Intelligent Transportation Systems Deployment Tracking Survey: 2020 Transit Findings

Final Report

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Final Report – November 2021
Publication Number FHWA-JPO-21-893



U.S. Department of Transportation

Produced by Intelligent Transportation Systems Joint Program Office
U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-21-893		

4. Title and Subtitle	5. Report Date
Intelligent Transportation Systems Deployment Tracking Survey: 2020 Transit Findings	November 2021
	6. Performing Organization Code V321

7. Author(s)	8. Performing Organization Report No.
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9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
U.S. Department of Transportation Volpe National Transportation Systems Center 55 Broadway Cambridge, MA 02142	**11. Contract or Grant No.** IAA 693JJ319N300031

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office (ITS JPO) 1200 New Jersey Avenue, SE Washington DC 20590	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report summarizes the Transit Management Survey findings of the 2020 Intelligent Transportation Systems (ITS) Deployment Tracking Surveys (DTS). Since 1997, the ITS Joint Program Office (JPO) has used the DTS on an ongoing basis to collect information about ITS deployment in metropolitan areas across the United States by surveying state and local transportation agencies. These surveys measure ITS deployment nationwide and are used to inform the ITS JPO on strategic planning decisions such as response to ITS deployment gaps and ITS deployment planning and execution.

The 2020 Transit Management Survey was administered online from December 15, 2020 to March 31, 2021. The survey population included transit management agencies within 108 large and medium sized metropolitan areas nationwide, focusing on agencies that serve populations of 50,000 or greater. The survey achieved a response rate of 64 percent with 136 completed surveys by transit management agencies.

17. Keywords	18. Distribution Statement
Intelligent transportation systems (ITS), transit, microtransit, automatic vehicle location (AVL), computer-aided dispatch and scheduling (CADS), automatic passenger counters (APC), electronic fare payment (EFP), traveler information	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	75	

Acknowledgements

The Volpe Center would like to thank all the transit agency staff who took the time to complete this survey; your responses are greatly appreciated. The Volpe Center also would like to thank Marcia Pincus, Intelligent Transportation Systems (ITS) Deployment Evaluation Program Manager, for her insights and support throughout this survey project. Additionally, the Volpe Center is grateful for the valuable feedback and review provided by Noblis. Finally, the Volpe Center would like to thank ITS Joint Program Office staff and ITS stakeholders (including Federal Transit Administration staff) who provided input on the survey instrument.

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Acronyms

Acronym	Meaning
AAC	Augmentative and Alternative Communication
ADA	Americans with Disabilities Act
APC	Automatic Passenger Counters
ATIS	Advanced Traveler Information System
AVL	Automatic Vehicle Location
CADS	Computer Aided Dispatch and Scheduling
CCTV	Closed-Circuit Television
DMS	Dynamic Message Signs
DSRC	Dedicated Short Range Communication
DTS	Deployment Tracking Survey
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GTFS	General Transit Feed Specification
ICM	Integrated Corridor Management
IT	Information Technology
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MDT	Mobile Data Terminal
MMS	Maintenance Management Systems
NeTEx	Network Timetable Exchange
SIRI	Service Interface for Real-Time Information
TDD	Telecommunications Device for the Deaf
TDM	Transportation Demand Management
TSP	Transit Signal Priority
TTY	Teletypewriter
USDOT	United States Department of Transportation

Executive Summary

Introduction

This report summarizes the **Transit Management Survey** (also referred to as the Transit Survey in this Report) findings of the 2020 Intelligent Transportation Systems (ITS) Deployment Tracking Survey (DTS) administered by the John A. Volpe National Transportation Center (Volpe) in support of the United States Department of Transportation (USDOT) ITS Joint Program Office (JPO). Since 1997, the ITS JPO has used the DTS on an ongoing basis to collect information about ITS deployment in metropolitan areas across the United States by surveying state and local transportation agencies. These surveys track ITS deployment (type and to what extent deployed) nationwide. The resulting data are used to inform the ITS JPO and other stakeholders on strategic planning and investment decisions related to ITS deployment (including gaps), market development, and technology transfer activities.

Methodology

The 2020 Transit Survey was administered to transit management agencies (also referred to as transit agencies in this Report) within 108 large and medium sized metropolitan areas nationwide, focusing on agencies that serve populations of 50,000 or greater. The 2020 Transit Survey is a modified version of the one conducted in 2016, shortened to reflect a core set of ITS technologies (see Appendix A for the 2020 survey instrument). The survey was administered to transit agencies from December 15, 2020 to March 31, 2021 using an online survey instrument. The Transit Survey achieved 136 completes with a response rate of 64 percent, exceeding its data collection goal of 60 percent.

Key Findings: Transit Management Agencies

This section describes key findings from the Transit Survey. In nearly all cases the findings reference **adoption** (i.e., whether or not an agency has deployed a technology, policy, etc.), and the percent of agencies is presented. However, for findings on **coverage**, which measures the extent to which a technology is deployed on a transit agencies' fleet vehicles, the statistics reference the percent of equipped vehicles.

Many transit ITS technologies see increasing adoption.

The 2020 Transit Survey shows significant growth in key transit ITS technologies, including *automatic vehicle location (AVL), computer aided dispatch and scheduling (CADS), mobile data terminals (MDT)*, and *automatic passenger counters (APC)*.[1]

- Each of these technologies has experienced significant growth since 2010, with agency adoption levels ranging from 71 percent to 92 percent in 2020 among all surveyed transit agencies.

[1] This finding references the percent of agencies adopting ITS technologies, with transit modes combined. The increase in adoption varies somewhat by specific mode (e.g., bus vs. demand responsive).

- Technologies experiencing notable growth in adoption between 2016 and 2020 include *CADS* (from 65 percent to 85 percent) and *APC* (from 60 percent to 71 percent).
- Adoption of *AVL* grew more modestly since 2016 (from 84 percent to 92 percent), as did *MDT* (from 74 percent to 79 percent).
- Adoption of *maintenance management systems (MMS)* (34 percent) as well as *transit signal priority (TSP)* (32 percent) remains relatively low among surveyed transit agencies. However, adoption of *TSP* has seen moderate growth since 2016 (from 26 percent to 32 percent).

Deployment of transit ITS technologies among transit agencies with **fixed route buses** (91 percent) tends to mirror deployment reported by transit agencies overall, with 70 percent or more of agencies reporting adoption of *AVL*, *CADS*, *MDT* and *APC* in 2020.

- Since 2016, there has been significant growth in adoption of *CADS* (from 57 percent to 73 percent) on fixed route buses, and moderate growth in *APC* (from 69 percent to 77 percent), and *MDT* (from 65 percent to 70 percent).
- Coverage of *AVL CADS, MDT*, and *APC* on fixed route buses (i.e., the extent to which the technologies are deployed on transit agencies' fleets) is very high, and in most cases nearly universal (99 percent *coverage* for *AVL* and *CADS*, 100 percent for *MDT*, and 92 percent for *APC*).

Nearly eight-in-ten agencies operating **paratransit** vehicles in compliance with the Americans with Disabilities Act (referred to as ADA paratransit throughout this Report) have adopted *AVL, CADS*, and *MDT*.

- The adoption of *CADS* by transit agencies with ADA paratransit service grew by 11 percentage points since 2016, from 67 percent to 78 percent in 2020, whereas *AVL* adoption increased moderately from 73 percent to 78 percent. *MDT* adoption has shown minimal growth, with 76 percent of agencies deploying in 2016 and 78 percent in 2020.
- With respect to coverage, agencies adopting *AVL, CADS,* or *MDT*, on their ADA paratransit vehicles have done so for their entire fleet of ADA paratransit vehicles.

Use of traveler information dissemination methods is increasing among transit agencies.

Use of traveler information dissemination methods was relatively low and stable prior to 2013, at which point mobile and web-based information technology usage began to climb.

- In 2020, *agency-branded* or *third-party mobile apps* (collectively, referred to as *mobile apps*), are the most used traveler information method (75 percent). Transit agency adoption of *mobile apps* is up nearly 50 percentage points since 2013 (when mobile apps were first measured), with growth evenly split across the last two survey cycles.
- Use of *websites* falls just below mobile apps at 72 percent. Trend in use of *websites* is up 33 percentage points since 2013, but most of this growth occurred between 2013 and 2016.
- Other traveler information methods seeing significant increases from 2013 to 2020 include use of *social media* (from 10 percent to 67 percent) and *email and text alerts* (from 15 percent to 63 percent). More mature technologies, such as *511* (18 percent) and *kiosks* (15 percent) are the least used and show minimal growth since 2016.

There also has been significant growth in the use of *dynamic message signs (DMS) in stations, at stops,* and *in vehicles* from 2010 to 2020. In the last survey cycle, use of *DMS in stations* has increased

significantly, from 38 percent of transit agencies in 2016 to 55 percent in 2020. Likewise, the recent growth in adoption of *DMS in vehicles* is notable, from 12 percent in 2016 to 25 percent in 2020. The trend in adoption of *DMS at stops* remains relatively flat since 2016.

Although still relatively rare, there has been growth in partnerships with ride-hailing companies.

Partnerships with *ride-hailing companies* increased significantly, from 4 percent in 2016 to 15 percent in 2020. Partnerships with *microtransit services* grew by six percentage points (from 3 percent in 2016 to 9 percent in 2020.

- Overall, nearly one-third of transit agencies are engaging in partnerships with any *private transportation services*, similar to what was reported in 2016; however, the average number of partnerships per agency increased from 1.3 to 2.1.

A large majority of transit agencies report plans to upgrade their fare payment systems within the next 5 years to accept additional or different types of payment.

Nearly three-quarters (72 percent) of transit agencies are planning to upgrade their fare payment systems in the *next five years*, with one-quarter planning to do so in the *next year*.

The most commonly accepted fare media (not including *cash*) are *magnetic stripe cards* (66 percent), followed by *mobile app payment* (49 percent) and *agency or regional smart cards* (42 percent). Fewer agencies use *mobile wallet* (10 percent) or *contactless credit/debit cards* (9 percent).

- Fare payment methods other than cash may experience growth over the next few years, based on transit agencies' reported plans to upgrade their fare payment systems to accept additional or different types of fare media.

A majority of transit agencies report use of real-time standards.

Just over one-half of transit agencies (54 percent) indicate use of real-time standards, namely *General Transit Feed Specification Real-Time (GTFS-RT)* and/or *Service Interface for Real-Time Information (SIRI)*.

ITS cybersecurity planning shows room for growth.

About half (55 percent) of surveyed transit agencies report that they have developed an *ITS-specific cybersecurity policy* (40 percent) or *plan to develop* a policy (15 percent). Notably, 17 percent of transit agencies have experienced a cybersecurity event affecting *Information Technology (IT) systems*, and 5 percent have experienced a cybersecurity event affecting *transportation operations* in the last three years.

A majority of transit agencies plan to invest in ITS in the next three years.

Roughly two-thirds of surveyed transit agencies (68 percent) plan to *expand or upgrade* their current ITS in the next three years, while about one-half of transit agencies plan to *invest in new ITS* (54 percent).

Conclusions

ITS transit technologies such as *AVL, CADS, MDT*, and *APC* have been adopted by a large majority of agencies, and coverage (i.e., the extent to which the technologies are deployed on transit agencies' fleets) is high and in some cases universal, indicating a level of maturity in the market. There is still room for growth in the adoption of technologies such as *TSP.*

Transit agencies are increasingly using different methods to disseminate real-time traveler information, with significant increases in the use of *mobile apps*, *websites, social media*, and *email/text alerts* since 2013. There has also been growth in the use of *DMS in stations, at stops,* and *in vehicles* since 2010.

Additionally, some transit agencies are partnering with mobility on demand service providers such as *ride-hailing companies*, *taxis*, and *microtransit* to supplement or complement their services. Overall, the proportion of transit agencies engaging in partnerships remains stable at nearly one-third, but the number of partnerships has increased since 2016.

While many transit technologies are mature, fare payment systems represent a category that is likely to see considerable growth in the next five years. Nearly three-quarters of transit agencies are planning to upgrade their fare payment systems in the *next five years*, with one-quarter planning to do so in the *next year*.

On cybersecurity, 40 percent of surveyed transit agencies have an *ITS-specific cybersecurity policy*, and an additional 15 percent are currently *developing a policy*. A relatively large number – nearly one-in-five transit agencies– report experiencing a cybersecurity event that affected their *IT systems* and/or *transportation operations* in the last three years. Given the relatively large number of agencies that have not developed an ITS-specific cybersecurity policy, there is room for growth in this area.

Chapter 1. Introduction

Purpose of the Report

This report summarizes the **Transit Management Survey** (also referred to as the Transit Survey in this Report) findings of the 2020 Intelligent Transportation Systems (ITS) Deployment Tracking Survey (DTS), administered by the United States Department of Transportation (USDOT) John A. Volpe National Transportation Center (Volpe) in support of the USDOT ITS Joint Program Office (JPO). These surveys track ITS deployment (type and to what extent deployed) nationwide. The resulting data are used to inform the ITS JPO and other stakeholders on strategic planning and investment decisions related to ITS deployment (including gaps), market development, and technology transfer activities. 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 DTS data serve a critical role in supporting this mission.

Background

Since 1997, the ITS JPO has used the DTS to collect information about ITS deployment in metropolitan areas across the United States. The surveys track the deployment of ITS technology by state and local transportation agencies. The DTS has been administered to freeway, arterial, and transit management agencies 12 times prior to the 2020 survey effort, and roughly once every three years since 2007. The ITS DTS survey program was initially developed to support ITS deployment program assessment by the ITS JPO, and to track and manage progress toward the ten year ITS deployment goal set by the Secretary of Transportation in 1995. The survey was conducted every 1-2 years during the goal measurement period. Following the goal period, the survey was conducted less regularly on a roughly 3-year cycle to monitor the deployment of ITS across the country. Prior to 2020, the most recent ITS DTS was conducted in 2016. In the fall of 2019, the ITS JPO administered a DTS-related special topic survey to obtain baseline data on the deployment of connected vehicle (CV) and automated vehicle (AV) technologies. This CV/AV survey was administered to the DTS population (108 large and medium size metro areas). The ITS Small Urban and Rural Transit Provider Survey was also conducted in 2019, in response to a Government Accountability Office recommendation that the ITS JPO track the deployment of ITS among small urban and rural transit providers.

Data collection for the 2020 Transit Survey was conducted between December 15, 2020 and March 31, 2021, roughly 9 to 11 months after pandemic restrictions were introduced. The pandemic did not appear to significantly impact survey response rates; however, it is unclear what impact, if any, the pandemic has had or will have on ITS adoption or plans for adoption. Future surveys may add clarity and additional insight on this issue.

Chapter 2. Methodology

This chapter describes the methodology for the Deployment Tracking Survey (DTS), including sample development, the survey instrument, and data collection. The final section addresses data reporting.

