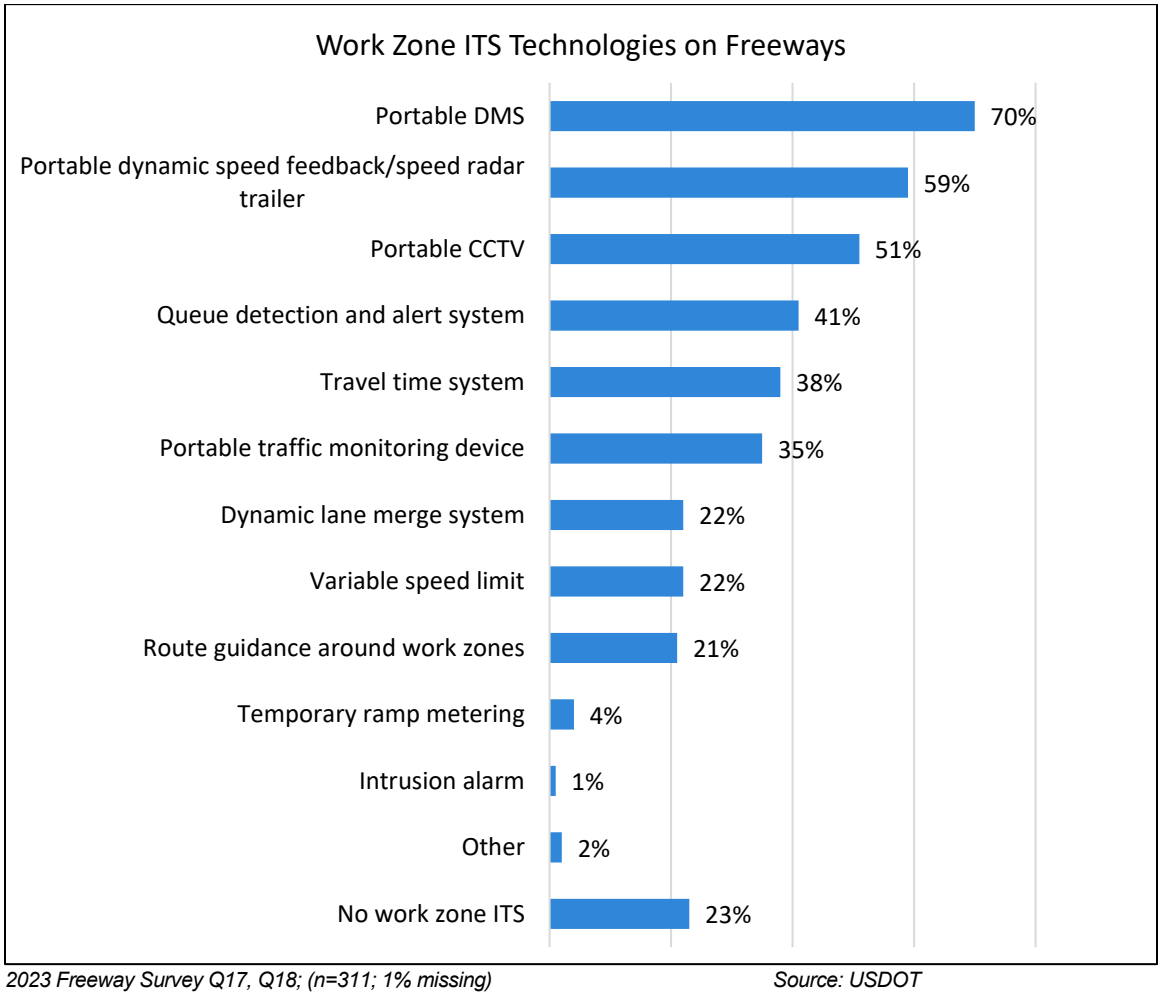
2023 Freeway Survey Q13; (n=311; 3% missing) *Source: USDOT*

Figure 3. ITS Safety Systems Technologies on Freeways

Key Finding: Freeway management agencies deploy a variety of ITS technologies at work zones; more than half deploy DMS, portable dynamic speed feedback signs, or portable CCTV.

Among all 2023 freeway management agency respondents, 76 percent reported deploying at least one work zone ITS technology. Freeway management agencies deploying ITS at work zones deploy an average of 4.9 work zone ITS technologies.

Among the most commonly deployed work zone ITS technologies are *portable DMS* (70 percent), *portable dynamic speed feedback/speed radar trailers* (59 percent), and *portable CCTV* (51 percent). More than one third deploy *queue detection and alert systems* (41 percent), *travel time system*s (38 percent), or *portable traffic monitoring devices* (35 percent). In addition, almost one fourth of freeway management agencies reported *no work zone ITS* (23 percent).



2023 Freeway Survey Q17, Q18; (n=311; 1% missing) *Source: USDOT*

Figure 4. Work Zone ITS Technologies on Freeways

Key Finding: State DOT districts with a large urban area tend to deploy ITS at higher rates on freeways compared to districts without a large urban area.

As shown in Table 3, State DOT districts with a large urban area are significantly more likely than State DOT districts without a large urban area to deploy one or more of the following on freeways:

- ITS safety systems technologies (84 percent compared to 73 percent)
- Methods for incident detection/verification (94 percent compared to 79 percent)
- Roadside ITS infrastructure (82 compared to 65 percent)
- Managed lane strategies (34 percent compared to 19 percent)

While nearly all State DOT districts – including those with and without a large urban area – are using at least one method to disseminate real-time traveler information, State DOT districts with a large urban area are significantly more likely than State DOT districts without a large urban area to use *third-party mobile applications* (60 percent compared to 47 percent). State DOT districts with a large urban area are also significantly more likely than State DOT districts without a large urban area to *deploy ramp metering* (37 percent compared to 8 percent).

In addition, about one fourth of State DOT districts with a large urban area (24 percent) are *developing, testing, or deploying connected vehicle (CV) technologies*, which is significantly higher than the 8 percent of State DOT districts without a large urban area that are doing so. State DOT districts with a large urban area are also significantly more likely to *deploy integrated corridor management (ICM)* compared to State DOT districts without a large urban area (27 percent compared to 16 percent).

Table 3. Freeway Management Agencies:
Significant Differences Between State DOT District Population Groups

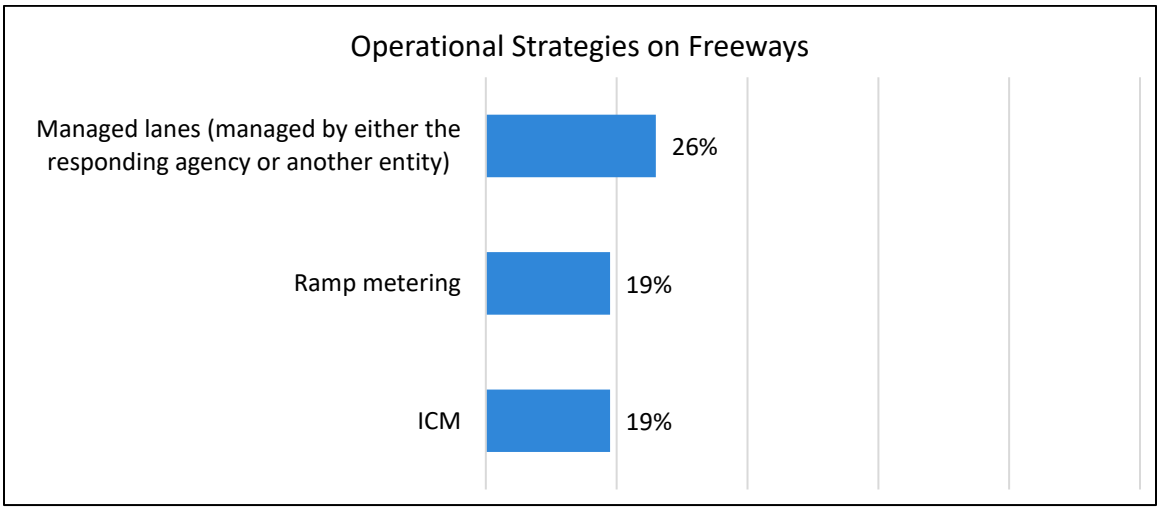
Technology/Method	State DOT Districts with a Large Urban Area (n=119)	State DOT Districts without a Large Urban Area (n=154)
One or more ITS safety system technologies *	84%	73%
One or methods for incident detection/verification *	96%	82%
One or more roadside infrastructure ITS *	94%	83%
Traveler Information Dissemination: Third Party Mobile Apps *	60%	47%
One or more managed lane strategies *	34%	19%
Freeway entrance ramp metering *	37%	8%
Developing, testing, or deploying CV technology *	24%	8%
ICM *	27%	16%

2023 Freeway Management Survey Q1, Q6, Q10, Q13, Q14, Q16, Q18, Q19, Q21, Q29 Source: USDOT
** statistically significant difference between State DOT districts with a large urban area & State DOT districts without a large urban area*

Key Finding: There are opportunities for increasing deployment of surveyed operational strategies on freeways.

Surveyed operational strategies include ramp metering, ICM, and managed lanes.[16] Overall, 42 percent of responding freeway management agencies are deploying one or more of these operational strategies.

As shown in Figure 5, *managed lanes* (operated by either the agency or another entity) are deployed by 26 percent of freeway management agencies, while *ramp metering* and *ICM* are each deployed by 19 percent of freeway management agencies.



2023 Freeway Survey Q6, Q10, Q50 (n=311) *Source: USDOT*

Figure 5. Operational Strategies on Freeways

While 42 percent deploy one or more of these surveyed operational strategies, nearly one fourth operate two or more (23 percent, or 58 freeway management agencies).

Additional analysis found that among the 58 freeway management agencies reporting use of two or more surveyed operational strategies, 24 agencies deploy both ICM and managed lanes, 17 agencies deploy both ramp metering and managed lanes, and 14 agencies deploy all three surveyed operational strategies. Only 3 agencies reported deploying both ramp metering and ICM.

[16] **Managed lanes** involve operating a set of freeway lanes that are separate from general purpose lanes using operational strategies such as pricing, vehicle eligibility, and access control to achieve optimal traffic conditions. To successfully execute these types of operational strategies, ITS is often used.

Ramp metering uses traffic signals installed on freeway on-ramps to control the frequency at which vehicles enter the flow of traffic on the freeway.

ICM is an approach to managing a transportation corridor (i.e., freeway, arterial, and public transit facilities with cross-facility connections) as a multimodal system, integrating operations such as traffic incident management, work zone management, traffic signal timing, and real-time traveler information to maximize the capacity of all facilities and modes across the corridor.

Key Findings for the Arterial Management Survey

This section summarizes key findings from the Arterial Management Survey, which was distributed to two distinct survey populations – (1) State DOT districts managing arterial roads and (2) local arterial management agencies. Findings are presented for all 2023 respondents (i.e., a total of 276 State DOT districts managing arterials and 423 local arterial management agencies).

Where applicable, subgroup findings highlight significant differences for **State DOT districts managing arterials** based on:

- **Population groups:** State DOT districts with at least one large urban area compared to State DOT districts without a large urban area. A large urban area is defined as places with populations greater than 100,000 or counties with populations greater than 950,000.

Where applicable, subgroup findings highlight significant differences for **local arterial management agencies** based on:

- **Agency type:** county agencies and place agencies
- **Statistical area:** agencies in large metropolitan areas, smaller urban areas (including small metropolitan and micropolitan areas), and rural areas

In comparing differences across subgroups, significance testing was performed at a significance level of 0.05, with a 95 percent confidence interval.