Sample Development

The 2020 Transit Survey was administered to transit management agencies (also referred to as transit agencies in this Report) within 108 large and medium sized metropolitan areas nationwide, focusing on agencies that serve populations of 50,000 or greater. The 2020 survey utilized the agency contact lists from the most recent DTS conducted in 2016. Prior to data collection, each agency was contacted by email and phone to notify them of the upcoming survey and to verify that the listed contact was the appropriate respondent for the 2020 DTS. Replacement contacts were obtained when necessary.

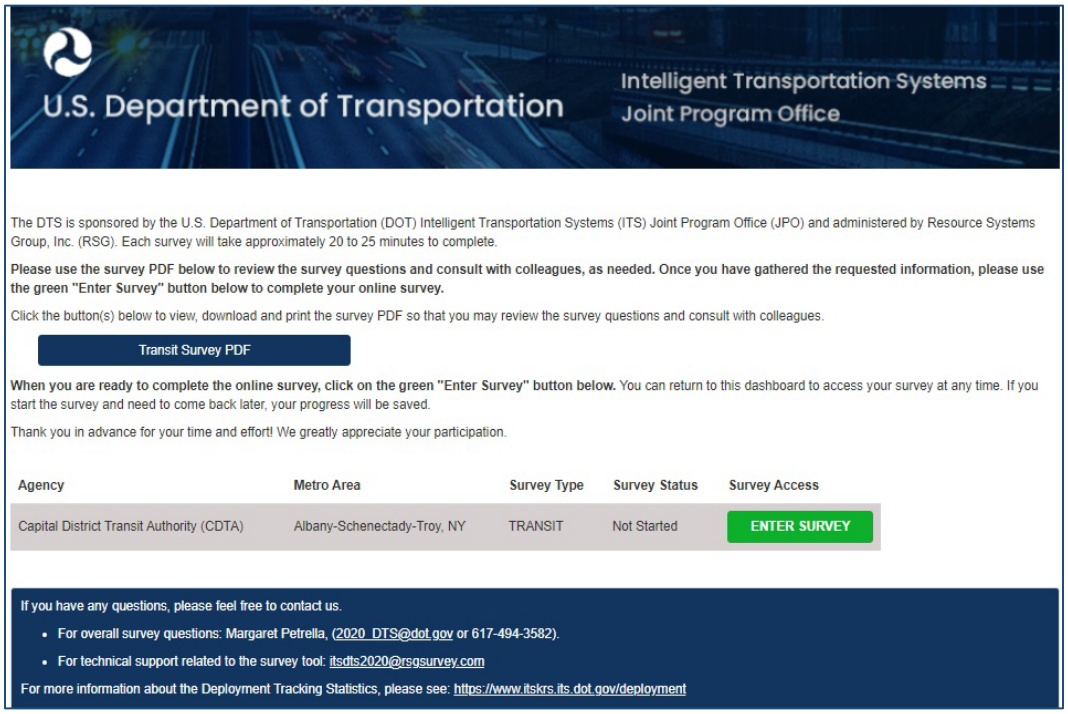
Survey Instrument

The 2020 Transit Survey is a modified version of the one conducted in 2016, shortened to reflect a core set of ITS technologies (see Appendix A for the 2020 survey instrument). The survey was reformatted, utilizing skip logic so that agencies received the battery of ITS questions only for the service types (e.g., bus, light rail, ferry, etc.) that they operate. With input from Federal Transit Administration (FTA) staff, the survey team made a number of changes to the transit survey, expanding batteries on traveler information systems and fare payment and adding additional response categories for questions on agency partnerships and independent travel for people with disabilities. Questions on cybersecurity were added to the survey, along with questions on whether agency staff or contractors are used for ITS installation, maintenance, and inspection.

Key topics covered by the 2020 Transit Survey include transit management technologies, traveler information systems, electronic fare payment, agency partnerships, integrated corridor management, ITS data use and collection, transportation demand management, telecommunications, ITS cybersecurity, maintenance of ITS technology, ITS installation, maintenance, and inspection staffing, technologies and services to support people with disabilities, ITS standards, and future plans for ITS deployment.

Data Collection

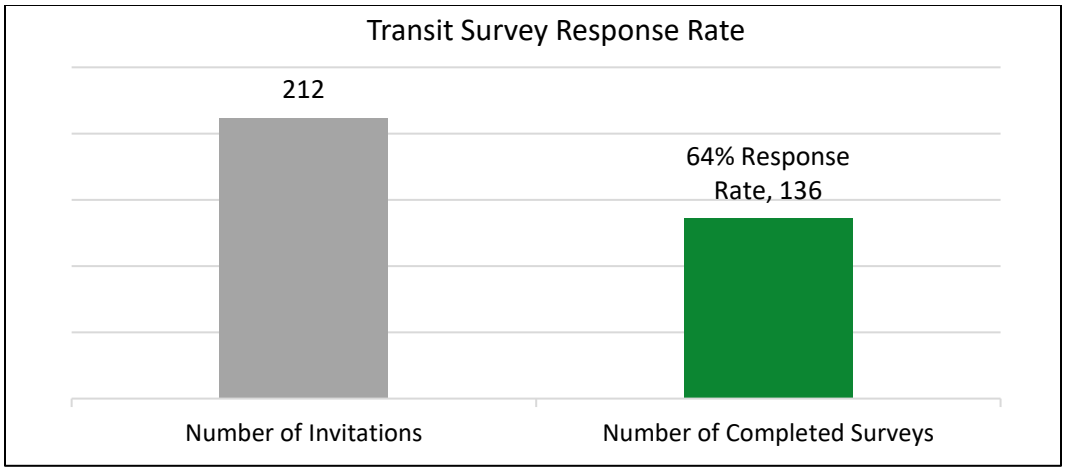
The Transit Survey was administered using an online survey instrument. Each respondent was provided access to a personalized dashboard that provided details on the survey effort, allowed them to download fillable PDFs of the survey instrument(s), and included unique links to access their survey(s). Several respondents were assigned two or more surveys, representing multiple metropolitan areas and/or more than one type of survey (freeway, arterial, or transit) for a single metropolitan area. If respondents left the survey prior to completion, responses to any completed questions were saved and were accessible by respondents if they returned to the survey (see Figure 1 for an example of a Transit Survey dashboard).



Source: USDOT

Figure 1. DTS Respondent Dashboard

The Transit Survey was launched on December 15, 2020. In total, 212 invitations were sent to transit agency contacts. Three rounds of reminder emails were sent in December 2020 and January 2021. Additional efforts to contact those who had not completed their assigned survey(s) were conducted by phone in February and March of 2021. Agencies were called and encouraged to complete the survey. Messages were left for respondents who could not be reached by phone and email reminders were also sent. The survey was closed March 31, 2021, resulting in 136 completes and a response rate of 64 percent (Figure 2).



Source: USDOT

Figure 2. Transit Survey Response Rate

The survey data went through an extensive review and cleaning process and open-ended responses were reviewed and coded into existing or new categories (where applicable).

Reporting

Where available, trend data are shown for the transit findings. In some cases, however, the question wording changed substantially over time, so it is not possible to show the trend. For most survey questions, trend is reported either over the last three (2013, 2016, 2020) or four surveys (2010, 2013, 2016 and 2020), and for a smaller subset of questions longer term trend is available (i.e., 2002-2020). Sample sizes for all survey years are provided in Appendix B and are not provided in longer trend charts due to space constraints. Table 1 describes how different magnitudes of change in the trend data are interpreted, providing a uniform way of describing the trend data.

Table 1. Interpretation of Trend Data

Change (positive or negative)	Growth (or Decline) Category
Zero percentage points	No growth/decline
One to four percentage points	Minimal growth/decline (not meaningful)
Five to eight percentage points	Moderate growth/decline
Nine percentage points or more	Significant growth/decline

For all charts not displaying trend data, data are from the 2020 survey. Question numbers from the 2020 surveys are referenced at the bottom of each figure.

Chapter 3. Transit Management Findings

This chapter presents the 2020 Transit Survey findings for key deployment tracking questions (see Appendix C for additional survey findings that are not reported in this chapter). Findings are based on total sample unless otherwise noted. In most cases the findings reference **adoption** (i.e., whether or not an agency has deployed a technology, policy, etc.), and the percent of agencies is presented. However, for findings on **coverage,** which measures the extent to which a technology is deployed on transit agencies' fleet vehicles, the statistics reference the percent of equipped vehicles.

Transit Modes Operated

Figure 3 shows that of the 136 transit agencies responding to the survey, nearly all (91 percent) operate *fixed route bus service.* Although three-quarters (74 percent) of survey respondents report operating *Americans with Disabilities Act (ADA) paratransit* service, additional research confirmed that, in fact, **all** agencies with fixed-route bus service do offer paratransit service, as expected. The next most common transit mode operated by surveyed agencies is *demand responsive service* (33 percent), followed by *light rail* (12 percent), *streetcar* (7 percent), *ferry boat* (7 percent) *commuter rail* (7 percent) and *heavy or rapid rail* (4 percent). An additional 7 percent of agencies report operating some *other* transit mode.

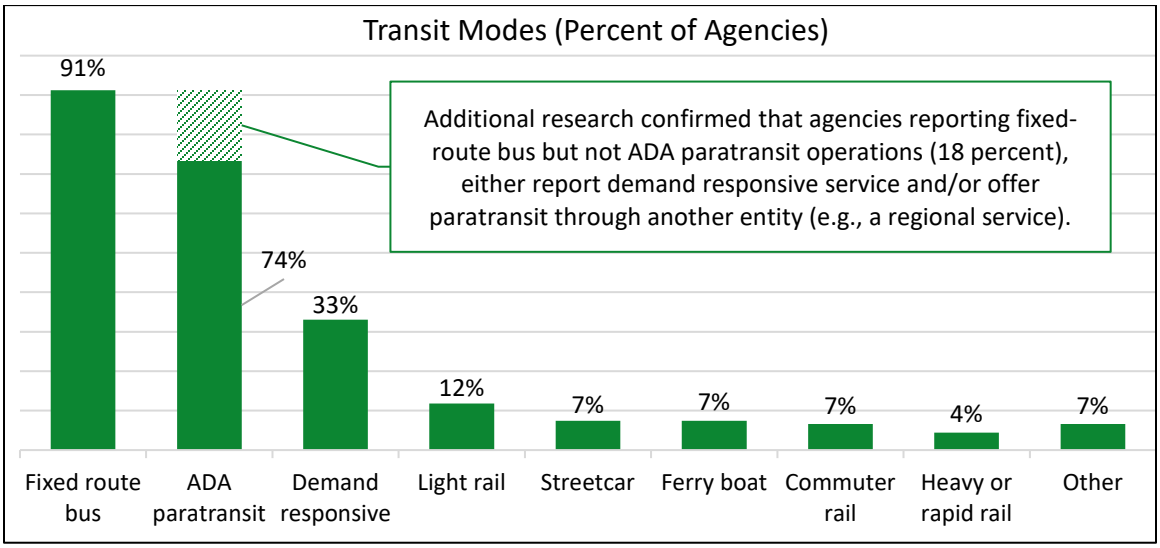


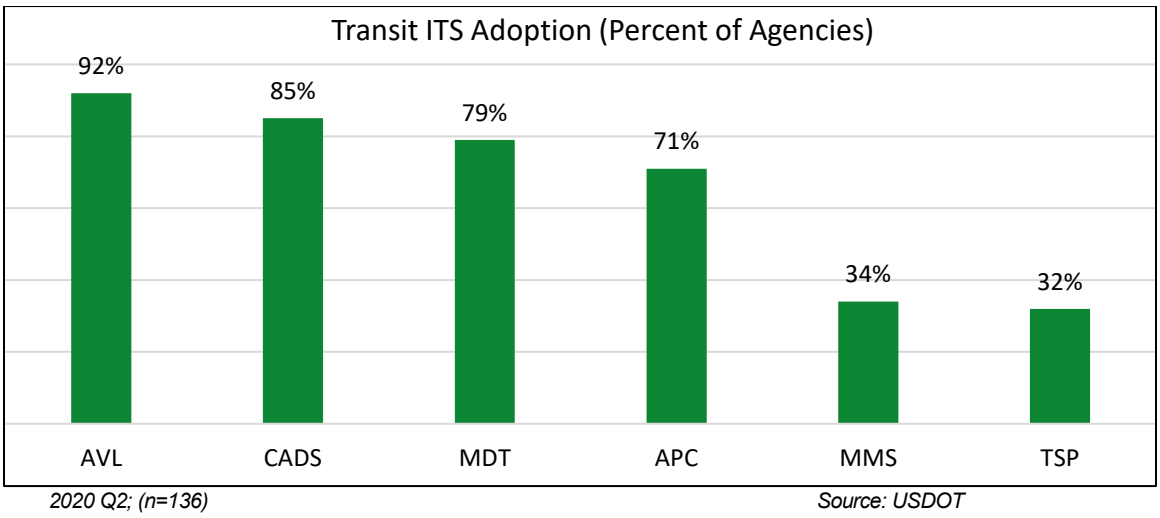
Figure 3. Transit Modes

The ADA paratransit discrepancy shown in Figure 3 (i.e., 18 percent of agencies which report that they operate *fixed route bus* service did not indicate *ADA paratransit* service) may be due to survey question wording and, in some cases, to respondent error. For example, transit agencies were asked to report on ADA paratransit service they **operate**, but there are a number of cases where the agency itself does not operate ADA paratransit but **offers** the service via partnering with some other entity, such as a regional

agency. Future surveys may want to include a revised question on ADA paratransit services that takes this distinction into account. In addition, for some of the discrepant cases, transit agencies indicated *demand responsive service* in their survey response, and additional research confirmed these agencies offer ADA paratransit. This suggests potential confusion between ADA paratransit and demand responsive service, so future surveys may want to add a note clarifying the differences between these service types.

Transit ITS Technology Adoption

In the 2020 survey, transit agencies report high levels of transit ITS adoption (Figure 4) with 92 percent of agencies reporting adoption of *automatic vehicle location (AVL)*, 85 percent c*omputer aided dispatch and scheduling (CADS)*, 79 percent *mobile data terminals (MDT)*, and 71 percent *automatic passenger counters (APC).* About one-third (34 percent) of surveyed transit agencies report adoption of *maintenance management systems (MMS)*, the remote monitoring of vehicle components (e.g., fuel and fluid level), and a similar number report adoption of *transit signal priority (TSP)* (32 percent).[2]



2020 Q2; (n=136) *Source: USDOT*

Figure 4. Transit ITS Adoption – All Modes

Overall, adoption levels of *AVL*, *CADS*, *MDT*, and *APC* have all experienced significant growth since 2010 whereas adoption of *TSP* shows less growth (Figure 5).[3]

Since 2010, *AVL* adoption has been steadily increasing, and in the last survey cycle, *AVL* adoption grew by eight percentage points showing nearly universal adoption by transit agencies (92 percent). While adoption of CADS also saw a steady increase between 2010 and 2016, the recent significant growth in

[2] The 2020 TSP question was only asked of agencies with *fixed-route bus*, *light rail*, or *streetcar*. Results in Figure 4 are based on total agencies for comparability.
[3] This finding references the percent of agencies adopting ITS technologies, with transit modes combined. The increase in adoption varies somewhat by specific mode (e.g., bus vs. demand responsive).

adoption – up 20 percentage points since 2016 - is notable, with 85 percent of transit agencies reporting the use of *CADS* in 2020.

While adoption of *APC* had minimal growth between 2010 and 2013, this technology has seen a significant growth of 24 percentage points since 2013 (from 47 percent adoption to 71 percent in 2020). Adoption of *MDT* has grown from 56 percent of surveyed transit agencies in 2010 to 79 percent in 2020; however, nearly all growth occurred between 2010 and 2016 (13 percentage points). In the most recent survey, *MDT* adoption grew by a moderate five percentage points.[4]

Nearly one-third (32 percent) of surveyed transit agencies have adopted *TSP*. This represents an increase of six percentage points compared to 2016, whereas trend had previously been flat (at about 26 percent) during the period from 2010 to 2016. It would be helpful to better understand agencies' perceived need for *TSP*, and the challenges or barriers they face in deploying this technology, in order to understand the opportunity for growth.

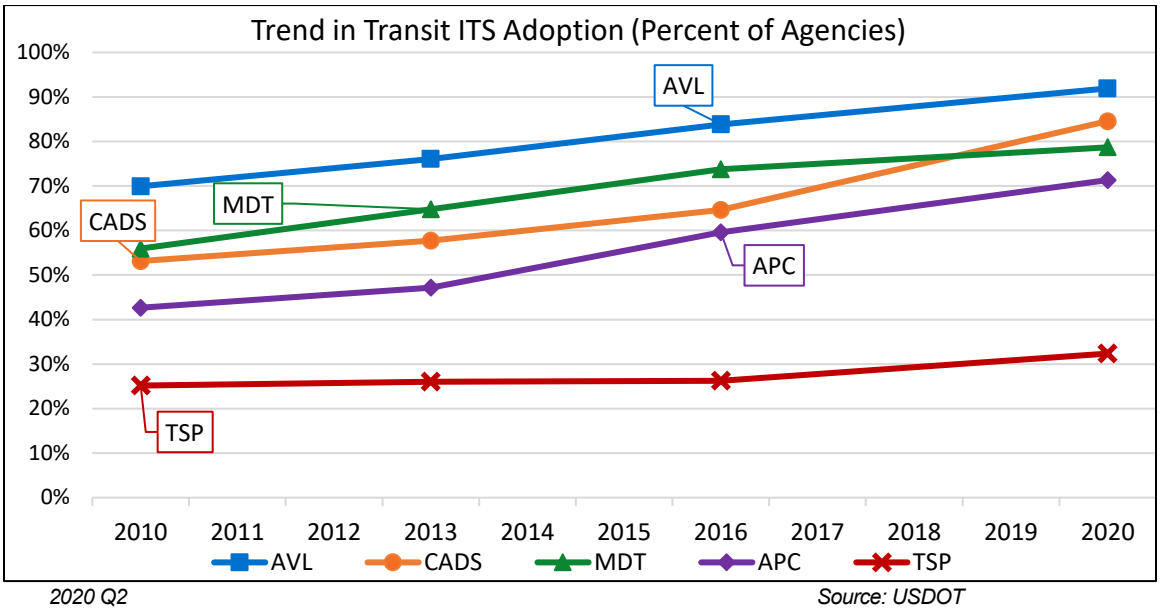


Figure 5. Trend in Transit ITS Adoption – All Modes

Transit Technology Adoption and Coverage by Transit Modes

This section presents findings for agencies operating specific transit modes. Analysis is shown for fixed route bus, ADA paratransit, and demand responsive service; the sample sizes for all other modes (i.e., light rail, commuter rail, streetcar, heavy or rapid rail, and ferry) are too small to report (see Appendix B for sample sizes). In most cases the findings reference **adoption**, but in a few cases, there are findings related to **coverage**.[5]

[4] Trend is not shown for *MMS* throughout the report, as this was a new response category in the 2020 survey.
[5] The survey asked agencies to report total number of vehicles by mode and total number of vehicles equipped with each technology by mode. Coverage was measured by mode for each transit agency (e.g., an agency's number of

Fixed Route Buses

Transit agencies operating *fixed route bus service* report having anywhere from 3 to 5,973 vehicles in their fleet, with a mean of 225 and median of 71. Figure 6 shows agency adoption of transit ITS technologies among transit agencies with fixed route buses. *AVL* has been adopted by a large majority of these transit agencies (89 percent). About three-quarters of agencies with fixed route buses have adopted *APC* (77 percent), *CADS* (73 percent) and *MDT* (70 percent), and about one-third (32 percent) have adopted *MMS* and *TSP*.

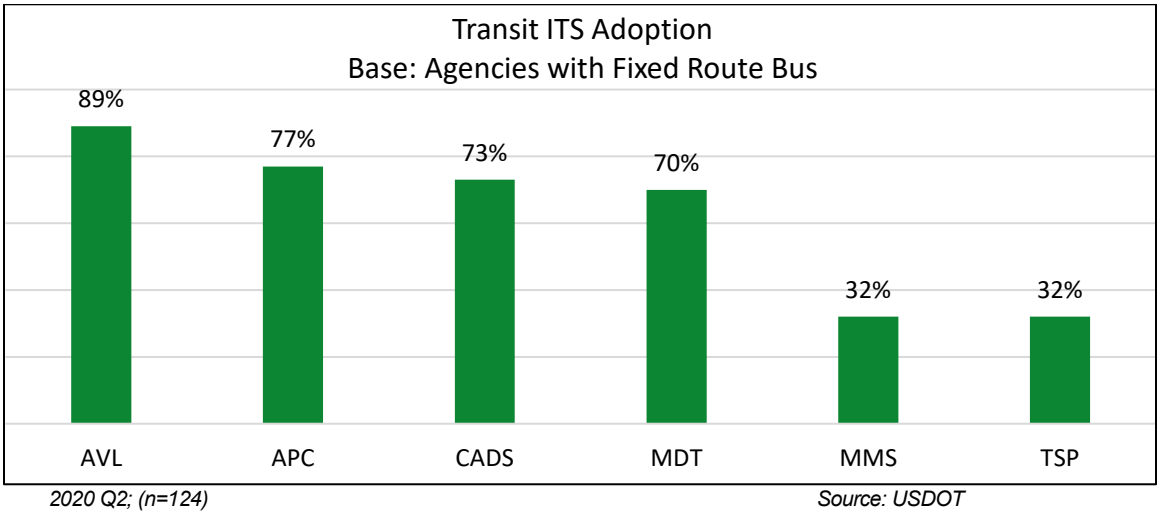
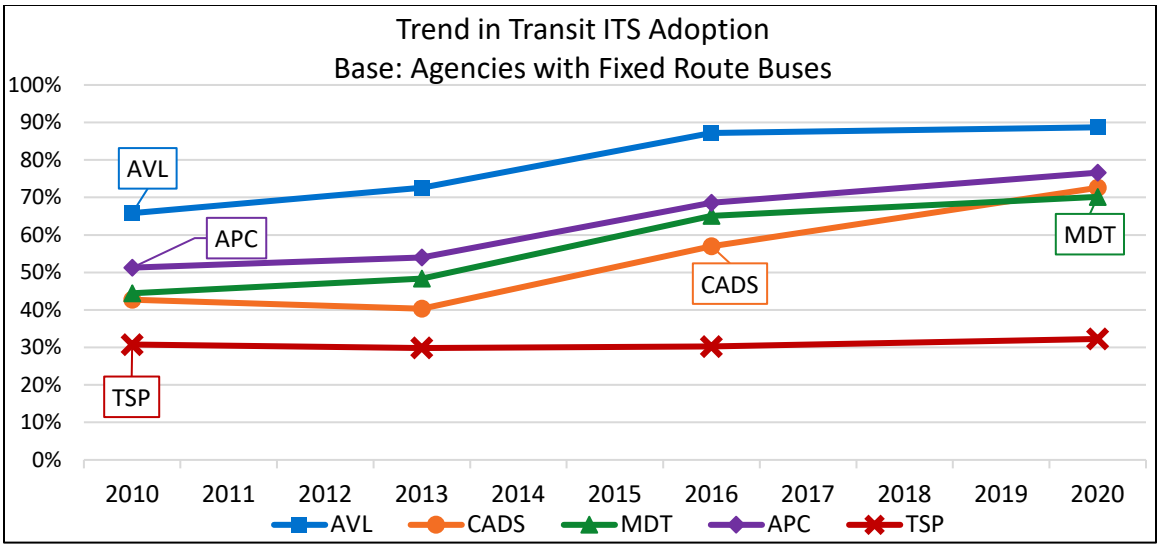


Figure 6. Transit ITS Adoption – Fixed Route Bus

Figure 7 shows the trend in transit ITS adoption (from 2010 to 2020) among surveyed transit agencies operating fixed route bus service. With the exception of TSP, adoption of all surveyed technologies has increased significantly, with growth primarily occurring between 2013 and 2020. *AVL* adoption increased by a significant 14 percentage points between 2013 and 2016 and saw minimal growth in the last survey cycle and is widely adopted among transit agencies with fixed route buses (89 percent). Adoption of *CADS* increased significantly between 2013 and 2016 (from 40 percent to 57 percent), as well as in the last survey cycle (from 57 percent to 73 percent in 2020). . *APC* and *MDT* adoption show a similar pattern, with significant growth between 2013 and 2016 (15 percentage points and 17 percentage points, respectively). Between 2016 and 2020, adoption of APC increased from 69 percent to 77 percent, while adoption of MDT grew from 65 percent to 70 percent. *TSP* adoption on fixed-route bus has a flat trend between 2010 and 2016.

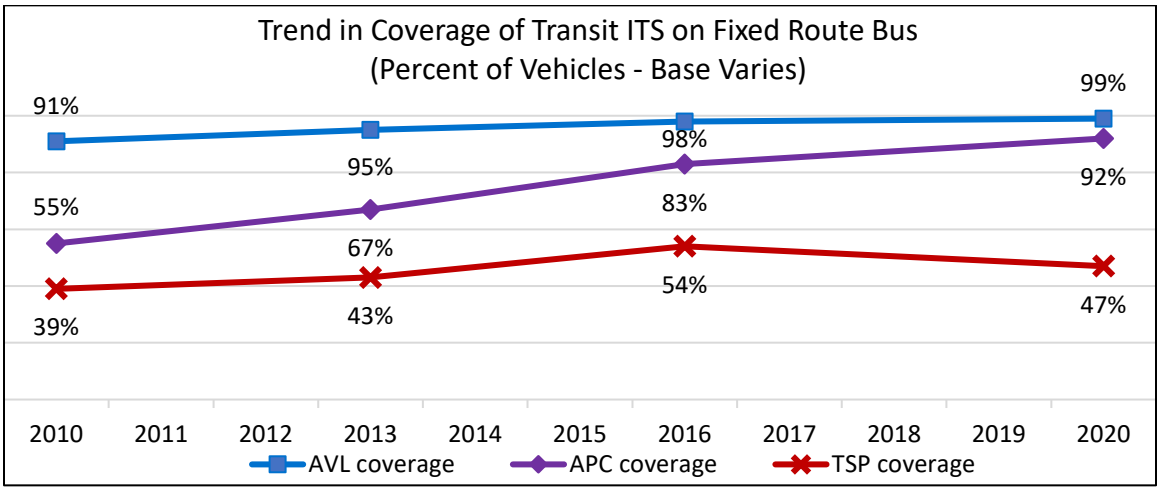
buses with AVL was divided by the total number of buses in their fleet), and the average was calculated across all agencies. Coverage was calculated only for agencies reporting adoption of the technology, as to not factor agencies without the technology into the coverage value.



2020 Q2; (n=124) *Source: USDOT*

Figure 7. Trend in Transit ITS Adoption – Fixed Route Buses

The survey data enables an assessment of technology coverage, that is the extent to which technologies are deployed on agencies' fleets. On fixed route buses, among agencies that have *AVL*, *CADS* and *MDT*, coverage is universal. In 2020, *AVL* coverage was 99 percent, *CADS* coverage was 99 percent (up from 95 percent in 2010), and *MDT* coverage was 100 percent (up from 94 percent in 2010) among agencies reporting use of these technologies. Coverage of *APC* is nearly as high; agencies deploying *APC* on fixed route buses have equipped, on average, 92 percent of their fleet. *TSP* coverage is lower, at 47 percent, suggesting that agencies are deploying TSP in a more limited fashion, likely on key corridors in their service, and hence may not need to equip all their vehicles with the technology (Figure 8).[6]



2020 Q1, Q2 *Source: USDOT*

Figure 8. Trend in Coverage of Transit ITS on Fixed Route Bus – AVL, APC, TSP

[6] In Figure 8, trend is not shown for CADS and MDT coverage because growth is minimal compared to the other transit ITS technologies.

ADA Paratransit Vehicles

Transit agencies operating *ADA paratransit service* report having anywhere from 2 to 2,027 vehicles in their fleet, with a mean of 121 and median of 27. Nearly eight-in ten agencies operating ADA paratransit have adopted *AVL*, *CADS* and *MDT* for use on these vehicles (Figure 9). Not surprisingly, adoption of *APC* is low, at 6 percent of agencies with ADA paratransit. This may be because paratransit trips are generally scheduled in advance and serve a limited number of passengers, so counters may not be needed. The adoption of *MMS* is also low, at 9 percent.