The key findings for arterial management agencies include:

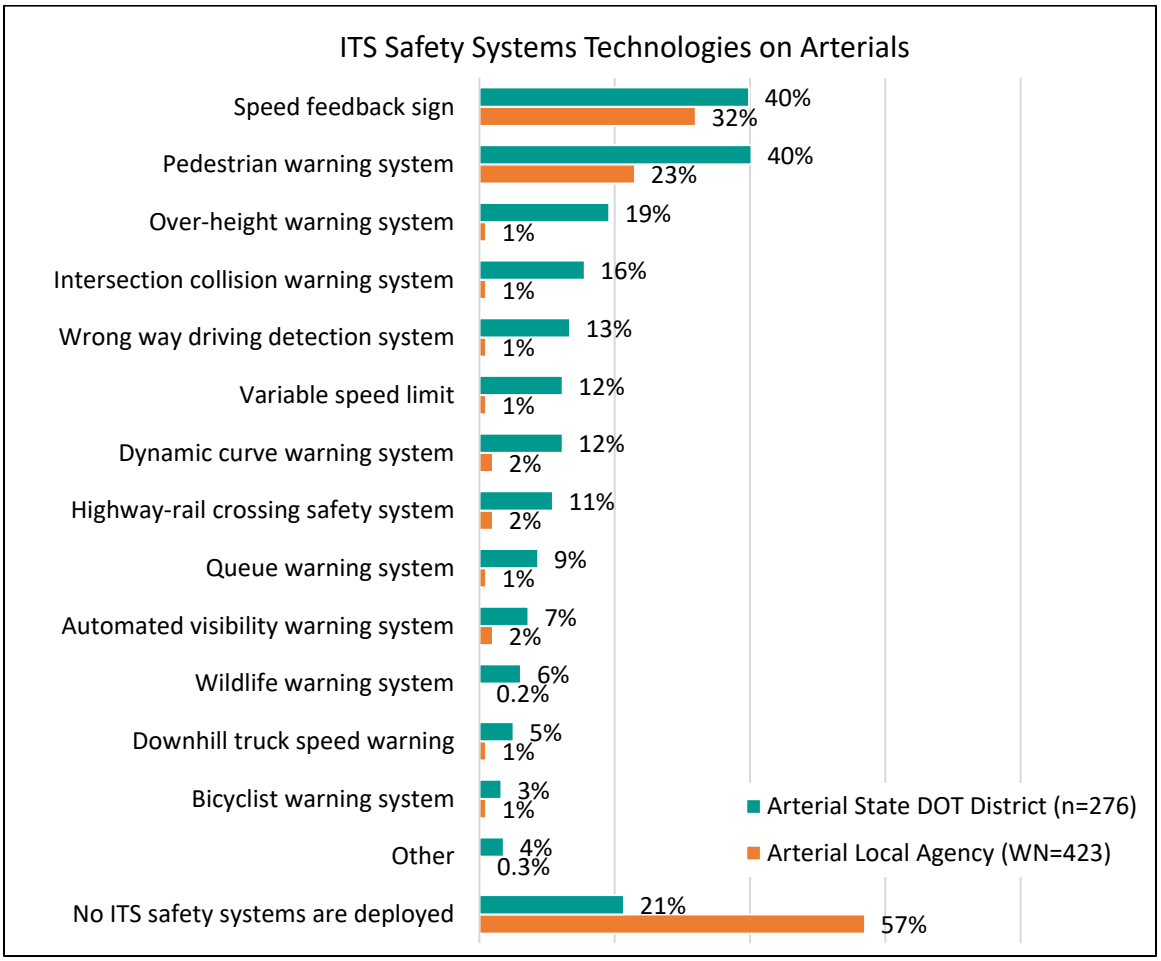
- *Pedestrian warning systems* and *speed feedback signs* are the two most commonly deployed ITS safety systems on arterials.
- ITS are widely deployed at signalized intersections.
- State DOT districts managing arterials are significantly more active in deploying ITS on arterial roads compared to local arterial management agencies.
- For a number of ITS technologies, local arterial management agencies in large metropolitan areas have significantly higher rates of adoption than local arterial management agencies in smaller urban and rural areas.

Key Finding: Pedestrian warning systems and speed feedback signs are the two most commonly deployed ITS safety system technologies on arterials.

While State DOT districts managing arterials are significantly more likely than local arterial management agencies to deploy one or more ITS safety system technologies (78 percent compared to 42 percent), higher percentages of both of agency types deploy *speed feedback signs* and *pedestrian warning systems* compared to other surveyed ITS safety system technologies.

Figure 6 shows that among State DOT districts managing arterials, *speed feedback signs* and *pedestrian warning systems* are each deployed by 40 percent, with no more than one fifth deploying other surveyed ITS safety systems. Similarly, about one third of local arterial management agencies deploy *speed feedback signs* (32 percent), and nearly one fourth deploy *pedestrian waning systems* (23 percent). All other surveyed ITS safety systems are deployed by 2 percent or less of local agencies.

Notably, more than half of local arterial management agencies reported no ITS safety systems deployed (57 percent), as did one fifth of State DOT districts managing arterials (21 percent). These findings suggest there may be opportunities for increasing the rates of deployment of ITS safety systems, particularly among local arterial management agencies.



2023 Arterial Survey Q17 *Source: USDOT*

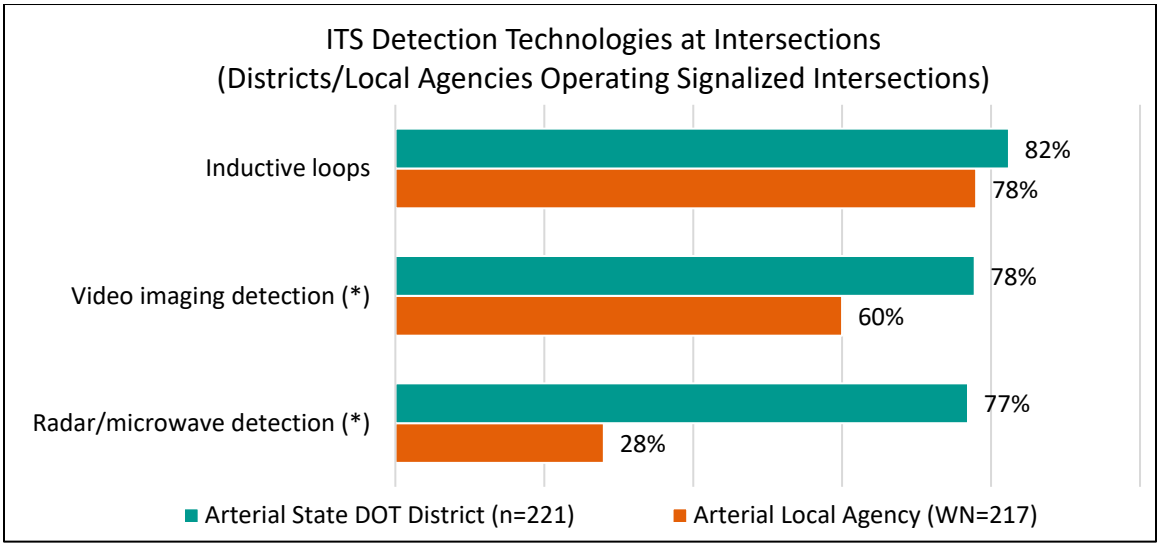
Figure 6. ITS Safety Systems Technologies on Arterials

Key Finding: ITS are widely deployed at signalized intersections.

Nearly all agencies that manage signalized intersections deploy one or more ITS detection technology at intersections, including both State DOT districts managing arterials (98 percent) and local arterial management agencies (94 percent).

As shown in Figure 7, a large majority of both State DOT districts and local arterial management agencies operating signalized intersections deploy *inductive loops* (82 percent and 78 percent, respectively). More than three fourths of State DOT districts deploy *video imaging detection* (78 percent), as does 60 percent of local arterial management agencies.

More than three fourths of State DOT districts operating signalized intersections deploy *radar/microwave detection* (77 percent) at signalized intersections while significantly fewer local arterial management agencies deploy *radar/microwave detection* (28 percent) at signalized intersections.

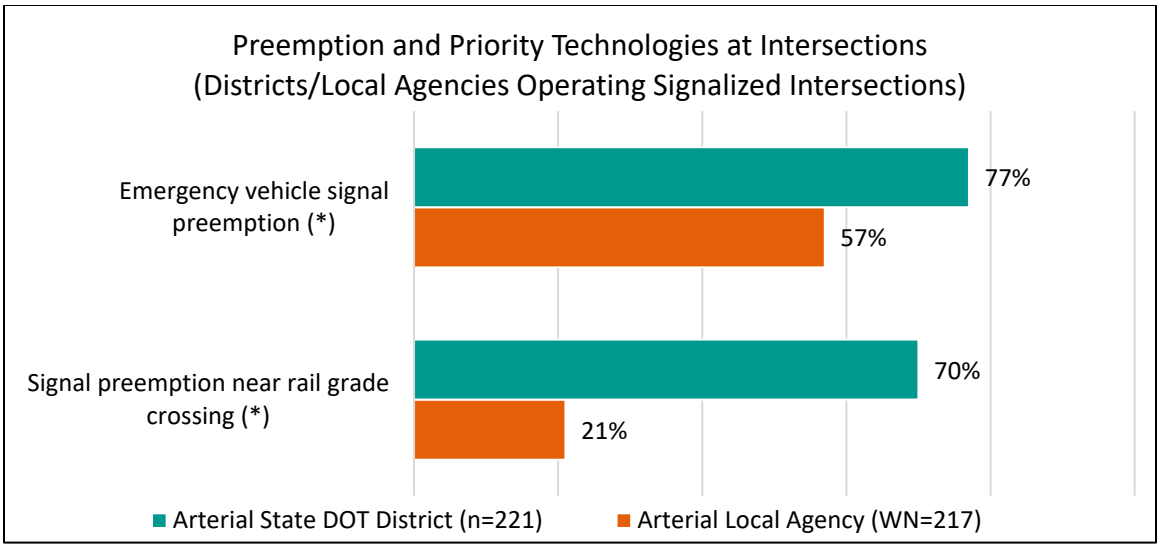


2023 Arterial Survey Q3 *Source: USDOT*
** statistically significant difference between State DOT districts managing arterials and local agencies*

Figure 7. ITS Detection Technologies at Intersections (Districts/Local Agencies Operating Signalized Intersections)

In addition, nearly all State DOT districts operating signalized intersections deploy at least one preemption or priority technology at signalized intersections (91 percent), as do a majority of local arterial management agencies operating signalized intersections (62 percent).

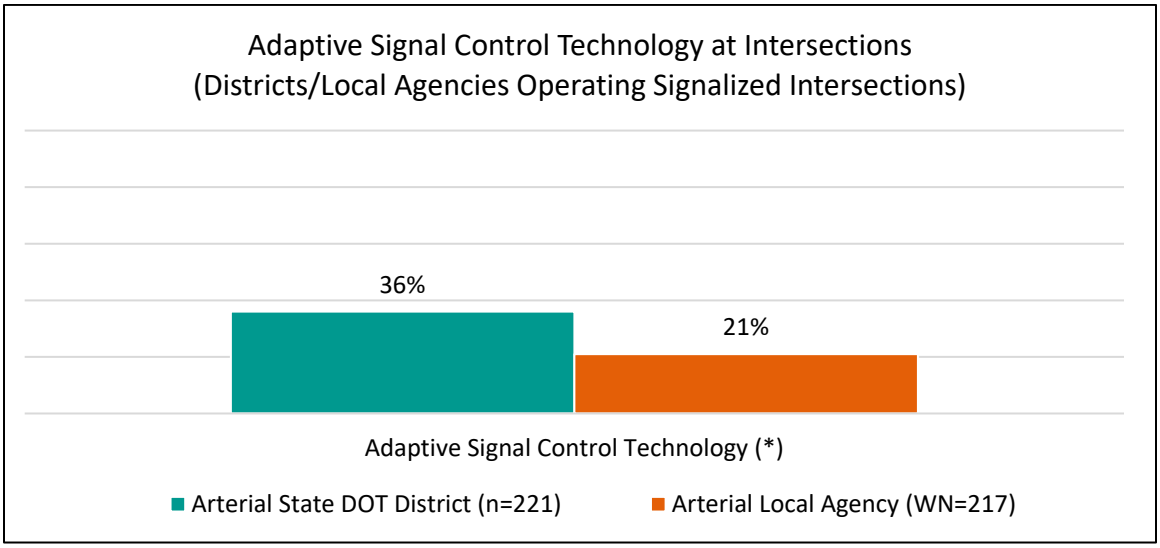
As shown in Figure 8, more than three fourths of State DOT districts operating signalized intersections deploy *emergency vehicle signal preemption* (77 percent). Likewise, a majority of local arterial management agencies operating signalized intersections deploy *emergency vehicle preemption* (57 percent). A large majority of State DOT districts operating signalized intersections also deploy *signal preemption near rail grade crossing* (70 percent).



2023 Arterial Survey Q8 *Source: USDOT*
** statistically significant difference between State DOT districts managing arterials and local agencies*

Figure 8. Preemption and Priority Technologies at Intersections (Districts/Local Agencies Operating Signalized Intersections)

While detection technologies and some preemption technologies have high rates of deployment among both local arterial management agencies and State DOT districts managing arterials, *adaptive signal control technology (ASCT)* is not as widely deployed. Just over one third of State DOT districts operating signalized intersections (36 percent) deploy *ASCT*, as do about one fifth of local arterial management agencies (21 percent) as shown in Figure 9.