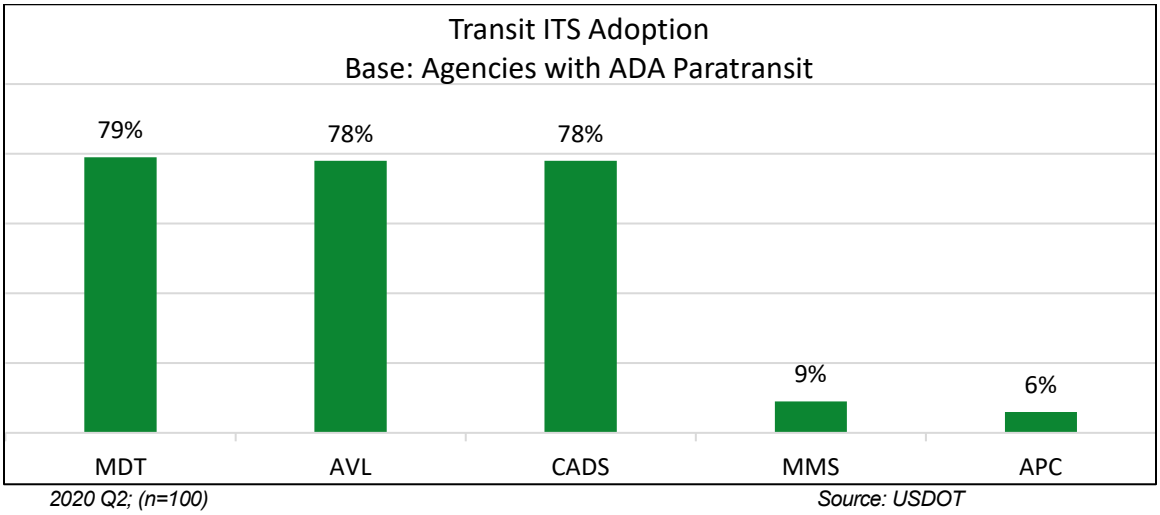
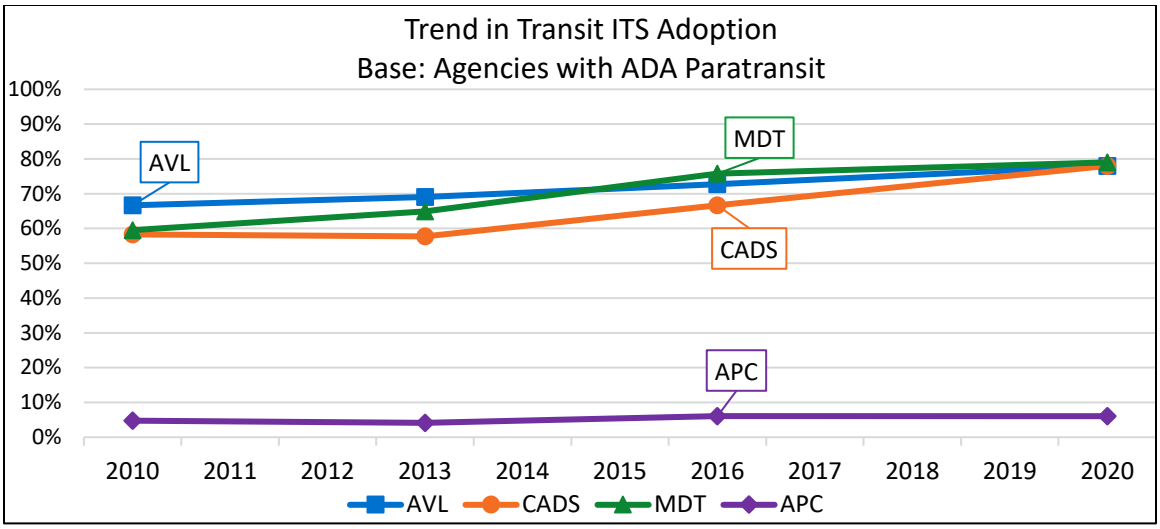


Figure 9. Transit ITS Adoption – ADA Paratransit

Among agencies operating ADA paratransit vehicles, there has been significant growth in the adoption of three technologies since 2010 – *AVL*, *CADS* and *MDT* (Figure 10), with adoption of *CADS* and *MDT* showing the greatest growth overall (20 percentage points and 19 percentage points, respectively).

The adoption of *CADS* experienced significant growth in the last survey cycle, increasing 11 percentage points (from 67 percent of agencies with ADA paratransit in 2016 to 78 percent in 2020). During that same period, growth in *AVL* adoption is moderate, increasing by five percentage points (from 73 percent to 78 percent), and *MDT* adoption has remained relatively flat (from 76 percent to 78 percent). *APC* deployment has been comparably low (6 percent), and trend has been flat since 2010.



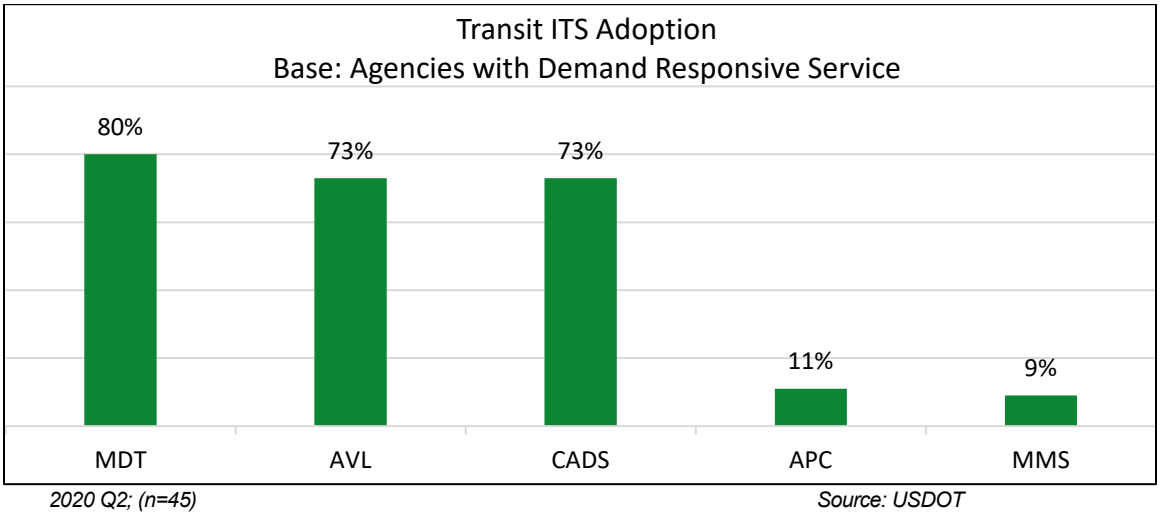
2020 Q2; (n=100) *Source: USDOT*

Figure 10. Trend in ITS Adoption – ADA Paratransit

With respect to coverage, surveyed agencies adopting *AVL*, *CADS*, or *MDT*, on their ADA paratransit vehicles have done so for their entire fleet of ADA paratransit vehicles (100 percent). *MMS*, used by a small number of agencies (n=9), also has universal coverage on ADA paratransit vehicles. APC, for the small number of agencies (n=6) that have adopted them, are used on a majority of vehicles (83 percent).

Demand Responsive Vehicles

Transit agencies operating *demand responsive service* have a range of 2 to 452 vehicles in their fleet, with a mean of 44 and median of 18. Figure 11 shows that 80 percent of surveyed transit agencies have adopted *MDT*. A large majority also report adopting *AVL* (73 percent), and an identical proportion report adopting *CADS* (73 percent) for use on demand responsive vehicles. Eleven percent of agencies with *demand responsive service* have adopted *APC* and 9 percent have adopted *MMS*.



2020 Q2; (n=45) *Source: USDOT*

Figure 11. Transit ITS Adoption – Demand Responsive Service

Trend for *demand responsive service* ITS adoption is not shown due to small sample sizes (see Appendix B for sample sizes).

Traveler Information

Figure 12 shows the adoption of in-vehicle traveler information systems among surveyed transit agencies with either fixed route bus, heavy or rapid rail, light rail, commuter rail, streetcar, or other transit modes. The most commonly used in-vehicle traveler information technology is *automated voice announcement (AVA) systems* (adopted by 84 percent of transit agencies). Less commonly adopted technologies are *dynamically updating passenger information displays* (42 percent) and *dynamically triggered automated announcements* (37 percent).

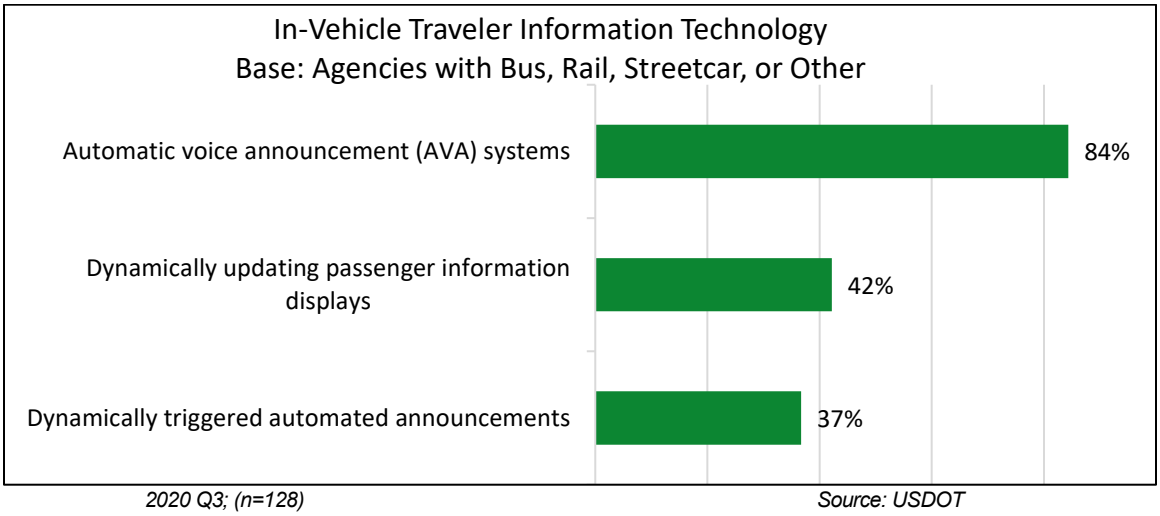


Figure 12. In-Vehicle Traveler Information Technology

Figure 13 shows a majority of all surveyed transit agencies serve *bus stops* (86 percent) or *multi-modal stations* (81 percent). Fewer agencies serve *rail stations* (22 percent) which corresponds with the relatively low number of surveyed transit agencies with rail transit modes (i.e., heavy or rapid rail, light rail, and/or commuter rail).

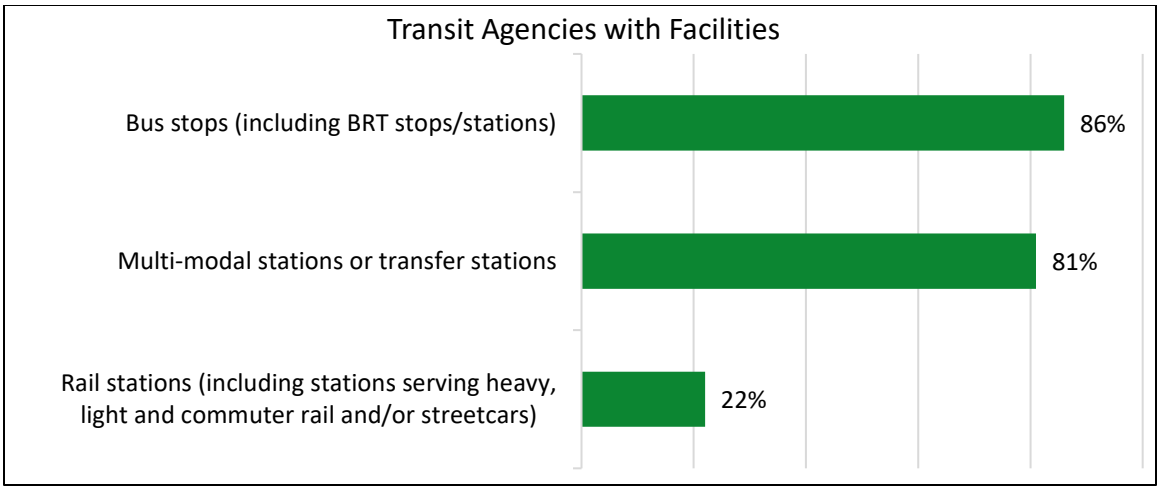


Figure 13. Transit Agencies with Facilities

Among agencies with each facility type (bus stops, rail stations, and multi-modal stations), Figure 14 shows the level of adoption of dynamic traveler information at transit facilities. Among transit agencies with bus stops, the most commonly used dynamic traveler information technology is *mobile applications* (60 percent), followed by *electronic displays* (49 percent) and *SMS or text* (47 percent).

By contrast, at rail stations, *electronic displays* are the most commonly used type of technology for dynamic traveler information (70 percent), and a somewhat smaller majority share traveler information via *mobile applications* (57 percent). *SMS or text* is used least often at rail stations (37 percent). However, the findings for rail stations should be interpreted with caution due to the small sample size (n=30). At multimodal stations, use of these traveler information methods is similar to rail stations, although use of *SMS or text* is slightly higher (45 percent) and more similar to adoption at bus stops.

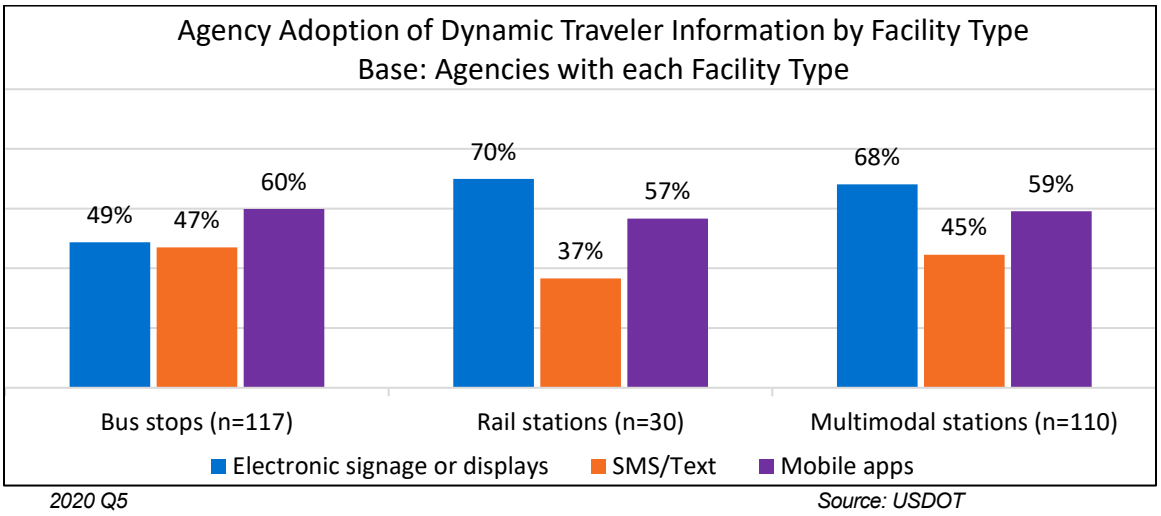
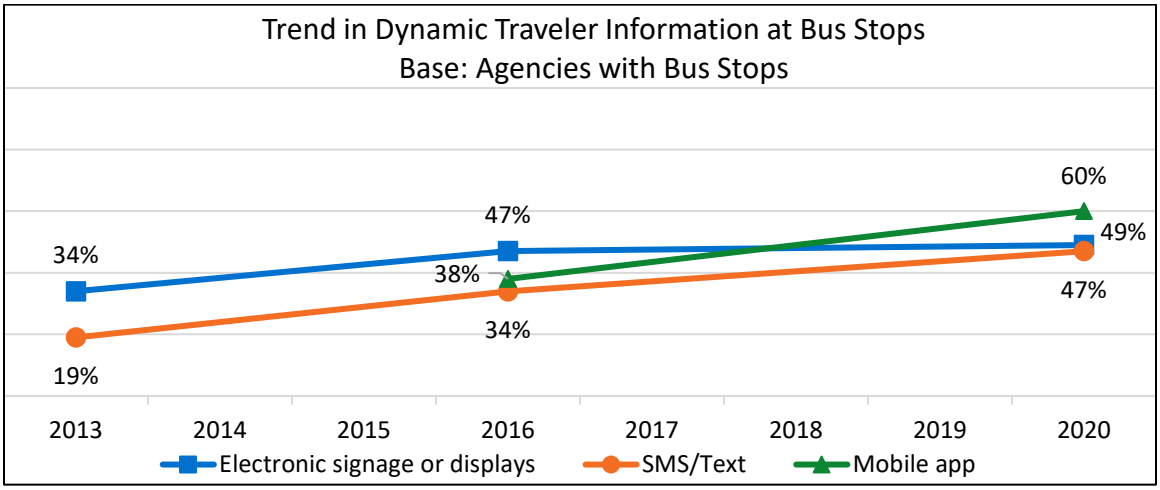


Figure 14. Agency Adoption of Dynamic Traveler Information by Facility Type

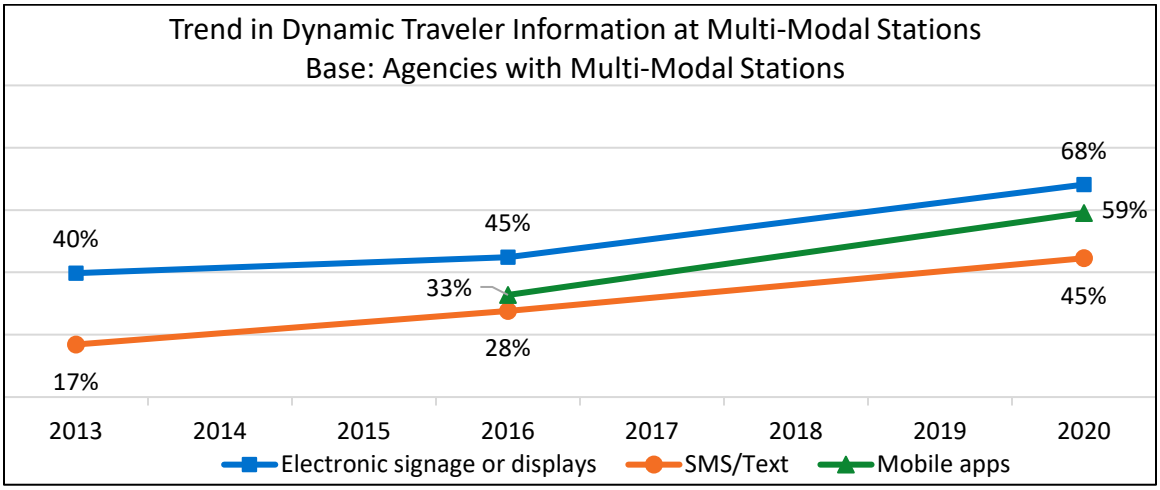
Figure 15 shows surveyed transit agencies are increasingly adopting dynamic traveler information technologies at *bus stops*. Use of *SMS or text* has grown steadily, from 19 percent of transit agencies with bus stops in 2013 to 47 percent in 2020. Use of *electronic displays* grew significantly between 2013 and 2016 (from 34 percent to 47 percent), but adoption has since leveled off, at 49 percent in 2020. Use of *mobile apps* at bus stops, first measured in 2016, has grown significantly (from 38 percent to 60 percent) and is the most commonly used technology at bus stops among the surveyed dynamic traveler information technologies.



2020 Q5; (n=117) *Source: USDOT*

Figure 15. Trend in Dynamic Traveler Information at Bus Stops

The adoption trend for *electronic displays*, *mobile applications* and *SMS or text* at *multimodal stations* (Figure 16) is very similar to the trend at bus stops, with significant growth for all three methods since 2013. One difference is that the use of *electronic displays* saw significant growth at multimodal stations since 2016, from 45 percent to 68 percent, whereas the trend in use of *electronic displays* at bus stops remained flat during that same period.



2020 Q5; (n=110) *Source: USDOT*

Figure 16. Trend in Dynamic Traveler Information at Multi-Modal Stations

Among all transit agencies, many real-time traveler information dissemination methods are used (Figure 17). *Agency-branded* (44 percent) or *third-party mobile apps* (64 percent), referred to collectively as *mobile apps*, are now the most used traveler information method, with 75 percent of surveyed transit agencies reporting use of either type of app. A similar number of agencies report using *websites* for dissemination of real-time traveler information (72 percent); about two-thirds of agencies report using *social media* (67 percent), and 63 percent report using *email or text alerts.* Agencies also use *DMS in stations* (55 percent), *at stops* (32 percent) or *in vehicles* (25 percent). Fewer agencies use *511* (18 percent), *kiosks* (15 percent), or *other* methods (3 percent), and 13 percent of agencies report that their agency does not provide real-time traveler information.

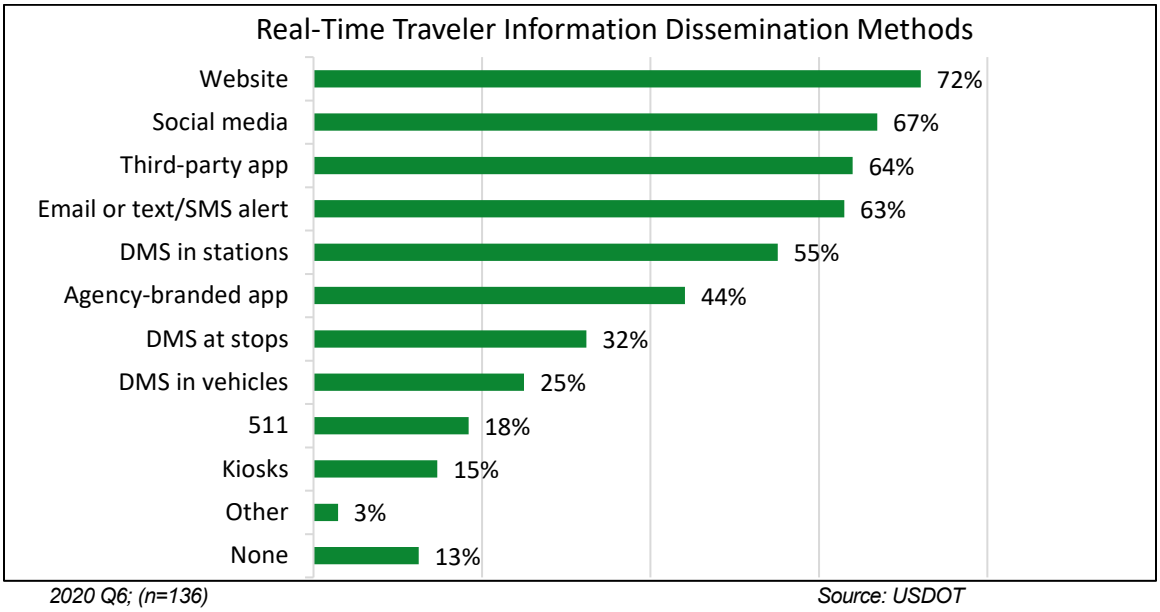


Figure 17. Real-Time Traveler Information Dissemination Methods

Figure 18 shows adoption of *mobile apps* for traveler information has grown substantially since 2013, when use of apps was first measured, up 50 percentage points (from 25 percent to 75 percent in 2020), with significant growth across both survey cycles. Use of *websites* falls just below mobile apps at 72 percent in 2020, and while *website* usage grew between 2013 and 2016, it has remained relatively stable since 2016. As with mobile apps, use of *social media* (67 percent) has shown strong growth since 2013, up 56 percentage points. Similarly, use of *email or text alerts* has grown 48 percentage points since 2013, from 15 percent to 63 percent usage in 2020. Although use of both *511* (18 percent) and *kiosks* (15 percent) show an overall growth of 10 percentage points since 2013, adoption slowed from 2016 to 2020 and remains lower than other traveler information methods. On average, transit agencies are using 4.6 of the surveyed traveler information systems.

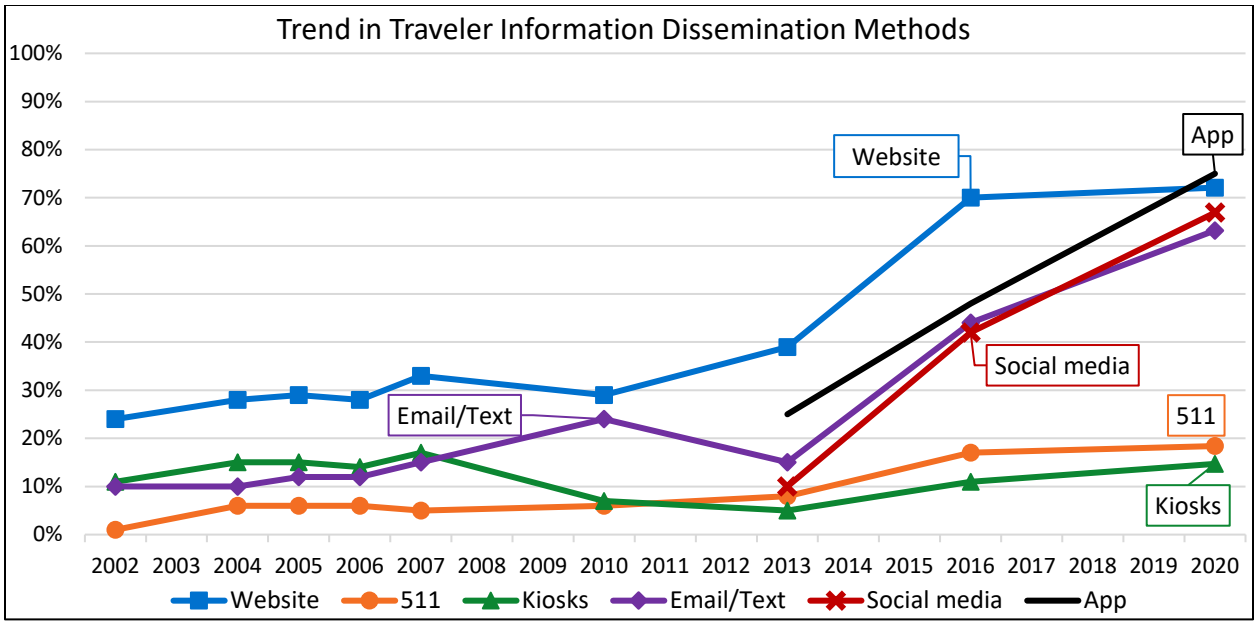


Figure 18. Trend in Traveler Information Dissemination Methods

Agencies also were asked to report on their use of *DMS in stations*, *in vehicles*, and *at stops*. Figure 19 shows steady growth in the use of DMS across the three surveyed venues since 2010. During the most recent survey cycle, there was significant growth (17 percentage points) in the use of *DMS in stations*, from 38 percent of surveyed transit agencies in 2016 to 55 percent in 2020. Likewise, the recent growth in adoption of *DMS in vehicles* is notable, from 12 percent in 2016 to 25 percent in 2020. While there is significant growth in the use of *DMS at stops* since 2010, the trend is relatively flat since 2016 (from 28 percent to 32 percent in 2020).

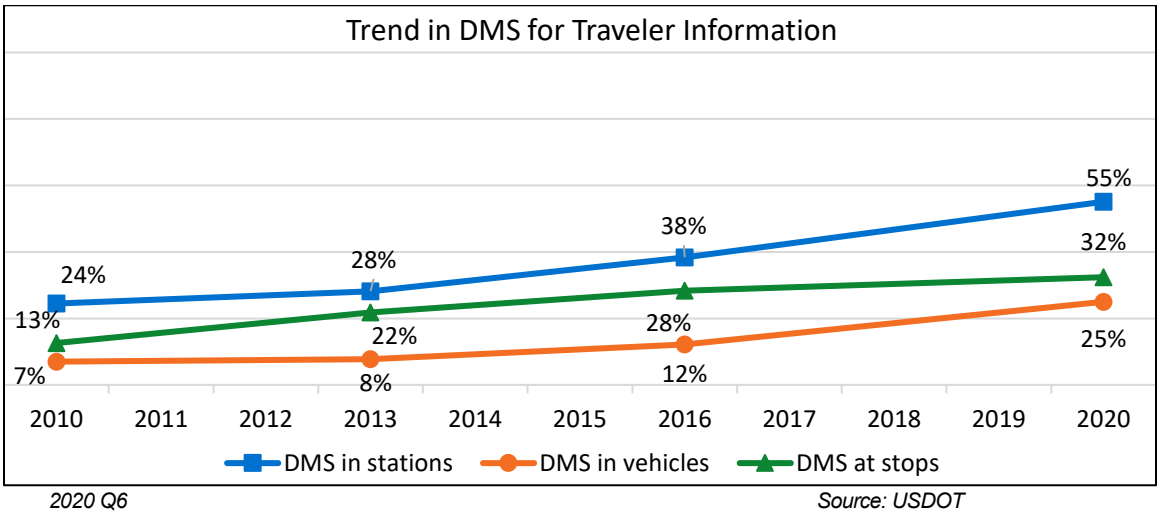


Figure 19. Trend in DMS for Traveler Information

Open Data Feed

Fifty-seven percent of surveyed transit *agencies provide an open data feed* (e.g., to app developers, information service providers, or the public) and an additional 15 percent indicate that their agency is *working on providing* an open data feed. About one-quarter (27 percent) report that their agency has *no current plans* for an open data feed and 1 percent of agencies did not provide a response (Figure 20).