2023 Arterial Survey Q5 *Source: USDOT*
** statistically significant difference between State DOT districts managing arterials and local agencies*

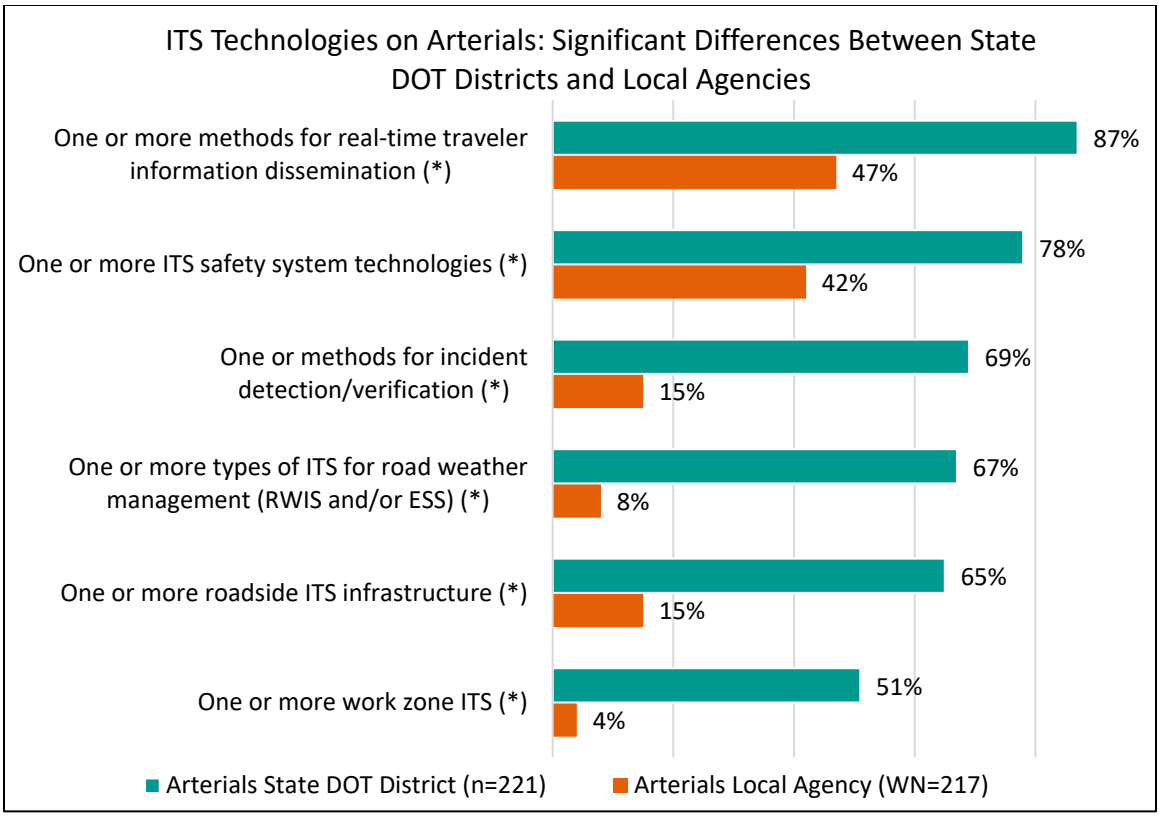
Figure 9. Adaptive Signal Control Technology at Intersections (Districts/Local Agencies Operating Signalized Intersections)

Key Finding: State DOT districts managing arterials are significantly more active in deploying ITS on arterial roads compared to local arterial management agencies.

Across a range of ITS technologies, the rate of deployment tends to be higher among State DOT districts managing arterials compared to local arterial management agencies. For example, nearly all State DOT districts managing arterials (87 percent) are using one or methods to disseminate real-time traveler information, compared to less than one half of local arterial management agencies (47 percent). Likewise, more than three fourths of State DOT districts managing arterials (78 percent) are deploying one or more ITS safety system technologies compared to 42 percent of local arterial management agencies.

For incident detection/verification method, roadside ITS infrastructure, ITS for road weather management, and work zone ITS, the gap in deployment rates between State DOT districts managing arterials and local arterial management agencies is even wider.

Figure 10 shows the significant difference in ITS deployments between State DOT districts managing arterials and local arterial management agencies. These findings suggest that there may be an opportunity for growth in ITS deployment particularly among local arterial management agencies.



2023 Arterial Survey Q9, Q17, Q19, Q21-Q24 *Source: USDOT*
** statistically significant difference between State DOT districts managing arterials and local agencies*

Figure 10. ITS Technologies on Arterials: Significant Differences Between State DOT Districts and Local Agencies

State DOT districts operating signalized intersections are also significantly more likely than local arterial management agencies operating signalized intersections to deploy certain ITS at signalized intersections, including:

- *Radar/microwave detection* (77 percent compared to 28 percent)
- *Signal preemption near rail grade crossing* (77 percent compared to 28 percent)
- *ASCT* (36 percent compared to 21 percent)

Key Finding: For a number of ITS technologies, local arterial management agencies in large metropolitan areas have significantly higher rates of adoption than local arterial management agencies in smaller urban and rural areas.

As shown in Table 4, local arterial management agencies in large metropolitan areas are significantly more likely than those in smaller urban and rural areas to deploy one or more of the following key ITS technologies or methods:

- Real-time traveler information dissemination methods
- ITS safety system technologies
- Incident detection/verification methods
- Roadside ITS infrastructure

These findings seem to suggest that local arterial management agencies in large urban areas may have different transportation needs or challenges compared to agencies in smaller urban and rural areas and that a “one-size-fits-all” approach may not work. Understanding the different transportation management challenges that agencies face in urban versus rural contexts may be important for identifying appropriate ITS solutions.

While higher percentages of local arterial management agencies in large urban areas tend to deploy ITS compared to agencies in small urban and rural areas, the survey found no differences by area type in the deployment of ITS for road weather management (i.e., the deployment of RWIS and/or ESS) and work zone ITS technologies; local arterial management agencies in large metropolitan areas as well as those in smaller urban and rural areas having similarly low levels of deployment of these types of ITS.

Table 4. Local Arterial Management Agencies: Comparison of ITS Deployment Between Statistical Areas

Technology/Method	Large Metropolitan Areas (WN=74; UWN=108)	Smaller Urban and Rural Areas (WN=349; UWN=315)
One or more methods for real-time traveler information dissemination *	62%	44%
One or more ITS safety system technologies *	58%	38%
One or methods for incident detection/verification *	40%	9%
One or more roadside infrastructure ITS *	30%	12%
ITS for road weather (RWIS and/or ESS)	13%	7%
One or more work zone ITS technologies	8%	3%

2023 Arterial Survey Q9, Q17, Q19, Q21-Q24 *Source: USDOT*

** statistically significant difference between local agencies in large metropolitan areas and local agencies in smaller urban and rural areas*

As shown in Table 5, among those operating signalized intersections, local arterial management agencies in large metropolitan areas are generally more likely than local agencies in smaller urban and rural areas to deploy ITS, including detection and preemption technologies, as well as ASCT.

Table 5. ITS Technologies at Signalized Intersections (Local Agencies Operating Signalized Intersections): Significant Differences Between Statistical Areas

Technology at signalized intersections	Large Metropolitan Areas (WN=61; UWN=95)	Smaller Urban and Rural Areas (WN=155; UWN=126)
Inductive loops *	89%	74%
Video imaging detection *	84%	50%
Radar/microwave detection *	56%	18%
Emergency vehicle signal preemption *	76%	50%
Signal preemption near a rail grade crossing *	49%	10%
Adaptive Signal Control Technology *	33%	17%

2023 Arterial Survey Q3, Q5, Q8 *Source: USDOT*

** statistically significant difference between local agencies in large metropolitan areas and local agencies in smaller urban and rural areas*

Crosscutting Findings For the Freeway and Arterial Management Surveys

This section presents key findings that synthesize data from the freeway management and arterial management surveys. These synthesized key findings include:

- External data sources are widely used for freeway and arterial management, particularly among State DOT districts, and these data serve multiple purposes.
- Freeway management agencies are significantly more likely than arterial management agencies to use vehicle probe data, including agency-deployed technology and/or purchased data. The percentage that purchases vehicle probe data exceeds the percentage that deploys vehicle probe readers, with the exception of local arterial management agencies.

Key Finding: External data sources are widely used for freeway and arterial management, particularly among State DOT districts, and these data serve multiple purposes.

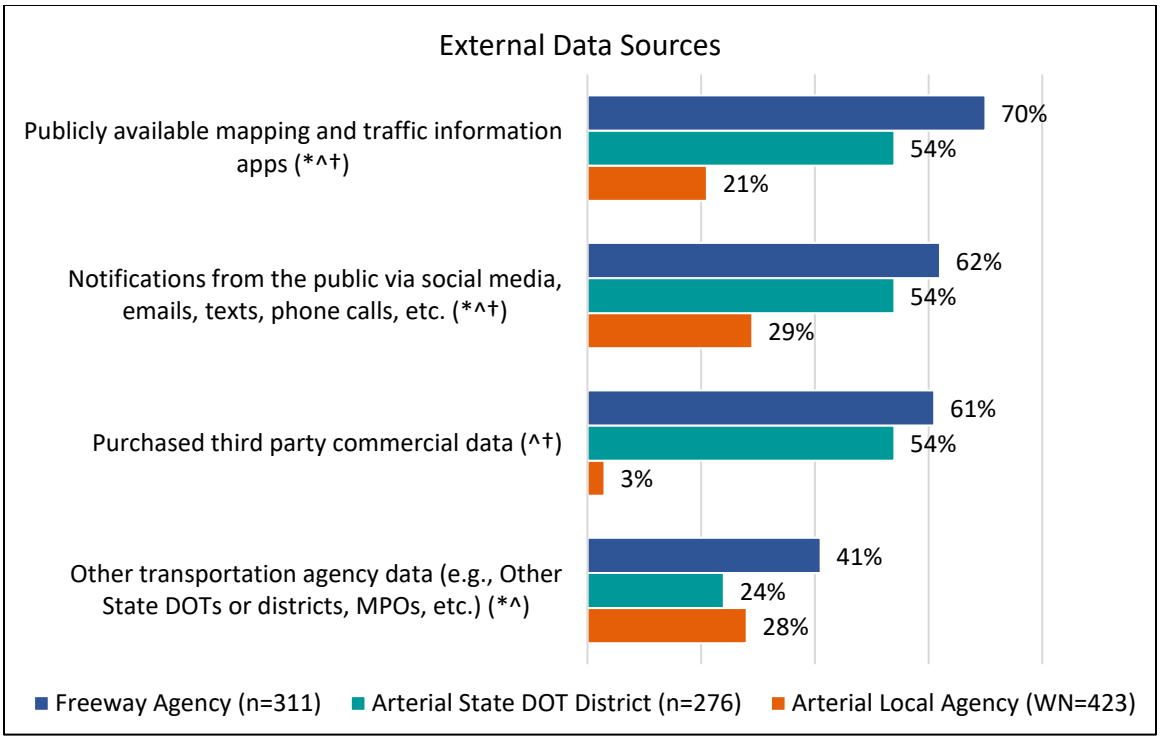
Nearly all freeway management agencies (90 percent) and a large majority of State DOT districts managing arterials (80 percent) use at least one source of external data for roadway management. Majorities of both agency types use the following:

- *Publicly available mapping and traffic information apps*
- *Notifications from the public via social media, emails, texts, phone calls, etc.*
- *Purchased third-party commercial data*

Among local arterial management agencies, less than one half indicated use of one or more sources of external data (47 percent), which is significantly lower than the use of external data reported by freeway management agencies (90 percent) and State DOT districts managing arterials (80 percent).

In addition, local arterial management agencies use a slightly different mix of external data sources. *Other transportation agency data (e.g. State DOT, MPOs,[17] etc.)* (28 percent) is among the top two mentions by local agencies, whereas it is the least mentioned source of external data by freeway management agencies and State DOT districts managing arterials (i.e., relative to the other surveyed external data sources). Local management agencies are also significantly less likely than other agency types to use *purchased third-party commercial data* (3 percent), as shown in Figure 11.

[17] Metropolitan planning organization.



2023 Freeway Survey Q3; Arterial Survey Q11 *Source: USDOT*
** statistically significant difference between freeway agencies and State DOT districts managing arterials;*
^ statistically significant difference between freeway agencies and local agencies;
† statistically significant difference between State DOT districts managing arterials and local agencies

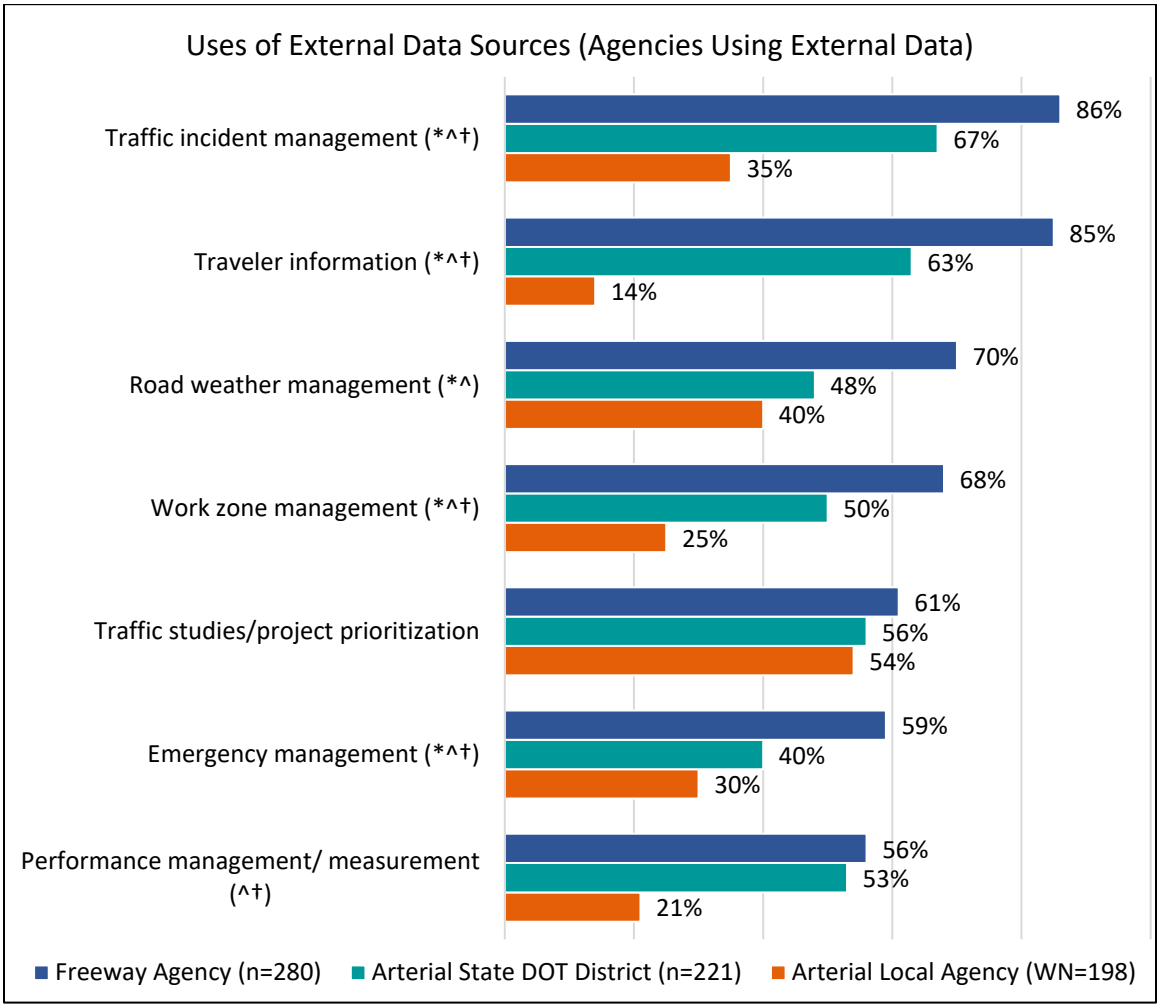
Figure 11. External Data Sources

The 2023 ITS Deployment Tracking Survey included a new question in the Freeway Management and Arterial Management Surveys about how external data are being used, and the findings are shown in Figure 12.