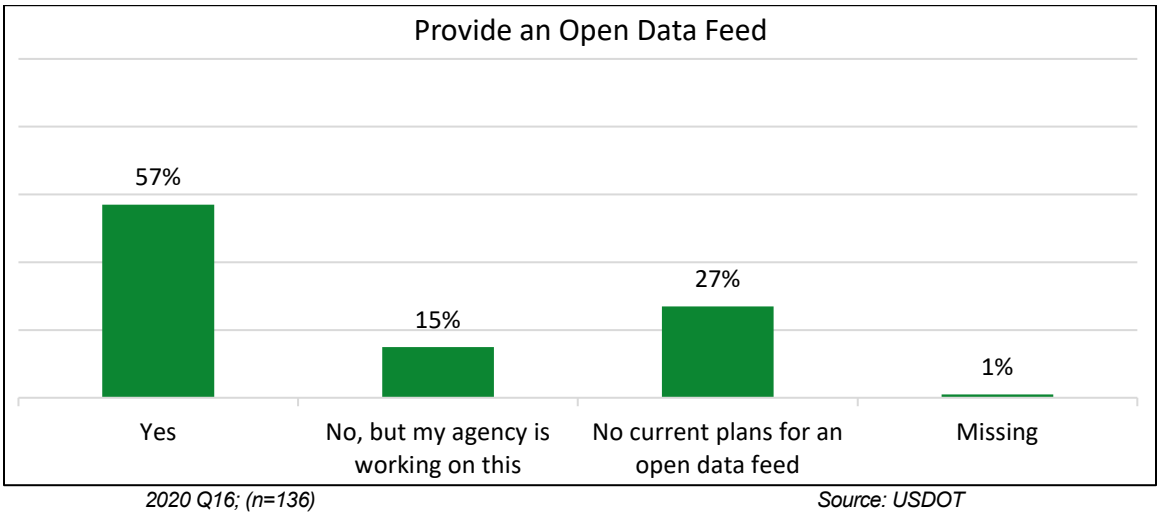


Figure 20. Provide an Open Data Feed

Telecommunications

As shown in Figure 21, both wired and wireless telecommunications play a role for transit agencies in communicating between their ITS devices and/or between ITS roadside devices and a central processing location (i.e., typically for data collection and dissemination). However, surveyed transit agencies are somewhat more likely to report the use of at least one wireless telecommunication option (87 percent), compared to the use of at least one wired telecommunication option (63 percent). On average, among agencies responding to this question, agencies indicate use of 3.3 telecommunications. Of the surveyed wired telecommunications, *fiber optic cable* (44 percent) is the most commonly used. About one-quarter of transit agencies use *Digital Subscriber Line* (23 percent), while *twisted copper pair or twisted wire pair* (18 percent), *coaxial cable* (13 percent), and *data cable over modem* (11 percent) are less commonly used.

Among the wireless telecommunication technologies, most surveyed transit agencies are using *Cellular (LTE 4G)* (72 percent) and more than one-half report use of *Wi-Fi* (59 percent). Less common wireless telecommunication technologies are *Cellular (GPRS-2G or 3G)* (13 percent), *microwave* (13 percent), *5G New Radio and small cell infrastructure* (10 percent),[7] *Dedicated Short Range Communication (DSRC)* (9

[7] At this time, *5G New Radio* is not yet commercially available, but it is likely respondents have implemented and are using *small cell infrastructure* with 4G radios.

percent), *ultra-wideband* (4 percent), *LTE Cellular V2X* (4 percent),[8] and *mobile or fixed service satellite* (1 percent). Seven percent of transit agencies report use of *radio* in the *other* response category.[9] Five percent of agencies report some *other* wired or wireless telecommunications, and 7 percent did not provide a response to this question.

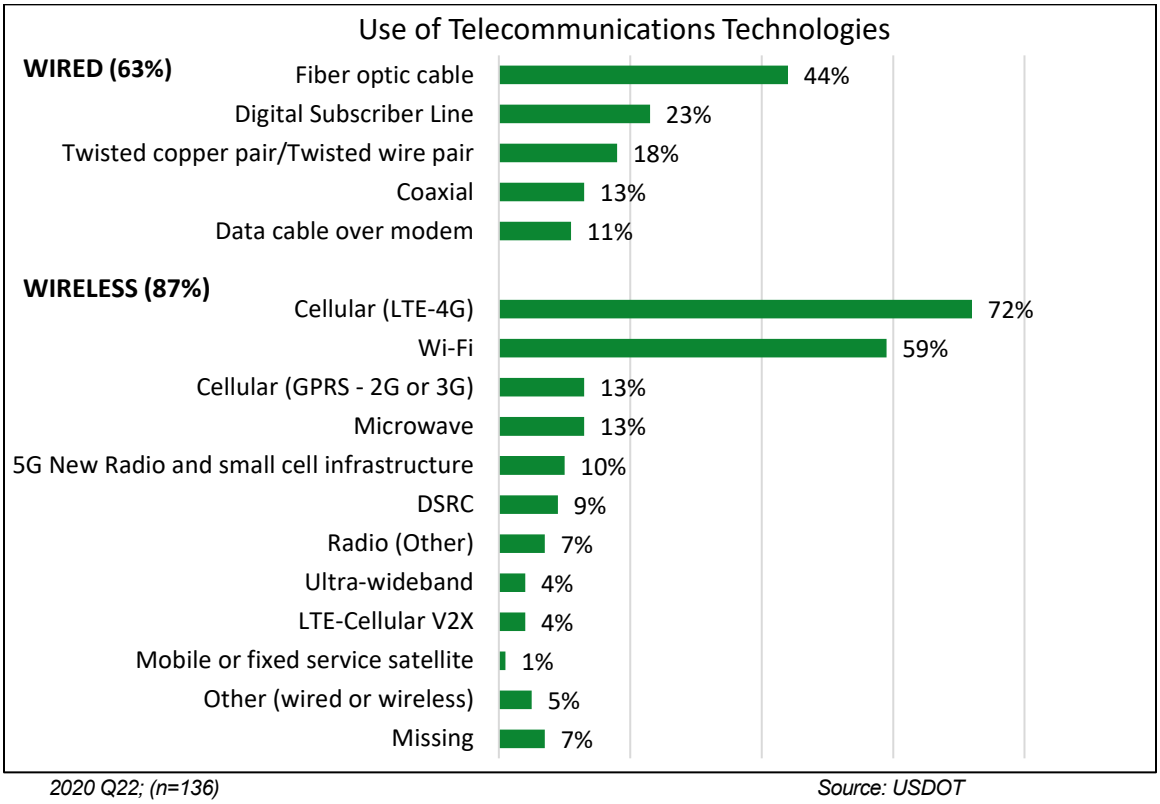


Figure 21. Use of Telecommunications Technologies

[8] Details about whether these *LTE-Cellular V2X* installations are being used with applications under their experimental license versus installed for testing needs further exploration.

[9] The *other* response category allows respondents to write in responses, specifying what they mean by "other." If at least 2 to 3 percent of respondents write in the same response, these are typically recoded into a new response category.

Electronic Fare Payment

A series of questions investigated the types of fare media that transit agencies accept, their adoption of electronic fare payment (EFP), the characteristics of the EFP system, and plans to upgrade fare payment systems.

Figure 22 shows nearly all surveyed transit agencies (96 percent) accept *cash* for transit fare payment, and those that do not (4 percent) offer *free/no fare* service. Aside from cash, the most commonly accepted fare media are *magnetic stripe cards* (66 percent), followed by *mobile app payment* (49 percent) and *agency or regional smart cards* (42 percent). Significantly fewer agencies accept *mobile wallet* (10 percent) or *contactless credit or debit cards* (9 percent). Seven percent of agencies also indicated accepting a *physical ticket, token, or pass,*[10] and 3 percent report another *other* response.

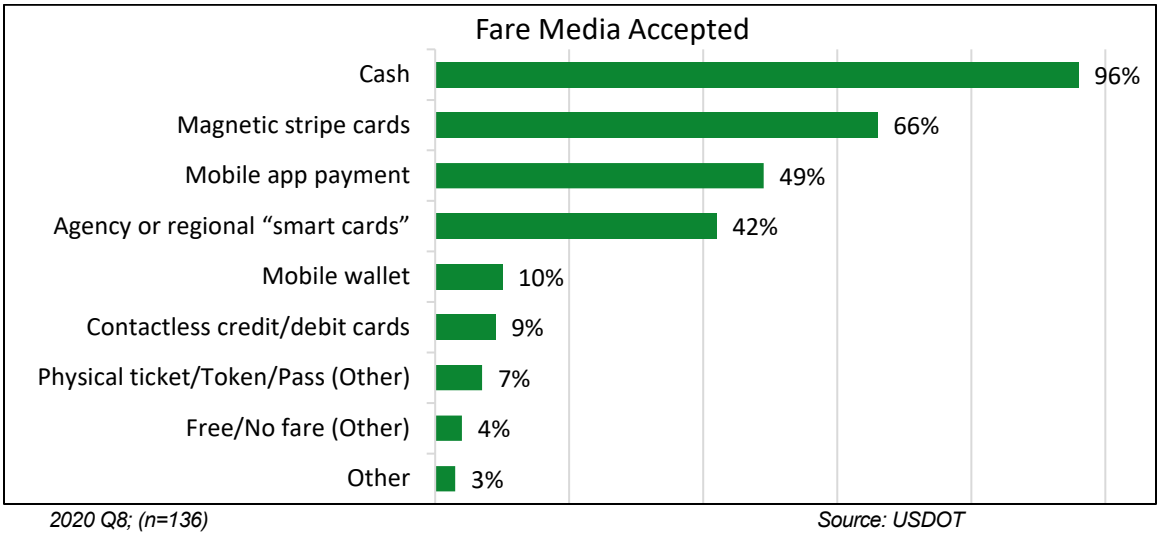
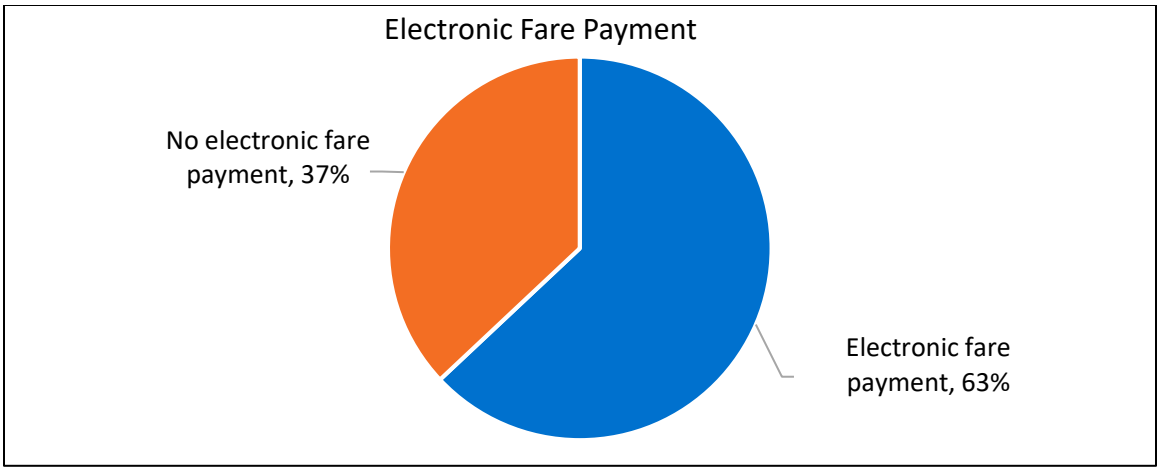


Figure 22. Fare Media Accepted

Nearly two-thirds of transit agencies (63 percent) report having an *EFP system*, while the remaining 37 percent indicate they *do not* (Figure 23). Data analysis suggests that agencies may have under-reported their EFP systems. Of the 50 agencies that indicated they *do not have EFP*, 29 agencies report using one or more payment options that would typically be associated with EFP (i.e., magnetic stripe cards, mobile app payment, agency or regional smart cards, contactless credit/debit cards, or mobile wallet*).* This discrepancy may be due to confusion around how EFP is defined. Future surveys may want to provide a clear definition for EFP.

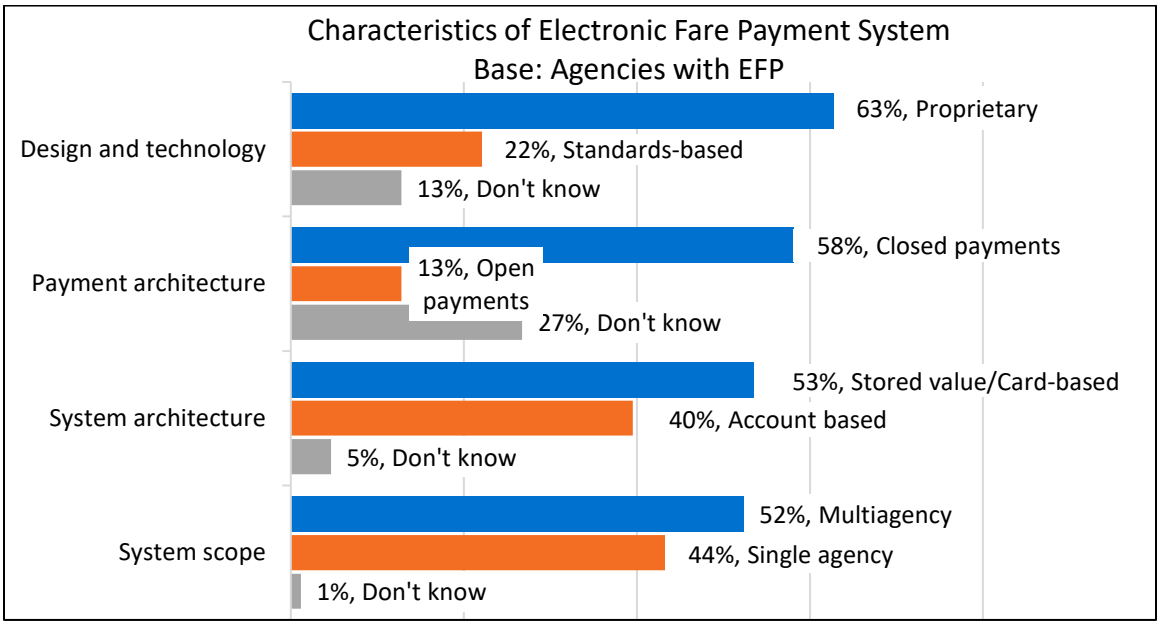
[10] Two new response categories – *free/no fare* and *physical ticket/ token/pass* - were added, based on a sufficient number of transit agencies writing in these responses to the *other* response option.



2020 Q8a; (n=136) *Source: USDOT*

Figure 23. Electronic Fare Payment

Figure 24 illustrates different characteristics of surveyed transit agencies' EFP systems, design and technology, payment architecture, system architecture, and system scope. With regards to design and technology, a majority of the systems are *proprietary* (63 percent) compared to 22 percent that are *standards based*; the remaining 13 percent of agencies indicate *don't know*. With respect to payment architecture, *closed payment systems* are more common than *open payment systems* (58 percent versus 13 percent), but more than one-quarter (27 percent) of surveyed transit agencies report that they *don't know*. In terms of system architecture, a majority report *stored value or card-based systems* (53 percent), with slightly fewer indicating *account-based systems* (40 percent) and 5 percent report *don't know*. On system scope, surveyed transit agencies are somewhat more likely to report *multiagency* than *single agency* systems (52 percent versus 44 percent), and only 1 percent report *don't know*.