Among responding agencies that use external data, both freeway management agencies and State DOT districts managing arterials indicated *traffic incident management* and *traveler information* as their top two uses. The third most common use reported by freeway management agencies was *road weather management* (70 percent), whereas for State DOT districts managing arterials it was *traffic studies/project prioritization* (56 percent).

Among local arterial management agencies, the top two reported uses of external data include *traffic studies/project prioritization* (54 percent) and *road weather management* (40 percent). The third top mention by local arterial management agencies was *traffic incident management* (35 percent). The use of external data for this purpose is still much lower among local arterial management agencies compared to freeway management agencies and State DOT districts managing arterials.

Relative to freeway management agencies and State DOT districts managing arterials, local arterial management agencies are also much less likely to use external data for *traveler information* (14 percent), *work zone management* (25 percent), or *performance management/measurement* (21 percent).



2023 Freeway Survey Q4; Arterial Survey Q12 *Source: USDOT*
** statistically significant difference between freeway agencies and State DOT districts managing arterials;*
^ statistically significant difference between freeway agencies and local agencies;
† statistically significant difference between State DOT districts managing arterials and local agencies

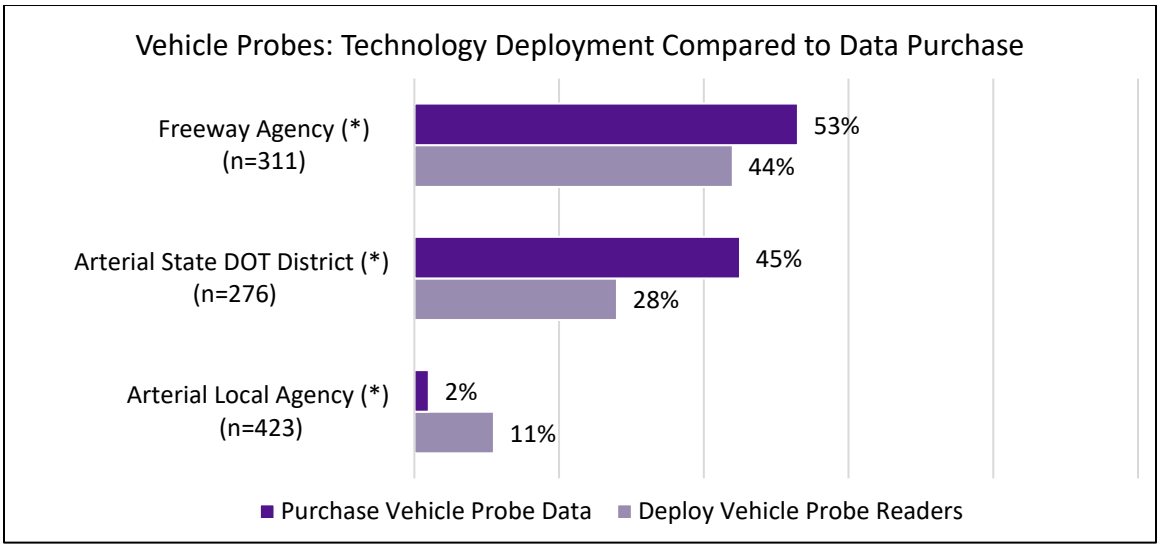
Figure 12. Uses of External Data Sources (Agencies Using External Data)

Key Finding: Freeway management agencies are significantly more likely than arterial management agencies to use vehicle probe data, including agency-deployed technology and/or purchased data. The percentage that purchases vehicle probe data exceeds the percentage that deploys vehicle probe readers, with the exception of local arterial management agencies.

Freeway and arterial management agencies were asked which vehicle probe readers they deploy (if any), and in a separate question, agencies that indicated they are purchasing third-party commercial data were also asked whether they purchase vehicle probe data (among other types of data).

The survey found that freeway management agencies (73 percent) are significantly more likely to use data from vehicle probes (whether through agency-deployed technology or agency-purchased vehicle probe data) than State DOT districts managing arterials (54 percent), which are also significantly more likely than local arterial management agencies (13 percent) to use data from vehicle probes.

As shown in Figure 13, among all responding freeway management agencies, just over one half reported the purchase of vehicle probe data (53 percent), while significantly fewer freeway management agencies are deploying one or more vehicle probe technologies (44 percent). Likewise, State DOT districts managing arterials are significantly more likely to purchase vehicle probe data (45 percent) than to deploy vehicle probe technology (28 percent). Among local arterial management agencies, few agencies are deploying vehicle probe technologies (11 percent) or purchasing vehicle probe data (2 percent).



2023 Freeway Survey Q2, Q5; Arterial Survey Q10, Q13 *Source: USDOT*

Figure 13. Vehicle Probe Data: Technology Deployment Compared to Data Purchase

In addition, when State DOT districts managing freeways are compared to toll authorities, State DOT districts are significantly more likely to purchase vehicle probe data than to deploy the technology (56 compared to 39 percent), whereas the reverse is true for toll authorities (26 percent deploy compared to 82 percent purchase).

Based on the 2023 survey data, additional analysis was performed among agencies that are deploying vehicle probe readers and/or purchasing vehicle probe data to understand the extent to which they are doing the following:

- Only deploying vehicle probe readers (i.e., and not purchasing)
- Only purchasing vehicle probe data (i.e., and not deploying)
- Both deploying vehicle probe readers and purchasing vehicle probe data

As shown in Table 6, freeway management agencies and to an even greater extent State DOT districts managing arterials are more likely to only purchase vehicle probe data than they are to only deploy vehicle probe readers (39 percent compared to 28 percent for freeway management agencies and 48 percent compared to 16 percent for State DOT districts managing arterials).

However, for both agency types, about one third (33 percent of freeway management agencies and 36 percent of State DOTs managing arterials) are both purchasing vehicle probe data and deploying vehicle probe readers.

These findings suggest that for some agencies, there may be utility to both deploying vehicle probe readers and purchasing vehicle probe data, such that one may not necessarily be a substitute for the other. However, there seems to be a greater inclination to purchase rather than to deploy among those freeway management agencies and State DOT districts managing arterials that are doing one and/or the other. Future surveys will show whether there is an increasing trend toward purchasing vehicle probe data instead of deploying vehicle probe technology.

Table 6. Overlap of Vehicle Probe Deployment and Purchase of Vehicle Probe Data (Agencies Deploying and/or Purchasing Vehicle Probe Data)

Technology/Purchase	Freeway management agencies (n=273)	Arterial State DOT districts (n=38)
Only deploy vehicle probe technology (no purchase of vehicle probe data)	28%	16%
Only purchase vehicle probe data (no deployment of vehicle probe technology)	39%	48%
Both deploy and purchase	33%	36%

2023 Freeway Survey Q2, Q5; Arterial Survey Q10, Q13 *Source: USDOT*

Key Findings for the Transit Management Survey

This section summarizes key findings from the Transit Management Survey, which was distributed to transit management agencies. Findings are presented for all 2023 respondents (i.e., a total of 464 transit agency respondents). Where applicable, subgroup findings highlight significant difference for transit management agencies based on:

- **Area type:** agencies in large urban, small urban, and rural areas

In comparing differences across subgroups, significance testing was performed at a significance level of 0.05, with a 95 percent confidence interval.

The key findings for transit management agencies include:

- Across all transit management agencies, the most widely deployed ITS technologies are automatic vehicle location, computer-aided dispatch and scheduling, and mobile data terminals, though deployment rates vary by mode.
- For many ITS technologies, there are significant differences by area type; ITS deployment rates are highest among transit agencies in large urban areas.
- Less than half of transit management agencies have adopted electronic fare payment, while cash and physical tickets/tokens/vouchers (i.e., with no embedded technology) are the two most accepted fare media among surveyed transit management agencies.
- More than 40 percent of transit management agencies reported using one or more ITS data standards.
- Just over 40 percent of transit management agencies provide an open data feed, mostly for fixed route service, and large majorities of transit agencies with an open data feed provide static as well as real-time information to the public.

Key Finding: Across all transit management agencies, the most widely deployed ITS technologies are automatic vehicle location (AVL), computer-aided dispatch and scheduling (CADS), and mobile data terminals (MDT), though deployment rates vary by mode.

Across all transit modes, large majorities of transit management agencies are deploying *AVL* (81 percent), *CADS* (70 percent), and *MDT*[18] (62 percent). Fewer agencies are deploying *automatic passenger counters (APC)* (37 percent), *maintenance management systems (MMS)* (27 percent), and *transit signal priority (TSP)* (13 percent) as shown in Figure 14.

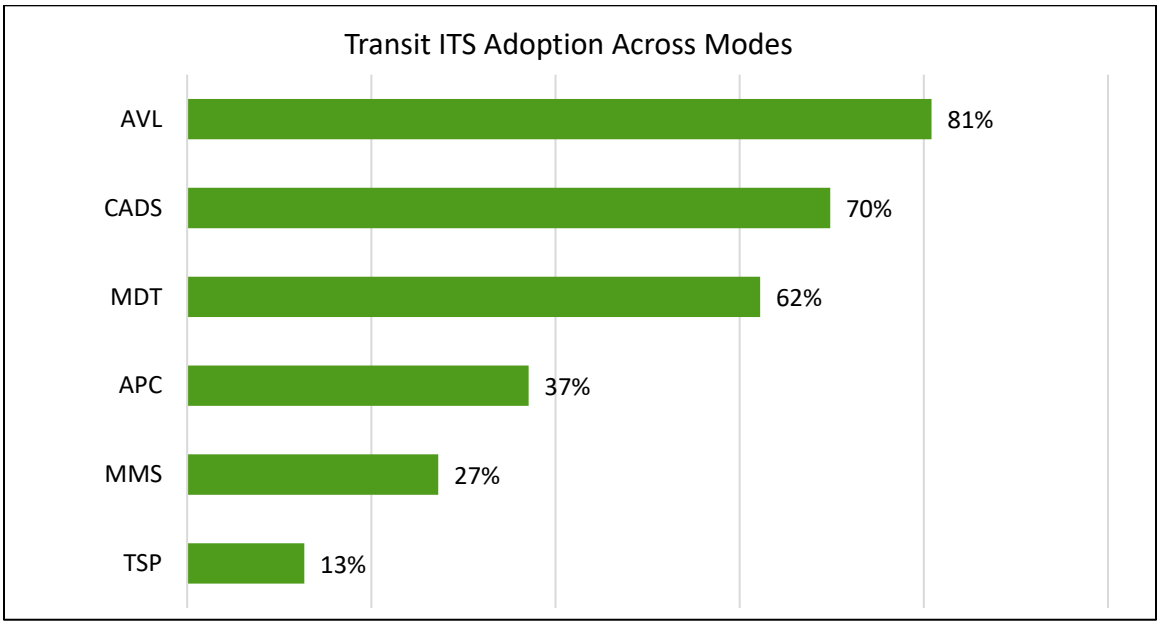
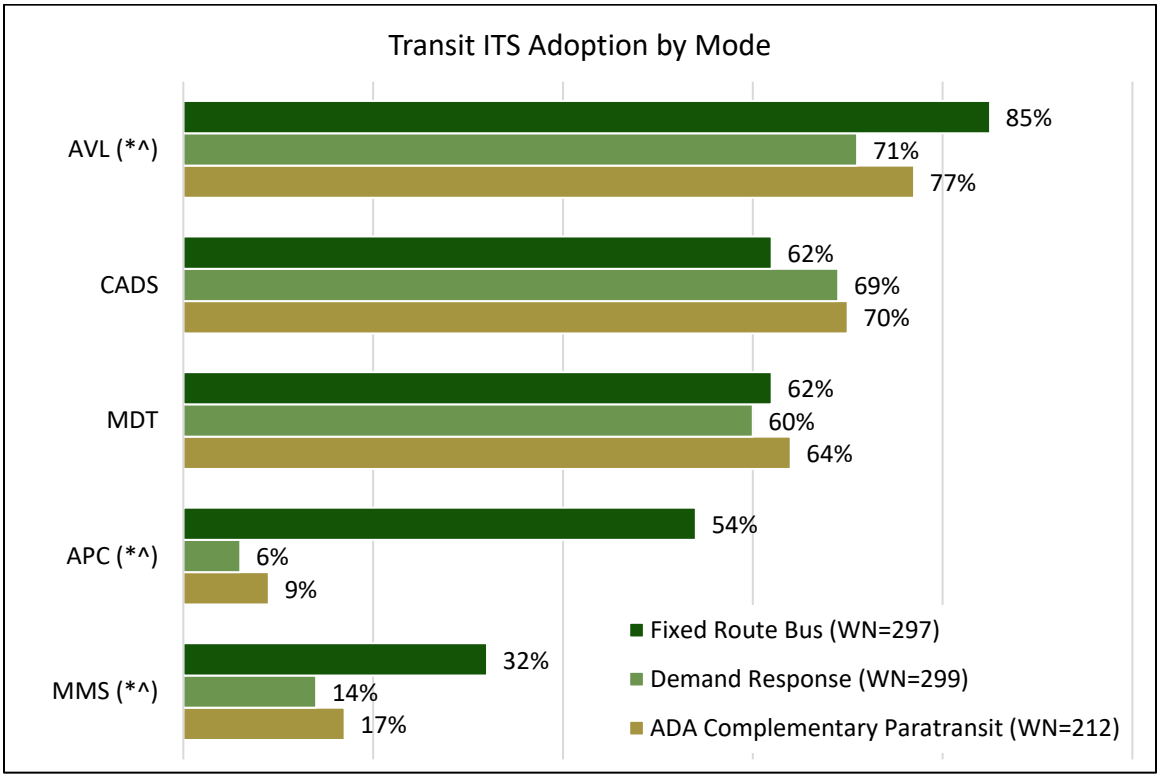


Figure 14. Transit ITS Adoption Across Modes

[18] Throughout the report, the term MDT is used to refer to the technology category encompassing MDTs, mobile data computers (MDC), and transit control heads (TCH).

Figure 15 shows transit ITS deployments by transit mode, including fixed route bus, demand responsive service, and ADA complementary paratransit.[19] *CADS* and *MDT* are deployed by similar percentages of transit management agencies across these modes. However, *AVL*, *APC*, and *MMS* are deployed by significantly higher percentages on fixed route buses as compared to demand responsive services and ADA complementary paratransit.



2023 Transit Survey Q3 *Source: USDOT*

**statistically significant difference between deployment on fixed route bus and demand response;*
^ statistically significant difference between deployment on fixed route bus and ADA complementary paratransit

Figure 15. Transit ITS Adoption by Mode

[19] Sample sizes for other modes, such as light rail/streetcar, heavy or rapid rail, commuter rail, and ferry were too small for subgroup analysis.

Key Finding: For many ITS technologies, there are significant differences by area type; ITS deployment rates are highest among transit agencies in large urban areas.

While transit management agencies in large urban areas always tend to deploy ITS at higher rates than transit management agencies in rural areas, comparisons to transit management agencies in small urban areas are less consistent.

Table 7 shows for some ITS, the percentage of agencies deploying them is similar among transit agencies in small urban areas and in large urban areas (e.g., *MDT*); whereas in other cases, the percentage of small urban agencies deploying a given ITS is similar to transit agencies in rural areas (e.g., *MMS*). Moreover, there are some ITS for which there are significant differences in deployment across all three area types (e.g., *APC*).

Table 7 also shows transit agencies in large urban areas are significantly more likely than agencies in either small urban or rural areas to deploy *APC*, *MMS*, and *TSP*. In addition, transit agencies in large urban areas are significantly more likely than those in rural areas to deploy *MDT*. For *AVL* and *CADS*, there were no statistically significant differences in deployment by geographic area type; these technologies are widely used across urban and rural contexts.

Table 7. Transit ITS Adoption: Significant Differences Between Area Types

Technology	Large Urban Area (WN=190; UWN=138)	Small Urban Areas (WN=109; UWN=156)	Rural Areas (WN=166; UWN=170)
AVL	85%	81%	76%
CADS	74%	67%	67%
MDT *	70%	60%	55%
APC *^†	60%	38%	10%
MMS *†	36%	20%	22%
TSP *†	25%	8%	2%

2023 Transit Survey Q3 *Source: USDOT*
** statistically significant difference between large urban and rural transit agencies;*
^ statistically significant difference between small urban and rural transit agencies;
† statistically significant difference between large urban and small urban transit agencies

Table 8 shows that transit management agencies in large urban areas (84 percent), as well as those in small urban areas (83 percent), are significantly more likely than transit agencies in rural areas (66 percent) to use one or more methods to disseminate real-time traveler information.

With regard to the provision of an open data feed and the provision of an agency branded trip planner, there are significant differences in deployment across all area types. Transit management agencies in large urban areas are significantly more likely than transit agencies in both small urban areas and rural areas to *provide an open data feed* and an *agency branded trip planner*. In addition, transit agencies in

small urban areas are significantly more likely than those in rural areas to *provide an open data feed*, as well as to provide an *agency branded trip planner*.

Transit management agencies in both large and small urban areas tend to *deploy electric fare payment (EFP)* at higher rates than transit agencies in rural areas. While relatively few transit agencies *partner to deploy ICM*, transit management agencies in large urban areas (11 percent) are significantly more likely than either agencies in small urban (4 percent) or rural areas (2 percent) to *partner to deploy ICM*.

Table 8. Transit Management Agencies: Comparison of ITS Deployment Between Area Types

Technology	Large Urban Area (WN=190; UWN=138)	Small Urban Areas (WN=109; UWN=156)	Rural Areas (WN=166; UWN=170)
One or more traveler information dissemination methods *^	84%	83%	66%
Open data feed *^†	59%	46%	21%
Trip planner *^†	51%	36%	15%
EFP *^	56%	46%	24%
Partner to deploy ICM *†	11%	4%	2%

2023 Transit Survey Q12, Q15, Q24, Q30, Q46 *Source: USDOT*

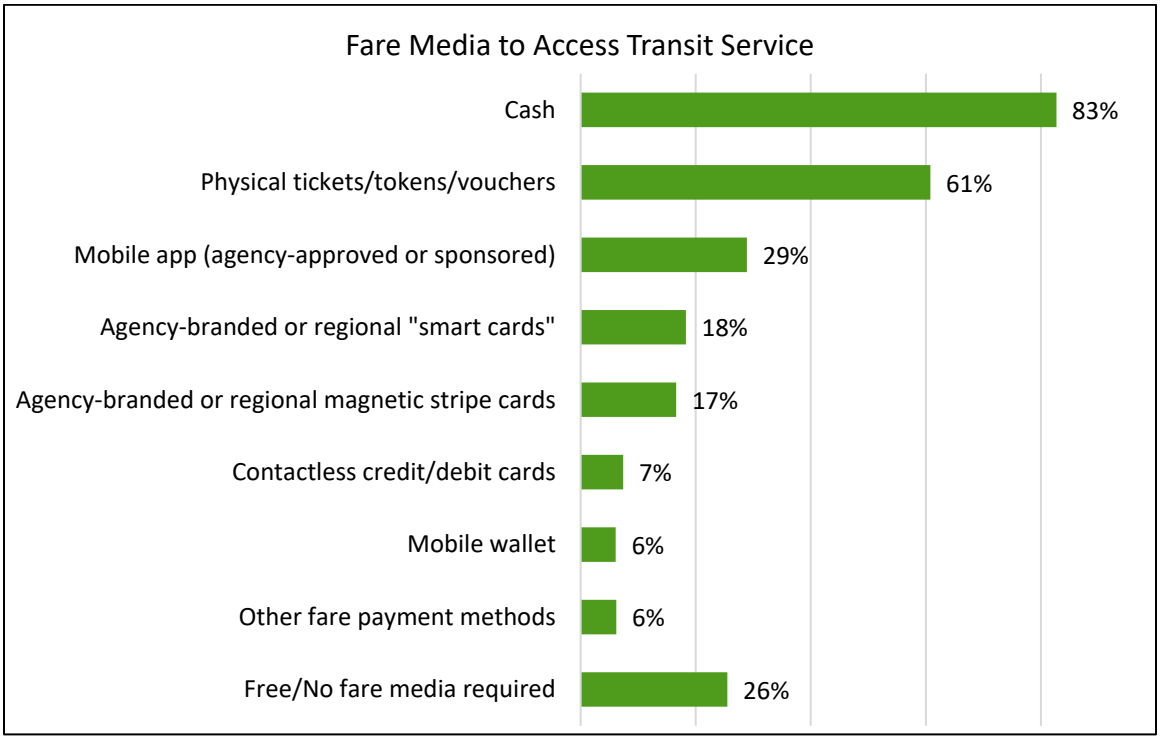
** statistically significant difference between large urban and rural transit agencies;*
^ statistically significant difference between small urban and rural transit agencies;
† statistically significant difference between large urban and small urban transit agencies

Key Finding: Less than half of transit management agencies have adopted EFP, while cash and physical tickets/tokens/vouchers (i.e., with no embedded technology) are the two most accepted fare media among surveyed transit management agencies.

Overall, 42 percent of transit management agencies reported *deploying EFP*. Transit agencies in large urban areas (56 percent) and transit agencies in small urban areas (46 percent) are each significantly more likely than transit agencies in rural areas (24 percent) to *deploy EFP*. The 2023 survey established a baseline for EFP among transit management agencies nationwide, and the next ITS Deployment Tracking Survey is expected to provide insight on trends in EFP use.

Figure 16 shows that with respect to fare media that are used to access transit service, the two most widely accepted methods by transit management agencies are *cash* (83 percent) and *physical tickets/tokens/vouchers* (61 percent), where 8 percent of all transit agencies report *cash* as their only fare media.

As shown in Figure 16, other surveyed methods are used by significantly fewer transit management agencies including *mobile apps* (29 percent), *agency-branded or regional smart cards* (18 percent), and *agency-branded or regional magnetic stripe cards* (17 percent). *Contactless credit/debit cards* and *mobile wallets* are each used by less than 10 percent of responding transit agencies.



2023 Transit Survey Q16; (n=464; 1% missing) *Source: USDOT*

Figure 16. Fare Media to Access Transit Service

About one fourth of transit agencies reported *free/no fare media required* (26 percent), which was a new response category in 2023 and could apply to one or all modes/services offered by the transit agency. Twelve (12) percent of all transit agencies reported only *free/no fare media required*, while 14 percent reported both *free/no fare media required* and another fare media.[20]

Table 9 shows that transit management agencies in both large urban areas and small urban areas are significantly more likely than transit agencies in rural areas to use *mobile apps* and *agency-branded or regional magnetic strip cards*.

A significantly higher percentage of transit agencies in large urban areas use *agency-branded or regional smart cards* compared to both transit agencies in small urban areas and transit agencies in rural areas. Transit agencies in large urban areas are also significantly more likely than agencies in rural areas to use *mobile wallet*.

Table 9. Fare Media to Access Transit Service: Significant Differences Between Area Types

Fare Media	Large Urban Area (WN=190; UWN=138)	Small Urban Areas (WN=109; UWN=156)	Rural Areas (WN=166; UWN=170)
Mobile app (agency-approved or sponsored) *^	40%	30%	16%
Agency-branded or regional magnetic stripe cards *^	24%	21%	5%
Agency-branded or regional "smart cards" *^†	33%	12%	5%
Mobile wallet *	11%	5%	1%