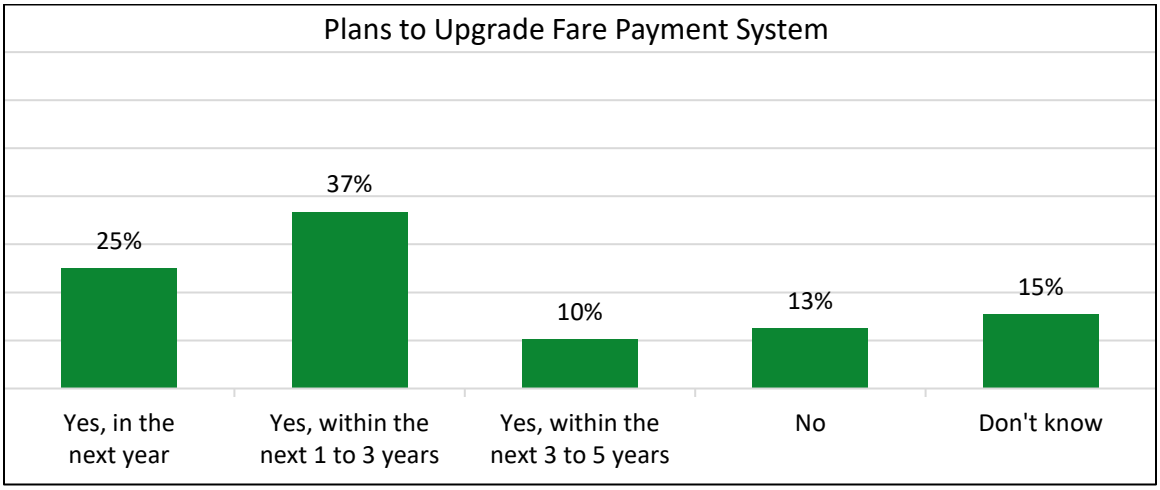


2020 Q9; (n=86) *Source: USDOT*

Figure 24. Characteristics of Electronic Fare Payment System

Fare Payment System Upgrades

Figure 25 shows the surveyed transit agencies' responses regarding plans to upgrade their fare payment systems to accept additional or different types of fare media. Seventy-two percent of agencies report plans to upgrade their fare payment systems within the next five years; one-quarter of surveyed transit agencies (25 percent) have plans to upgrade *in the next year*, an additional 37 percent indicate plans to do so within the *next one to three years*, and a smaller number (10 percent) indicate plans to upgrade in the *next three to five years*. The remaining agencies report that they have *no plans* (13 percent) to upgrade their fare payment options, or *don't know* (15 percent).



2020 Q10; (n=136) *Source: USDOT*

Figure 25. Plans to Upgrade Fare Payment System

Transit Tools and Supports

Nearly three-quarters (74 percent) of surveyed transit agencies report having a *trip planner*, and the remaining quarter indicate that they do not. Figure 26 shows that among agencies with trip planners, 60 percent include *modes other than transit*, and one-half incorporate *multiple transit systems in their area*. Significantly fewer – about one-third – report incorporating *more than one mode within their agency* (34 percent)[11] or incorporating *payment of fares for agency services* (33 percent). About one-quarter have built *real-time traffic conditions* into their trip planners (27 percent), 18 percent incorporate *private mobility service providers*, such as bike-share, scooter-share, taxis, and ride-hailing, and 10 percent incorporate *payment of fares to mobility providers*. Nearly one-fifth (17 percent) have not incorporated any of these features in their trip planners.

[11] If based on agencies providing multiple fixed route services (not including ADA paratransit or demand responsive service), about two-thirds of agencies are incorporating *more than one mode within their agency* in their trip planners; however, the sample size is small (n=28).

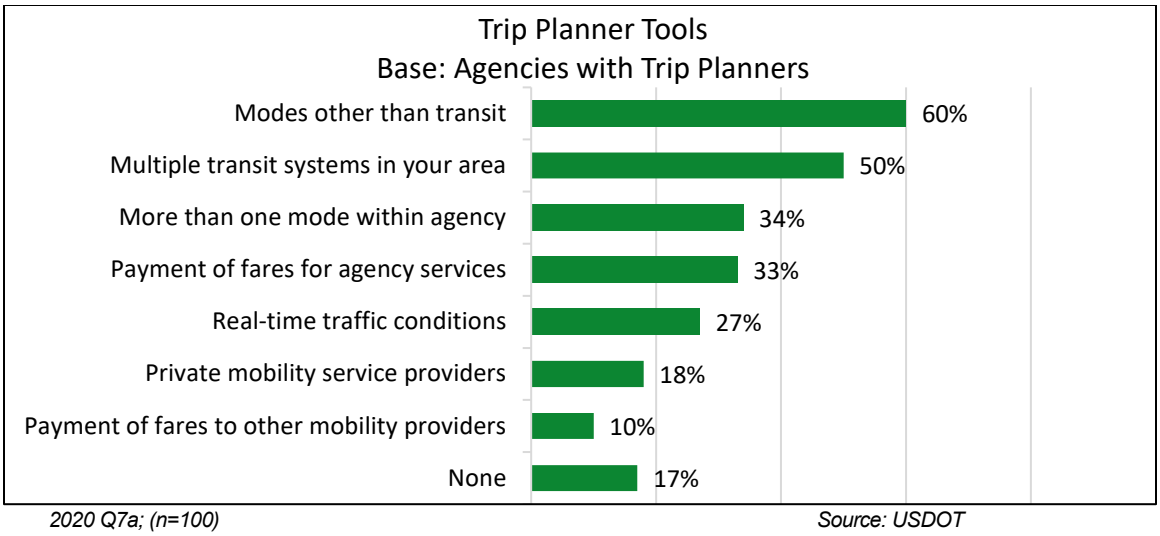


Figure 26. Trip Planner Tools

Independent Travel for People with Disabilities

Figure 27 shows several technologies or services offered to support independent travel for people with disabilities. It should be noted that this survey question focused on ITS and did not include a comprehensive list of all possible technologies (or non-technology solutions) that agencies may be using to meet ADA requirements (see Appendix A for the full text of the question and response options). In addition, several individual survey questions address activities that go beyond minimum ADA requirements (e.g., automated announcements and travel training). Finally, in some cases, the percent adopting a technology or solution may be lower because that response does not apply to a subset of agencies (e.g., agencies that do not have fare vending machines would have left the response audio- and braille-equipped fare/ticket vending machines blank).

In 2020, nearly two-thirds of transit agencies (62 percent) have adopted *automated announcements and displays.* Just under one-half have *accessible agency owned websites and/or mobile applications* (e.g., adjustable text sizes, screen reader capable, image descriptions) (46 percent),[12] as well as trip reservation systems with ways to *reserve trips in addition to phone calls and teletypewriter (TTY) or Telecommunications Device for the Deaf (TDD)* (44 percent).

About one-third of surveyed transit agencies have *audio- and braille-equipped fare or ticket vending machines* (34 percent), and a similar number have *travel training and independent travel support applications* (32 percent) and *flexible or on-demand mobility services* including microtransit operated by the agency or through formal partnerships (wheelchair-accessible) (29 percent). Five percent offer *indoor*

[12] Forty-six percent of agencies report providing accessible agency-owned websites and/or mobile applications (Figure 27), while 72 percent of agencies report using websites to disseminate real-time traveler information (Figure 18). However, it is not clear how many of the latter are agency-owned. This may help explain the discrepancy between the two percentages. Respondent error or misunderstanding also may be an issue.

navigation support,[13] 4 percent use *augmentative and alternative communication (AAC) aids*, and 15 percent report having none of these specific technologies or services currently implemented or piloted.

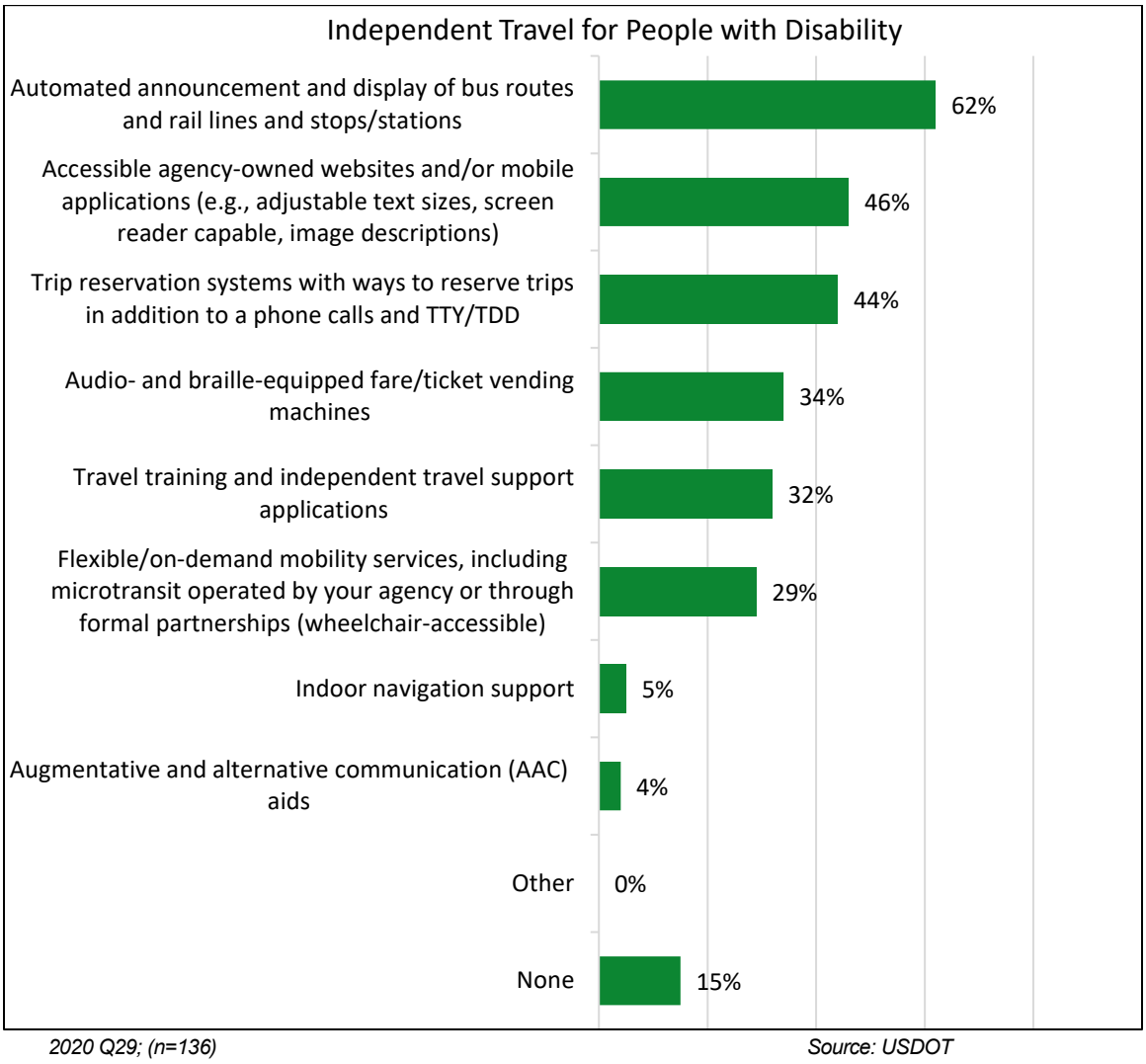
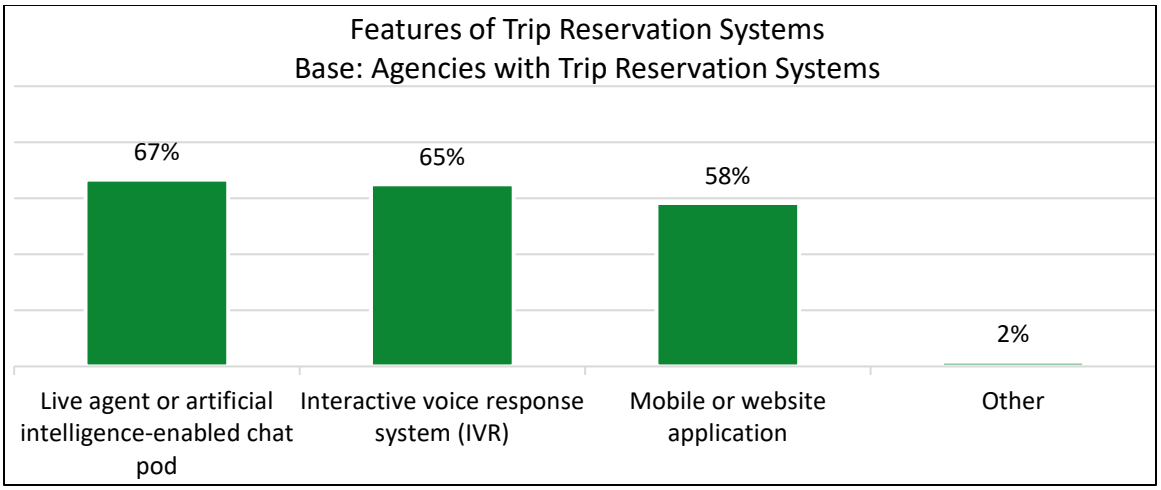


Figure 27. Independent Travel for People with Disability

A follow-up question was asked of the 44 percent of agencies with *trip reservation systems* (Figure 27). Among these agencies, two-thirds report having *a live agent or artificial intelligence-enabled chat pod* (67 percent), and a similarly high number have an *interactive voice response system* (65 percent). Slightly fewer agencies with trip reservation systems have a *mobile or website application* (58 percent), and 2 percent report *other* features of their trip reservation system (Figure 28).

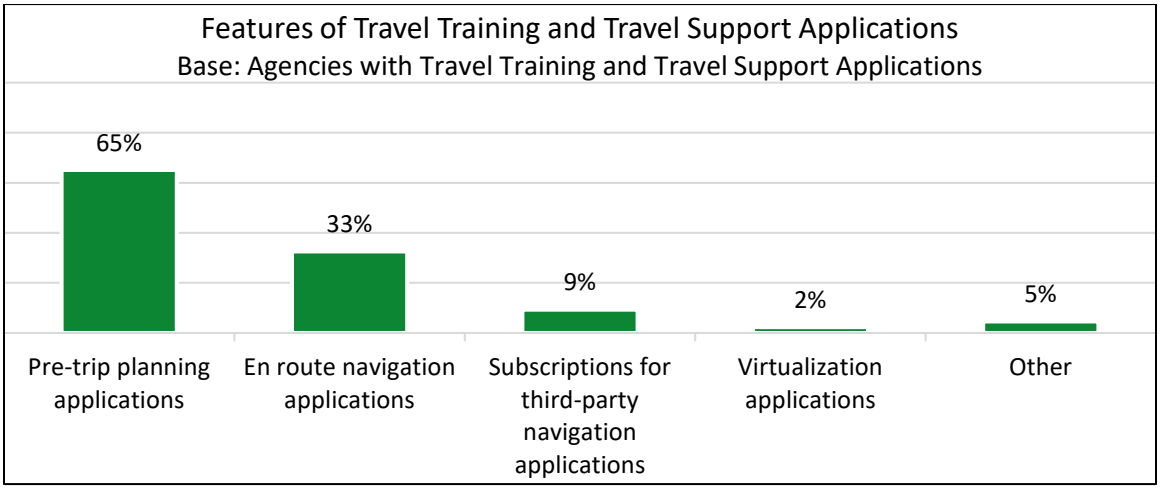
[13] Findings for the follow-up question on the types of indoor navigation provided are not shown due to the small sample (n=7) of transit agencies with indoor navigation (see Appendix C for findings).