2023 Transit Survey Q16 *Source: USDOT*

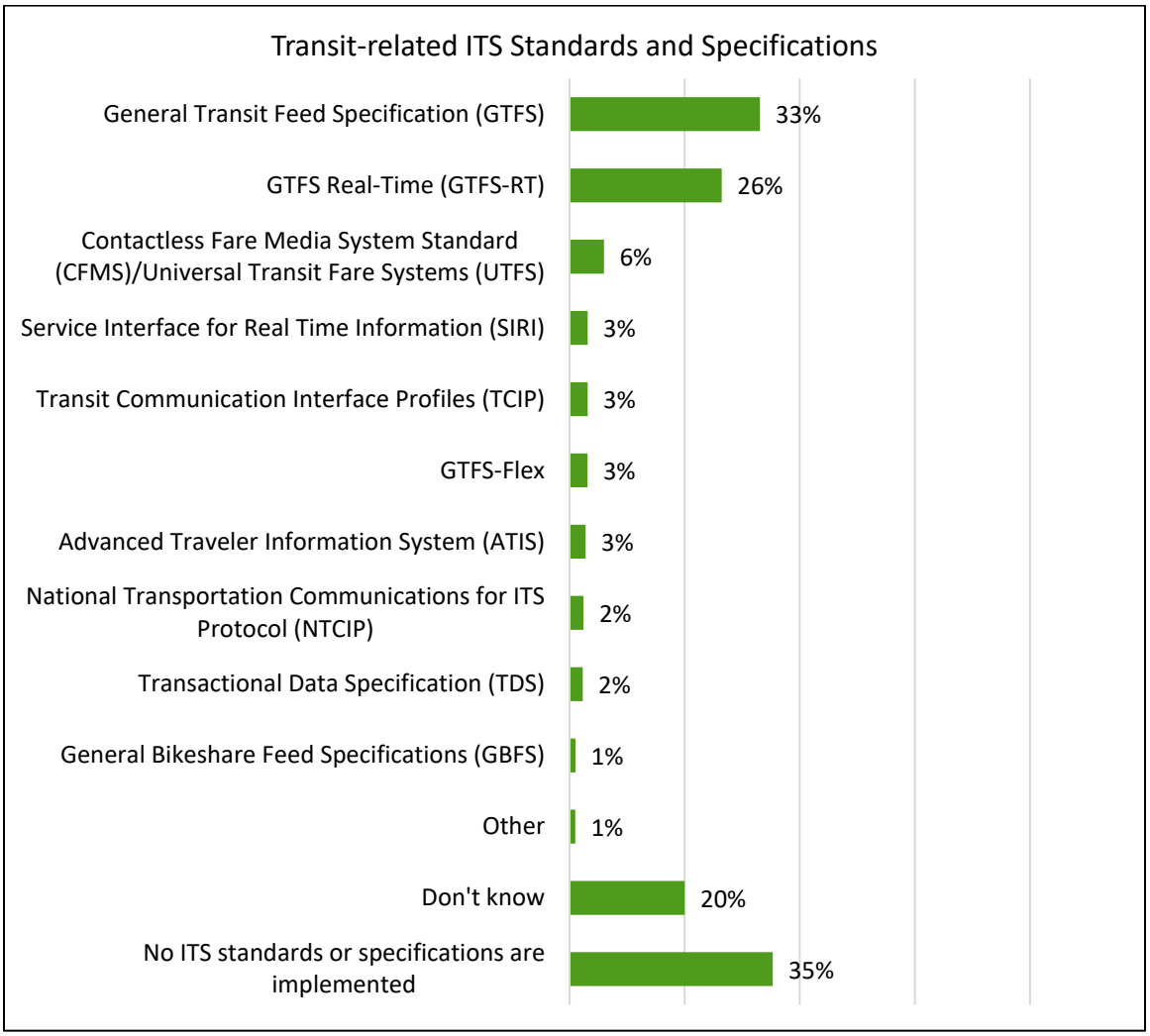
** statistically significant difference between large urban and rural transit agencies;*
^ statistically significant difference between small urban and rural transit agencies;
† statistically significant difference between large urban and small urban transit agencies

[20] The free/no fare may be limited to specific route(s), service(s), or ridership type(s).

Key Finding: More than 40 percent of transit management agencies reported using one or more ITS data standards.

Forty-two (42) percent of transit management agencies use one or more ITS standards.

Figure 17 shows the two most commonly used standards are *General Transit Feed Specification (GTFS)* (33 percent) and *GTFS Real-Time* (26 percent). However, all other surveyed ITS standards are each used by less than 7 percent of responding transit management agencies. Additionally, more than one half of transit respondents (55 percent) indicated either *no ITS standards or specifications are implemented* (35 percent) or *don't know* (20 percent).



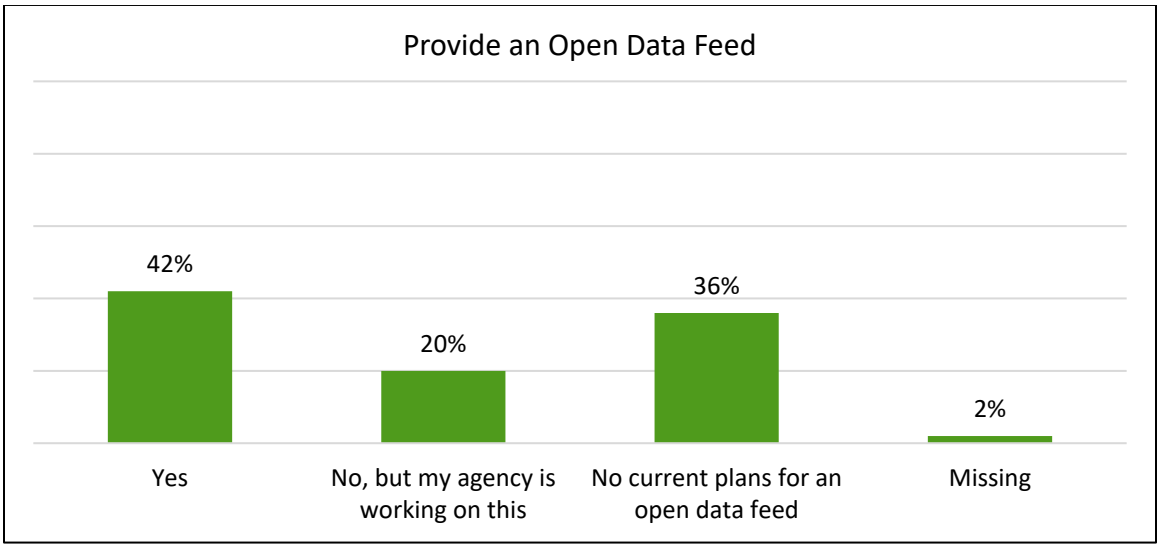
2023 Transit Survey Q51; (n=464; 3% missing) *Source: USDOT*

Figure 17. Transit-related ITS Standards and Specifications

Key Finding: Just over 40 percent of transit management agencies provide an open data feed, mostly for fixed route service, and large majorities of transit agencies with an open data feed provide static as well as real-time information to the public.

Forty-two (42 percent) of transit management agencies *provide an open data feed*, and one fifth are *working on this* (20 percent) as shown in Figure 18.

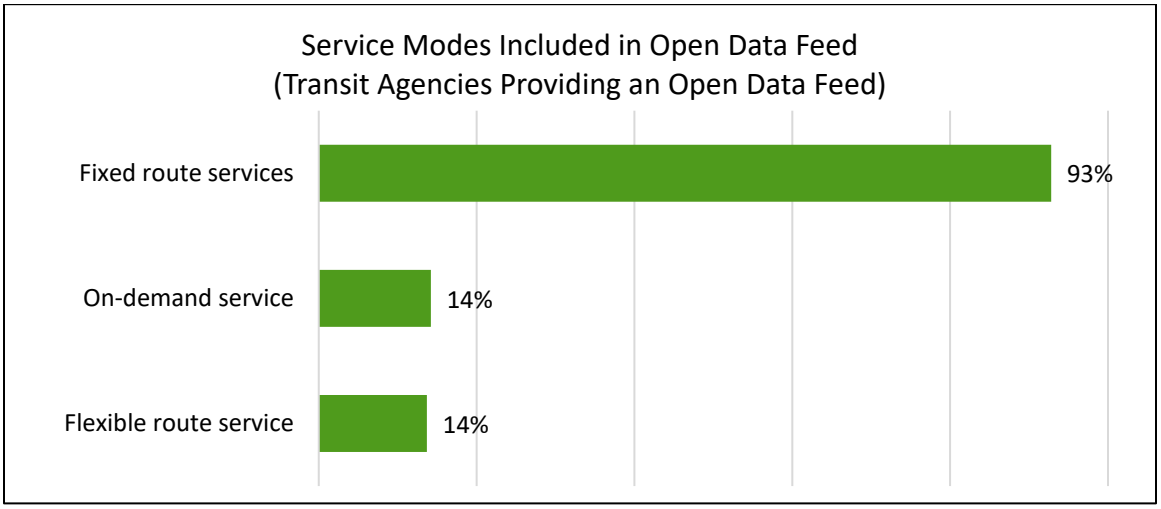
Additional analysis found that transit management agencies in large urban areas (59 percent) are significantly more likely than those in either small urban (46 percent) or rural areas (21 percent) to *provide an open data feed*.



2023 Transit Survey Q9; (n=464) *Source: USDOT*

Figure 18. Provide an Open Data Feed

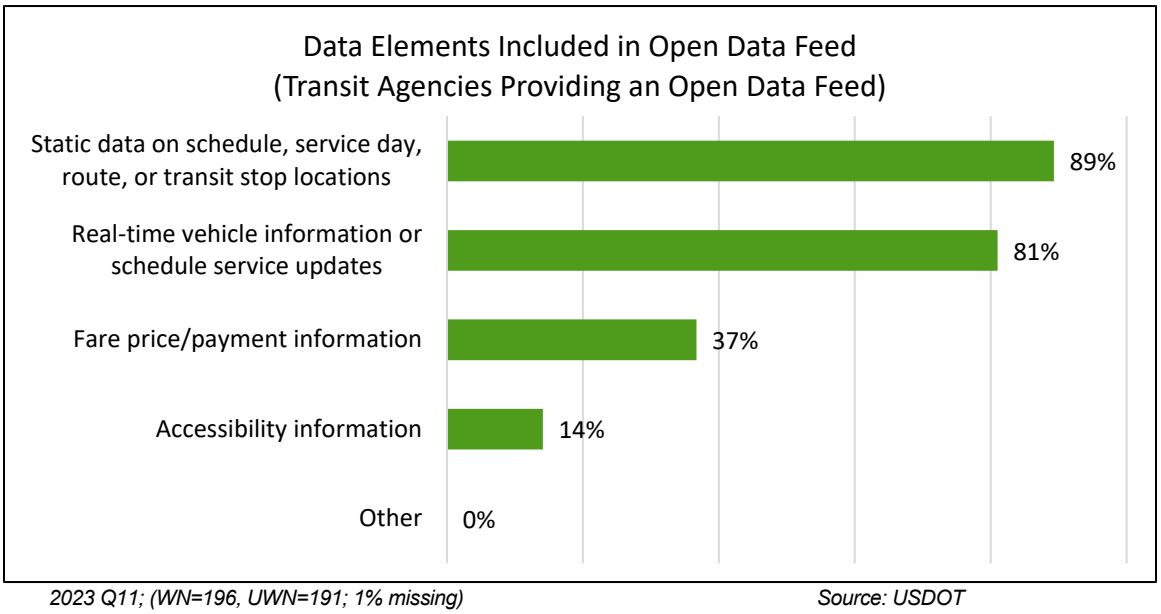
Figure 19 shows nearly all of the 196 transit management agencies that provide an open data feed include *fixed route services* (93 percent) in their open data feed. A smaller percentage of these transit agencies include *on-demand service* (14 percent) or *flexible route services* (14 percent).



2023 Q10; (WN=196, UWN=191; 0% missing) *Source: USDOT*

Figure 19. Service Modes Included in Open Data Feed (Transit Agencies Providing an Open Data Feed)

Figure 20 shows that a large majority of the 196 transit management agencies that provide an open data feed provide *static data on schedule, service day, route, or transit stop locations* (89 percent) and *real-time vehicle information or schedule service updates* (81 percent). Fewer transit agencies provide *fare price/payment information* (37 percent), and 14 percent provide *accessibility information*.



2023 Q11; (WN=196, UWN=191; 1% missing) *Source: USDOT*

Figure 20. Data Elements Included in Open Data Feed (Transit Agencies Providing an Open Data Feed)

Crosscutting Findings for the Freeway, Arterial, and Transit Management Surveys

This section presents key findings synthesized across the freeway management, arterial management, and transit management surveys. The synthesized key findings include:

- Freeway management agencies and State DOT districts managing arterials lead the way with respect to the deployment of telecommunications technologies, with large majorities deploying fiber optic cable and cellular (LTE-4G); whereas transit agencies use a greater mix of wired and wireless telecommunications technologies.
- While deployment of CV and AV technologies is relatively low across all surveyed agencies, one fourth or more of freeway management agencies and State DOT districts managing arterials are planning for the deployment of CV technologies.
- Future plans to expand/upgrade ITS or invest in new ITS vary by surveyed agency types.

Key Finding: Freeway management agencies and State DOT districts managing arterials lead the way with respect to the deployment of telecommunications technologies, with large majorities deploying fiber optic cable and cellular (LTE-4G); whereas transit agencies use a greater mix of wired and wireless telecommunications technologies.

Telecommunications technologies enable communications between ITS devices, roadside devices, and/or a central processing location and are the chief method(s) for enabling data collection, transmission, and dissemination. The findings indicate that freeway management agencies and State DOT districts managing arterials lead the way with respect to the deployment of telecommunications technologies.

Table 10 shows a large majority freeway management agencies (89 percent) as well as State DOT districts managing arterials (84 percent) use at least one telecommunications technology (either wired or wireless) to enable ITS. A smaller majority of transit management agencies reported deploying one or more telecommunications technologies (66 percent), and only about one fifth of local arterial management agencies (22 percent) are deploying one or more telecommunications technologies. In addition, 41 percent of local arterial management agencies responded *don't know*.

Of the wired technologies, *fiber optic cable* is the most used type of telecommunications technology by freeway management agencies (79 percent), as well as by State DOT districts managing arterials (70 percent), with significantly fewer freeway agencies or State DOT districts managing arterials using other types of wired telecommunication technologies.

Of the wireless technologies, *cellular (LTE-4G)* is used by 75 percent of freeway management agencies and 72 percent of State DOT districts managing arterials, and for both of these agency types, deployment of cellular (LTE-4G) is significantly higher than for any other wireless technologies.

Relative to other agency types, local arterial management agencies were significantly more likely to respond *don't know*, *no telecommunications used to enable ITS on arterials*, or *no ITS infrastructure or devices deployed*. Although their overall deployment of telecommunications technologies to enable ITS is very limited, *fiber optic cable* and *cellular* (*LTE-4G)* are the most deployed technologies by local arterial management agencies (17 percent and 9 percent, respectively).

Transit management agencies are the only agency type that are more likely to deploy wireless technologies than wired technologies (64 percent compared to 43 percent), which may reflect the different communication needs of transit management agencies relative to the other agency types that manage roads. While no single wireless technology is used by more than half of transit agencies, nearly one half deploy *cellular (LTE-4G)* (47 percent), more than one third deploy *Wi-Fi* (37 percent), and about one fourth deploy *5G new radio and small cell infrastructure* (24 percent).

Fiber optic cable (31 percent) is the most commonly deployed wired telecommunications technology among transit management agencies, but only about one third of transit respondents are deploying this technology. It may be possible that transit agencies are using the fiber optic cable networks deployed by freeway management agencies or State DOT districts that manage arterials since transit agencies do not manage roads.

Overall, the findings suggest that there is greater readiness for ITS deployment among freeway management agencies and State DOT districts managing arterials (compared to local arterial management agencies), as a greater percentage of these agency types have the telecommunications to enable ITS.

Table 10. Telecommunications Technologies

Response	Freeway Agency (n=311)	Arterial State DOT District (n=276)	Arterial Local Agency (n=423)	Transit Agency (n=464)
Wired technologies (deploy one or more)	82%	74%	19%	43%
Fiber optic cable	79%	70%	17%	31%
Twisted copper pair/Twisted wired pair	32%	25%	6%	8%
Coaxial	21%	15%	3%	11%
Data cable over modem	16%	23%	2%	11%
Digital subscriber line	16%	16%	1%	5%
Wireless (deploy one or more)	82%	78%	14%	64%
Cellular (LTE-4G)	75%	72%	9%	47%
Microwave	33%	27%	1%	2%
5G New Radio and small cell infrastructure	30%	21%	5%	24%
Wi-Fi	16%	12%	4%	37%
Dedicated short range communications	11%	11%	2%	4%
LTE-Cellular V2X	10%	16%	1%	3%
Cellular (GPRS 2G or 3G)	8%	9%	1%	2%
Mobile or Fixed service satellite	2%	1%	1%	3%
Ultra-wideband	2%	4%	1%	2%
Don't know	10%	12%	41%	24%
No telecommunications used to enable ITS	0%	1%	20%	5%
Not applicable, no ITS deployed	1%	3%	17%	3%

2023 Freeway Survey Q35; Arterial Survey Q42; Transit Survey Q36 *Source: USDOT*

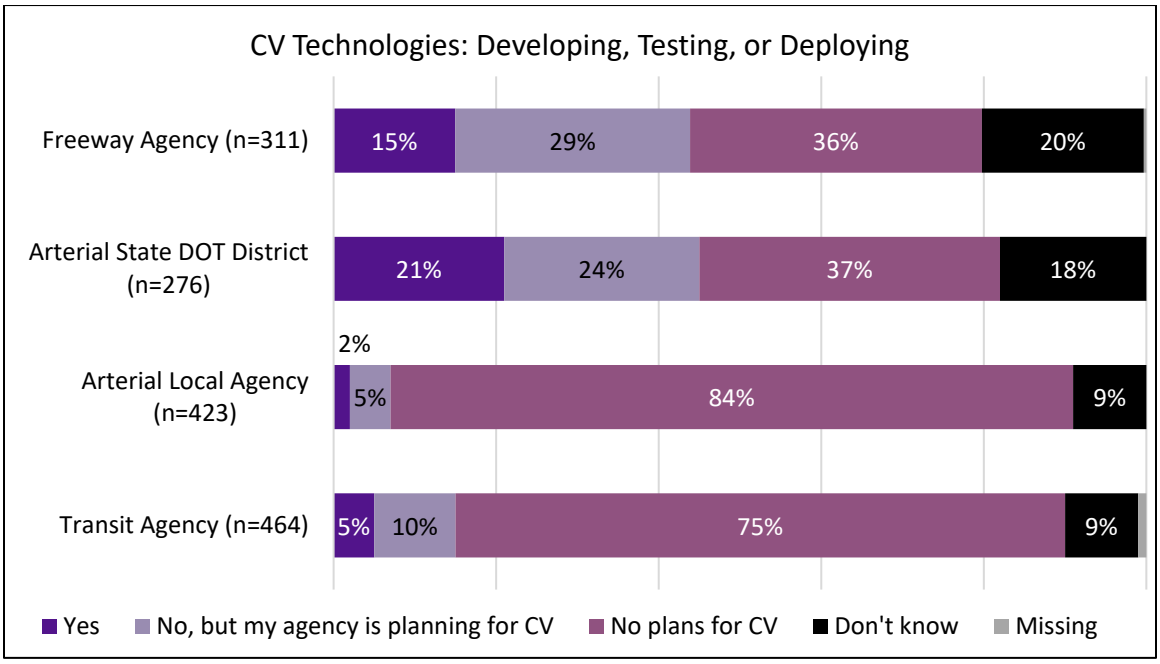
Key Finding: While deployment of CV and AV technologies is relatively low across all surveyed agencies, one fourth or more of freeway management agencies and State DOT districts managing arterials are planning for the deployment of CV technologies.

CV Technologies

Figure 21 shows freeway management agencies and State DOT districts managing arterials reported similar levels of engagement with CV technologies. About one fifth of State DOT districts managing arterials (21 percent) and nearly as many freeway management agencies (15 percent) reported *currently developing, testing, or deploying CV*.

In addition, about one fourth or more of each of these agency types indicated that they are not currently deploying but are *planning for CV* (24 percent of State DOT districts managing arterials and 29 percent of freeway management agencies). However, approximately one fifth of freeway management agencies (20 percent) and State DOT districts managing arterials (18 percent) responded *don't know*.

Transit management agencies and local arterial management agencies are significantly less likely to either be *developing, testing or deploying CV*, or to have *plans to do so*. Large majorities of local arterial management agencies (84 percent) and transit agencies (75 percent) reported *no plans for CV*.



2023 Freeway Survey Q21; Arterial Survey Q28; Transit Survey Q24 *Source: USDOT*

Figure 21. CV Technologies: Developing, Testing, or Deploying

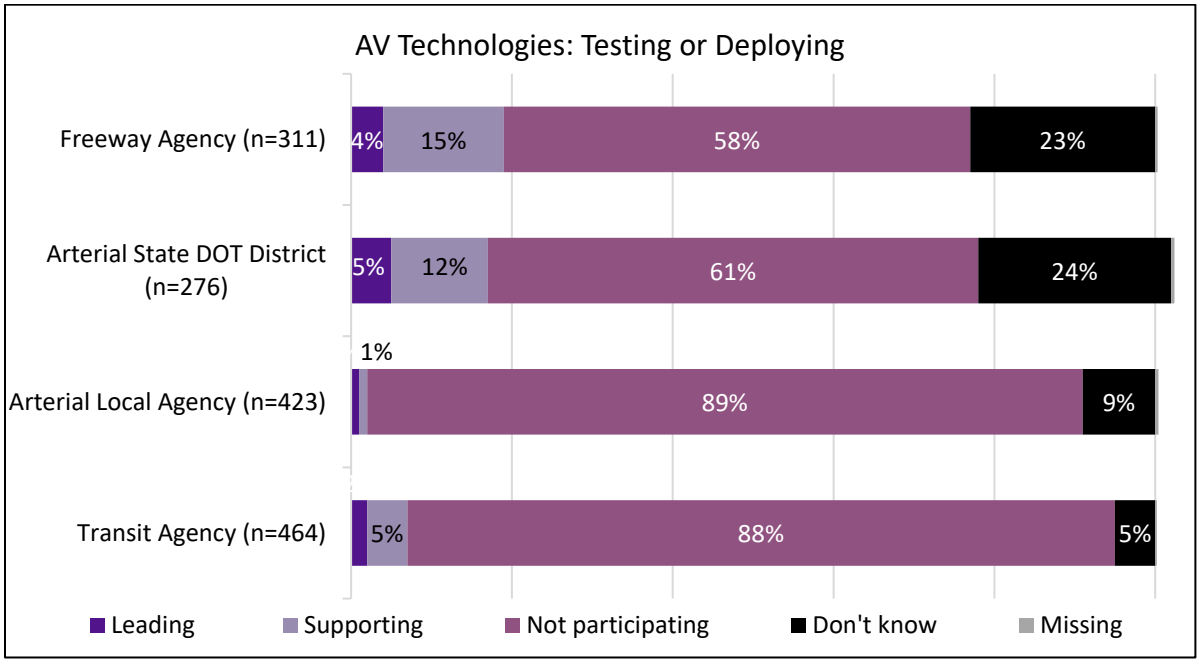
AV Technologies

With respect to AV technologies, freeway management agencies and State DOT districts managing arterials are again more active than either local arterial management agencies or transit agencies, with overall levels of AV involvement (i.e., leading or supporting AV testing in the last five years) similar to rates of reported development, testing, or deployment of CV technologies.

The 2023 Deployment Tracking Surveys asked if agencies are currently participating in or had participated in any AV tests or deployments in the last five years. Respondents were able to select both *leading AV testing/deployment* and *supporting the planning or execution of AV testing/deployment,* if applicable.

Figure 22 shows about one fifth of freeway management agencies are involved in AV testing or deployment in the last five years, with 4 percent *leading* and 15 percent *supporting* such AV testing or deployment. Similarly, for State DOT districts managing arterials, 5 percent are *leading*, and 12 percent are *supporting* AV testing or deployment.

By contrast, only 2 percent of transit agencies are *leading,* and 5 percent are *supporting* AV testing or deployment in the last five years. One (1) percent of local arterial management agencies are *leading,* and 1 percent are *supporting*.



2023 Freeway Survey Q29; Arterial Survey Q36; Transit Survey Q30 *Source: USDOT*

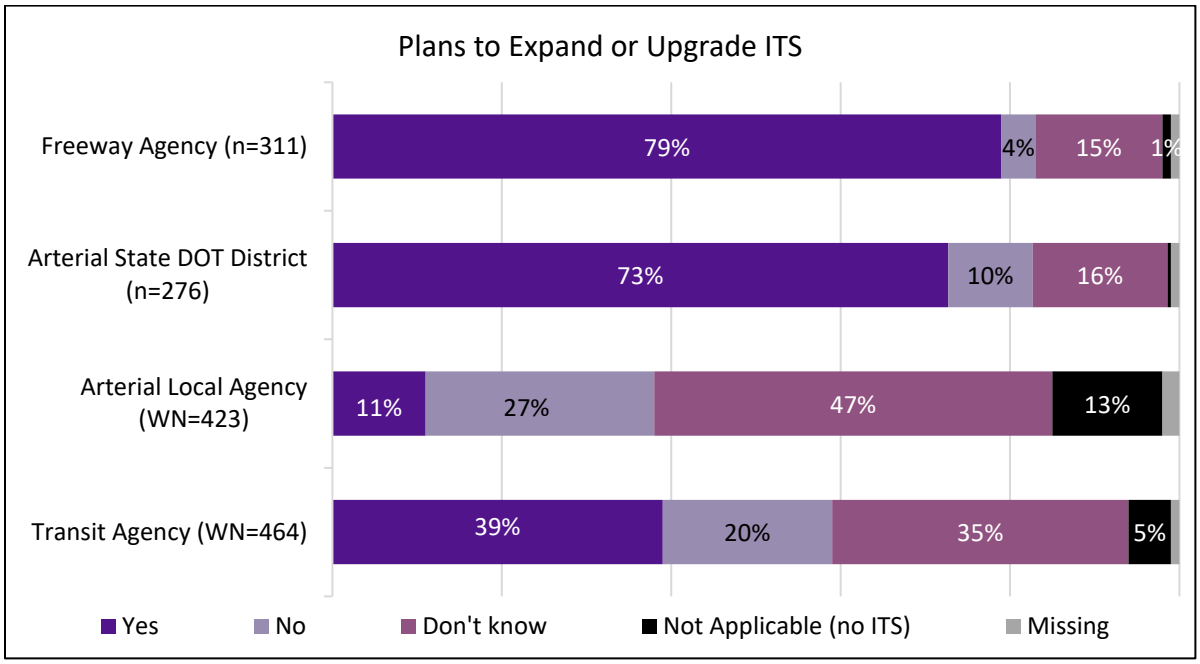
Figure 22. AV Technologies: AV Testing or Deploying[21]

[21] Respondents were able to select both leading AV testing/deployment and supporting the planning or execution of AV testing/deployment, if applicable. Therefore, the bars in the chart may not add to 100 percent.

Key Finding: Future plans to expand/upgrade ITS or invest in new ITS vary by surveyed agency types.

Figure 23 shows a large majority of freeway management agencies (79 percent) and State DOT districts managing arterials (73 percent) *plan to upgrade or expand their current ITS* in the next three years.

Significantly fewer transit management agencies (39 percent) or local arterial management agencies (11 percent) reported *plans to upgrade or expand their current ITS*. However, nearly half of local arterial management agencies (47 percent) responded *don't know,* as did just over one third of transit management agencies (35 percent).

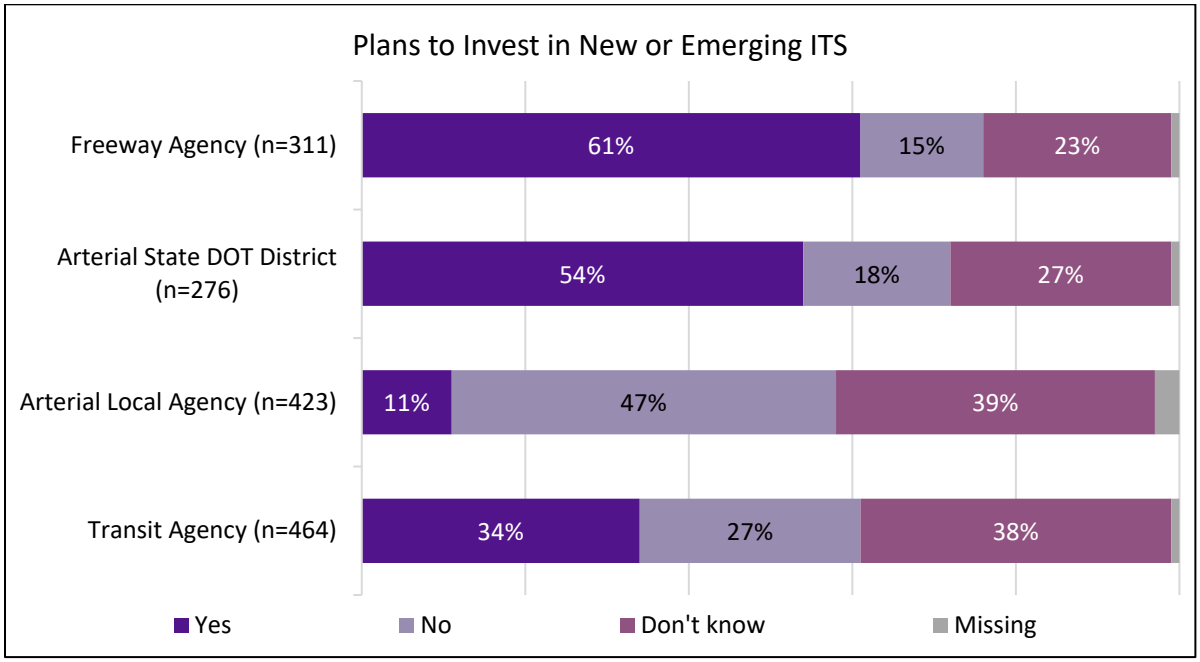


2023 Freeway Survey Q54; Arterial Survey Q60; Transit Survey Q52 *Source: USDOT*

Figure 23. Plans to Expand or Upgrade ITS

Figure 24 shows a similar pattern with a majority of freeway management agencies (61 percent) *planning to invest in new or emerging ITS* in the next three years, as well as just over half of State DOT districts managing arterials (54 percent). By contrast, about one third of transit management agencies (34 percent) and only 11 percent of local arterial management agencies *plan to invest in new or emerging ITS* in the next three years.

About one fourth of freeway management agencies and State DOT districts managing arterials responded *don't know* about their plans to invest in new ITS. Among local arterial management agencies and transit management agencies, an even larger percentage – nearly 40 percent – responded *don't know*. Compared to other agency types, local arterial management agencies were most likely to report *no plans for new ITS investment*.



2023 Freeway Survey Q55; Arterial Survey Q61; Transit Survey Q53 *Source: USDOT*

Figure 24. Plans to Invest in New or Emerging ITS

In general, these findings related to future ITS investment plans (whether expanding/upgrading or investing in new ITS) are not surprising given the higher level of ITS activity among freeway management agencies and State DOT districts managing arterials. Both of these agency types also have higher percentages deploying telecommunication technologies, which are foundational to the deployment of ITS.

Chapter 4. Conclusions

With the 2023 ITS Deployment Tracking Survey, the ITS JPO significantly expanded the geographic coverage of the ITS Deployment Tracking Survey to include smaller urban and rural areas in addition to large metropolitan areas, thus enabling the reporting of ITS deployment data on a nationwide basis. Given that the 2023 ITS Deployment Tracking Survey was the first time in which smaller urban and rural areas were surveyed, there are no trend data for these new populations. The 2023 ITS Deployment Tracking Survey data establish a baseline for freeway, arterial, and transit agencies' deployment of ITS nationwide. Following the next ITS Deployment Tracking Survey (anticipated in 2026), it will be possible to assess trends for this nationwide sample.

The 2023 ITS Deployment Tracking Survey provides insights on where technical assistance or outreach may be needed to increase adoption of less mature ITS technologies. Survey responses can also raise questions that may merit further research and investigation.

ITS safety systems technologies present opportunities for future growth

Among all freeway respondents, 76 percent reported deploying at least one surveyed ITS safety systems technology. However, no single ITS safety system technology is used by a majority of freeway management agencies. The most commonly deployed ITS safety systems include *queue warning systems* (40 percent) and *wrong way driving systems* (33 percent). While these findings reflect the variety of safety-related needs of freeway management agencies, they also suggest there is room for growth in the deployment of ITS safety systems technologies on freeways.

Among State DOT districts managing arterials and local arterial management agencies, there are two ITS safety system technologies that are more commonly deployed (relative to the other safety systems) - *speed feedback signs* and *pedestrian warning systems* – but each of these technologies is deployed by 40 percent of State DOT districts managing arterials and no more than one third of local arterial management agencies. All other surveyed ITS safety systems are deployed by significantly fewer State DOT districts and local arterial management agencies. Overall, these findings suggest that there is room for growth in the deployment of ITS safety systems among both State DOT districts managing arterials and local arterial management agencies.

Across all surveys there are significant differences in ITS deployment by area type.

Across the three survey populations, the survey team conducted subgroup analysis that assessed differences in ITS deployment by area type. Specific measures of area type were developed for each survey population. For example, for both the Freeway Management Survey and the Arterial State DOT Survey, State DOT districts with a large urban area were compared to State DOT districts without a large urban. For the Local Arterial Survey, however, the sample was developed using Census data, so it was

possible to analyze ITS deployment by census-designated statistical areas. For the Transit Management Survey, the survey team relied on area type designations in the NTD.

Across all four survey populations, the survey found a consistent pattern – more urbanized areas tend to deploy ITS at higher rates compared to less urbanized areas. For example, for a number of ITS technologies, State DOT districts with large urban areas are significantly more likely to deploy ITS compared to State DOT districts without a large urban area – both on freeways and arterials. In the case of local arterial management agencies, local agencies in large metropolitan areas tend to have the higher percentages of ITS adoption when compared to local agencies in smaller urban and rural areas. Among transit management agencies, there was a similar pattern whereby higher percentages of transit agencies in large urban areas deploy ITS than transit agencies in rural areas, and for a number of ITS, transit agencies in large urban areas are also more likely than transit agencies in small urban areas to deploy.

A number of ITS technologies have reached maturity.

Freeway Management Agencies

Most responding freeway management agencies are deploying ITS, with a large majority of freeway management agencies having deployed one or more of the following:

- *DMS*
    - For real-time traveler information dissemination (89 percent)
    - For management of adverse weather impacts (85 percent)
    - For work zone management (70 percent)
- *CCTV* for incident detection/verification (85 percent)
- *Radar/microwave detection* (69 percent)
- *Permanent* Road Weather Information Systems (RWIS) or Environmental Sensor Stations (ESS) (79 percent)

Arterial Management Agencies

On arterials, nearly all State DOT districts that manage arterials and local arterial management agencies (that manage signalized intersections) are deploying ITS at signalized intersections:

- One or more ITS detection technologies at signalized intersections (98 percent of State DOT districts and 94 percent of local arterial management agencies) including:
    - *Inductive loops* (82 percent of State DOT districts; 78 percent of local arterial management agencies)
    - *Video imaging detection* (78 percent of State DOT districts; 50 percent of local arterial management agencies)

- One or more preemption or priority technology at signalized intersections (91 percent of State DOT districts and 62 percent of local arterial management agencies) including:
    - *Emergency vehicle signal preemption* (77 percent of State DOT districts; 57 percent of local arterial management agencies)

Transit Management Agencies

For transit management agencies, mature technologies that are deployed at high rates include *AVL* (81 percent), *CADS* (70 percent), and *MDTs* (62 percent). These technologies are deployed by large majorities across different transit modes.

Some ITS technologies are less widely adopted.

Among freeway management agencies, a number of surveyed ITS technologies have not attained widespread deployment, and future surveys will provide insight on whether the deployment of these ITS technologies is growing or has leveled off. Less widely deployed ITS technologies (or strategies that involve the deployment of ITS) are *ramp metering, ICM,* and *managed lanes*. Likewise, many of the surveyed ITS safety system technologies are deployed by one fourth or fewer freeway management agencies, as are a number of work zone ITS technologies.

Among arterial management agencies, including both State DOT districts managing arterials and local agencies, *ASCT* is less widely deployed, as is *TSP*. Similar to freeway management agencies, there are also a number of ITS safety system technologies and ITS for work zones that are deployed by relatively few agencies, but this may be due in part to the different transportation needs and challenges of agencies.

Among transit management agencies, the ITS technologies less widely deployed on fleet vehicles include *MMS* and *TSP*. In addition, relatively few transit management agencies are *partnering to deploy ICM*, and while just over 40 percent have *deployed EFP*, there is room for growth in the adoption of this technology.

Freeway and arterial management agencies use external data from a variety of sources.

Nearly all freeway management agencies (90 percent) and a large majority of State DOT districts managing arterials (80 percent) use at least one source of external data for roadway management. The most common sources for both are *publicly available mapping and traffic information apps* (70 percent and 54 percent respectively), *notifications from the public* (62 percent and 54 percent, respectively), and *purchased third-party commercial data* (61 percent and 54 percent, respectively).

Nearly one half of local arterial management agencies are also using external data (47 percent), with less than one third using any one surveyed source. The most widely used sources by local arterial management agencies include *notifications from the public* (29 percent), *other transportation agency data (e.g. State DOT, MPO, etc.)* (28 percent), and *publicly available mapping and traffic information apps* (21 percent). Few local agencies are *purchasing third-party commercial data* (3 percent).

The different deployment rates of telecommunication technologies suggest varying levels of readiness for ITS deployment.

Telecommunications technologies enable ITS and as a result are one factor, among others, that may indicate agencies' readiness to deploy ITS. Large majorities of freeway management agencies (79 percent) and State DOT districts managing arterials (70 percent) deploy *fiber optic cable,* and similarly, large majorities of both agency types deploy *cellular (LTE-4G)* (75 percent and 72 percent, respectively).

Among transit management agencies, nearly two thirds deploy one or more wireless technologies (64 percent), and there is a greater variation in use compared to other agency types, with the most commonly deployed wireless technologies including *cellular (LTE 4G)* (47 percent), *Wi-Fi* (37 percent), and *5G new radio and small cell infrastructure* (24 percent). Less than half of transit management agencies deploy one or more wired technologies (43 percent); however, since transit agencies do not manage the roadways, they may be using the telecommunications deployed by State DOT districts. Relative to other agency types, significantly fewer local arterial management agencies deploy either any wired technologies (19 percent) or wireless technologies (14 percent).

These findings suggest a higher level of readiness for ITS deployment among freeway management agencies and State DOT districts managing arterials, particularly when compared to local arterial management agencies. For transit management agencies, the telecommunications needs are somewhat different, as there is a greater reliance on wireless technologies, and it is unclear to what extent transit management agencies can use existing telecommunications deployed by State DOT districts or other entities.

CV and AV technologies are in the early stages of deployment

About one fifth of State DOT districts managing arterials (21 percent) and nearly as many freeway management agencies (15 percent) reported *currently developing, testing, or deploying CV*. An even larger percentage – about one fourth or more of each of these agency types – indicated that they are *planning for CV* (24 percent of State DOT districts managing arterials and 29 percent of freeway management agencies). The next Deployment Tracking Survey will provide insight on whether the agencies planning to deploy have progressed from *planning* to *developing, testing, or deploying*.

Transit management agencies and local arterial management agencies are significantly less likely to either be *developing, testing or deploying CV* (5 percent and 2 percent, respectively), or to have *plans to do so* (10 percent and 5 percent, respectively).

With respect to AV technologies nearly one fifth of freeway management agencies (19 percent) and State DOT districts managing arterials (17 percent) are leading or supporting AV testing, compared to 7 percent of transit management agencies and 2 percent of local arterial management agencies.

State DOT districts (on both freeways and arterials) are driving future plans to expand/upgrade ITS and to invest in new ITS.

In the next three years, majorities of freeway management agencies, which are largely State DOT districts, reported *planning to upgrade or expand their current ITS* (79 percent) and *planning to invest in new or emerging ITS* (61 percent). Likewise, similar percentages of State DOT districts managing arterials reported *planning to upgrade or expand their current ITS* (73 percent) and *planning to invest in new or emerging ITS* (54 percent).

By contrast, fewer transit management agencies reported *planning to upgrade or expand their current ITS* (39 percent) and *planning to invest in new or emerging ITS* (34 percent), and only 11 percent of local arterial management agencies reported either *planning to upgrade or expand their current ITS* or *planning to invest in new or emerging ITS*.

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