2020 Q30; (n=30) *Source: USDOT*

Figure 28. Independent Travel for People with Disability – Features of Trip Reservation Systems

Figure 27 shows that among the 32 percent of agencies that deploy *travel training and travel support applications*, about two-thirds offer *pre-trip planning applications* (65 percent), compared to one-third that offer *en route navigation* (33 percent). Significantly fewer agencies with travel applications provide *subscriptions for third party navigation applications* (9 percent) or *visualization applications* (2 percent). Five percent report *other* features (Figure 29).

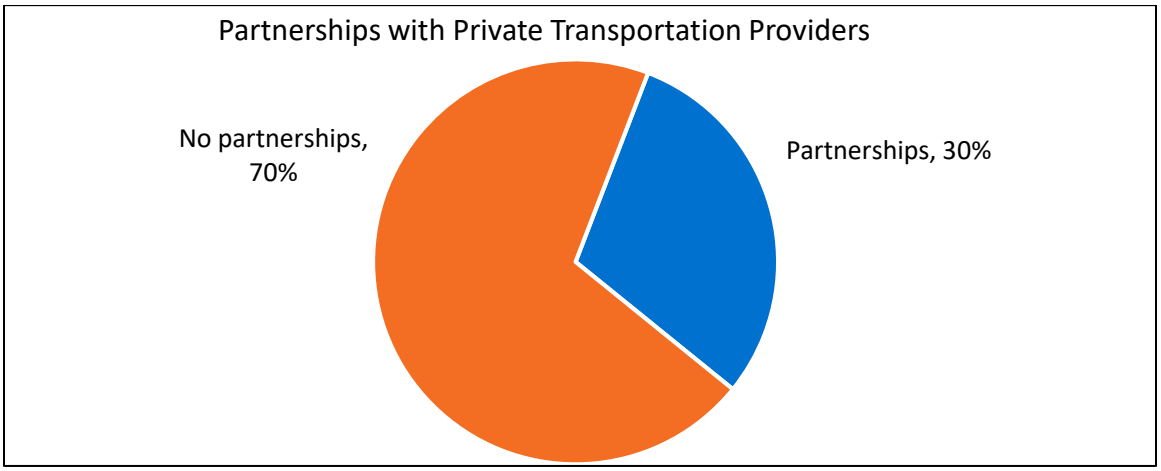


2020 Q32; (n=43) *Source: USDOT*

Figure 29. Independent Travel for People with Disability – Features of Travel Training and Travel Support Applications

Partnership and Coordination

Overall, thirty percent of surveyed transit agencies *partner with private transportation services* (Figure 30), a similar number to 2016, where 32 percent of surveyed agencies indicated partnerships.



2020 Q11; (n=136) *Source: USDOT*

Figure 30. Partnerships with Private Transportation Providers

Figure 31 shows the trend in partnerships with specific private transportation providers. While the overall number of agencies that partner has remained stable since 2016 (30 percent in 2020 versus 32 percent in 2016), the mix of partnerships has changed. In addition, transit agencies are, on average, engaging in more partnerships, as the mean number of partnerships increased from 1.3 in 2016 to 2.1 in 2020.

Ride-hailing (15 percent) and *taxi* (12 percent) are the two most commonly reported partnerships in 2020, with a significant increase in partnerships with *ride-hailing companies*, from 4 percent in 2016 to 15 percent in 2020. Partnerships with *microtransit services* show moderate growth (six percentage points from 3 percent in 2016 to 9 percent in 2020). Six percent or fewer agencies engage in other partnerships, including *bike-share* (6 percent), *carpool matching* (5 percent), *parking* (4 percent), *scooter-share* (4 percent), or *other* private transportation providers (6 percent). Trend data are not available for carpool matching and scooter-share partnerships because they are new response options in the 2020 survey.

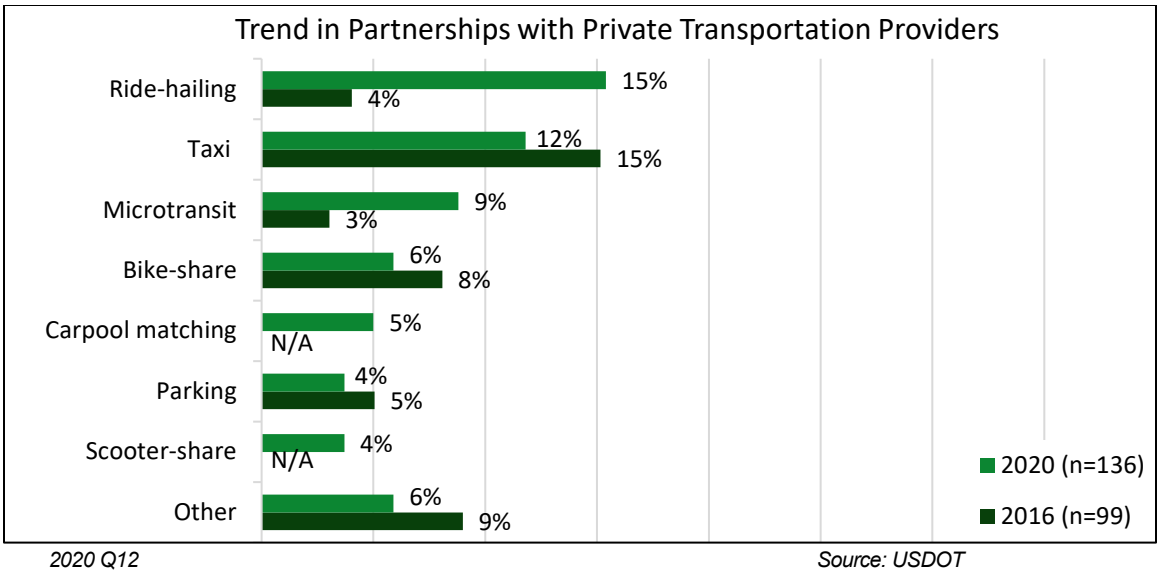


Figure 31. Trend in Partnerships with Private Transportation Providers

Figure 32 shows the types of partnerships reported among the surveyed transit agencies who report partnering with private transportation providers (30 percent). The most common type of partnership is one that *provides subsidized or unsubsidized service to agency customers* – this is reported by a large majority of agencies (88 percent). Significantly less common, but still adopted by about one-third of agencies, are partnerships that *integrate real-time, schedule, or availability data in trip planning tools* (32 percent). The least common partnerships are those that *share traveler information through an app* (20 percent), *share payment platforms* (17 percent), or *integrate dispatching* (12 percent). Seven percent of agencies report *other,* and 2 percent are missing responses.

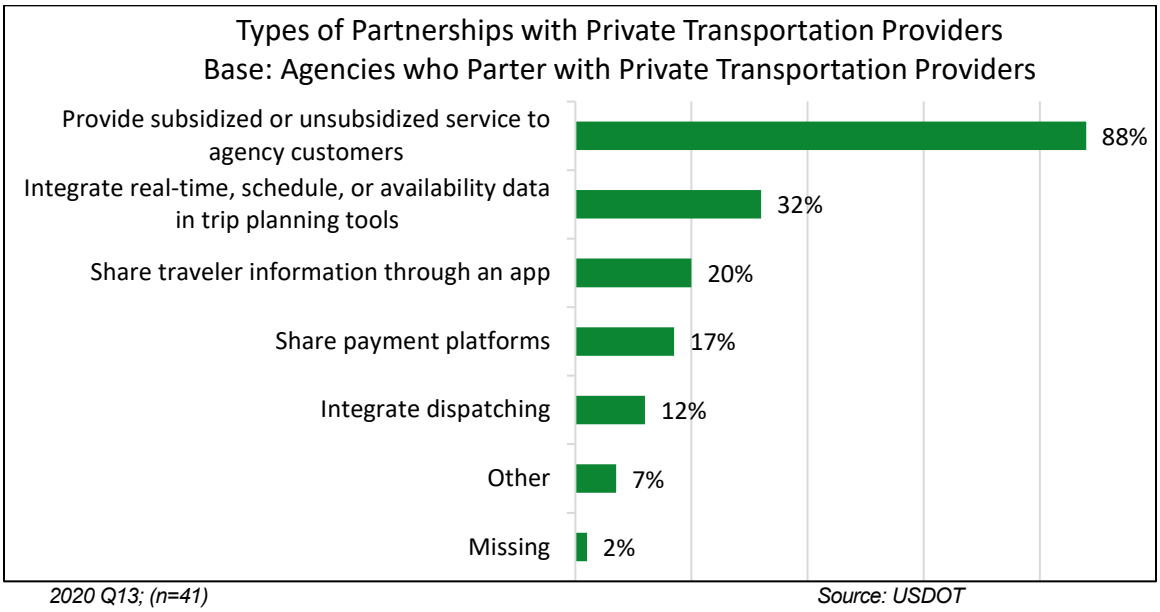
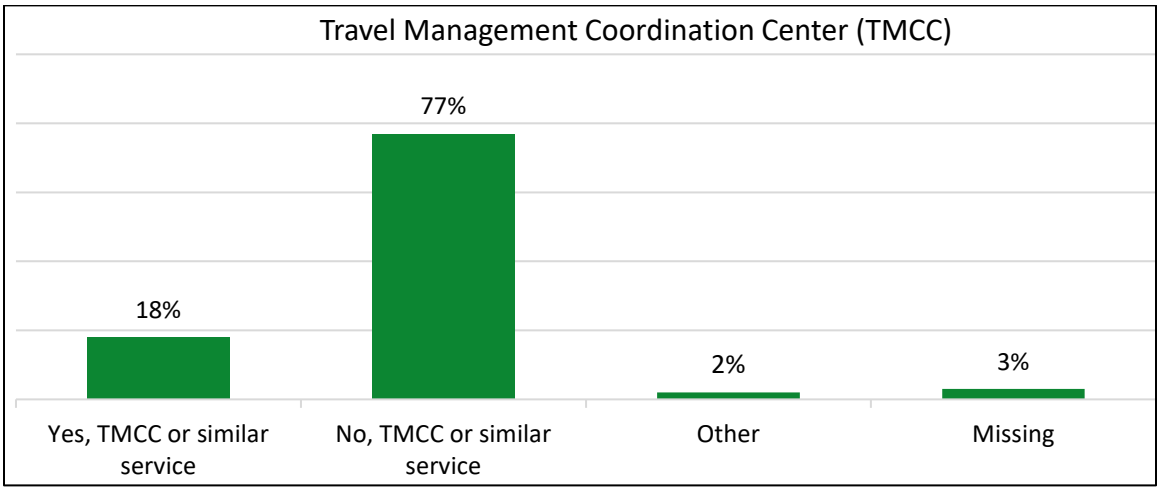


Figure 32. Types of Partnerships with Private Transportation Providers

Travel Management Coordination Center

A Travel Management Coordination Center (TMCC) works with other entities to coordinate mobility services for the transportation disadvantaged. These entities may include social service agencies, Health and Human Services, non-emergency medical transportation services, or private transportation providers, among others. Eighteen percent of surveyed transit agencies report they *operate a TMCC* or similar service, whereas more than three-quarters (77 percent) *do not*. Two percent of agencies indicate *other*, and 3 percent did not respond (Figure 33).



2020 Q14; (n=136) *Source: USDOT*

Figure 33. Travel Management Coordination Center

Integrated Corridor Management

As defined in the 2020 survey, Integrated Corridor Management (ICM) is an approach to manage a transportation corridor 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. A corridor includes freeway, arterial, and public transit facilities with cross-facility connections.

A majority of surveyed transit agencies (71 percent) indicate they have *no plans to deploy ICM*. Eight percent report having *deployed ICM*, and an additional 18 percent have *plans to deploy* (Figure 34). Overall, surveyed transit agencies do not show high levels of interest in ICM.

Due to survey length, the survey did not include follow-up questions on the nature of agencies' ICM deployments. As a result, the data do not include information on what technology deployments and operational strategies comprise their ICM. There may be a range of technologies in ICM deployments, with some agencies deploying more sophisticated systems than others. Additional data are needed to understand the nature of these ICM deployments and the extent to which agencies are coordinating with other partner agencies in the corridor.

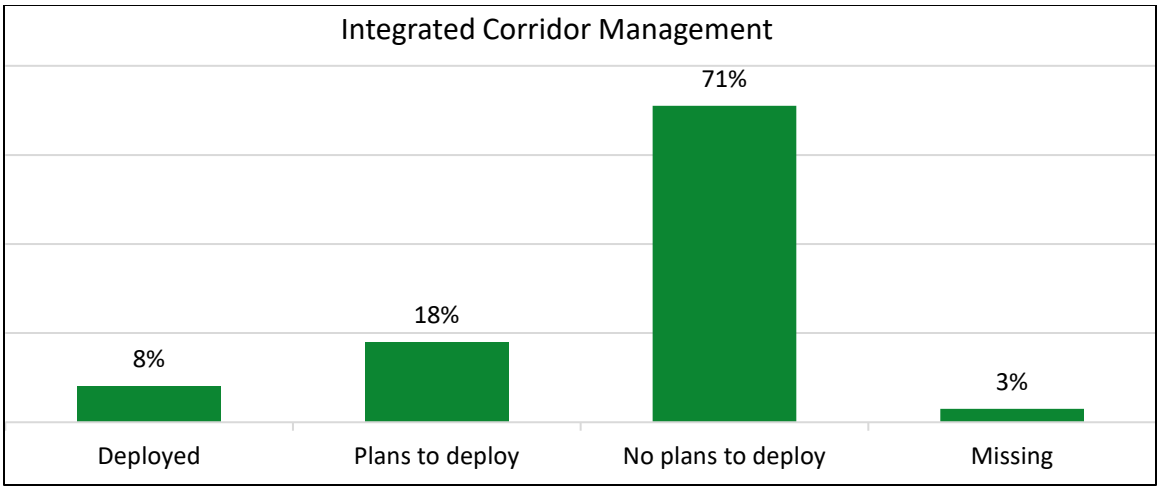


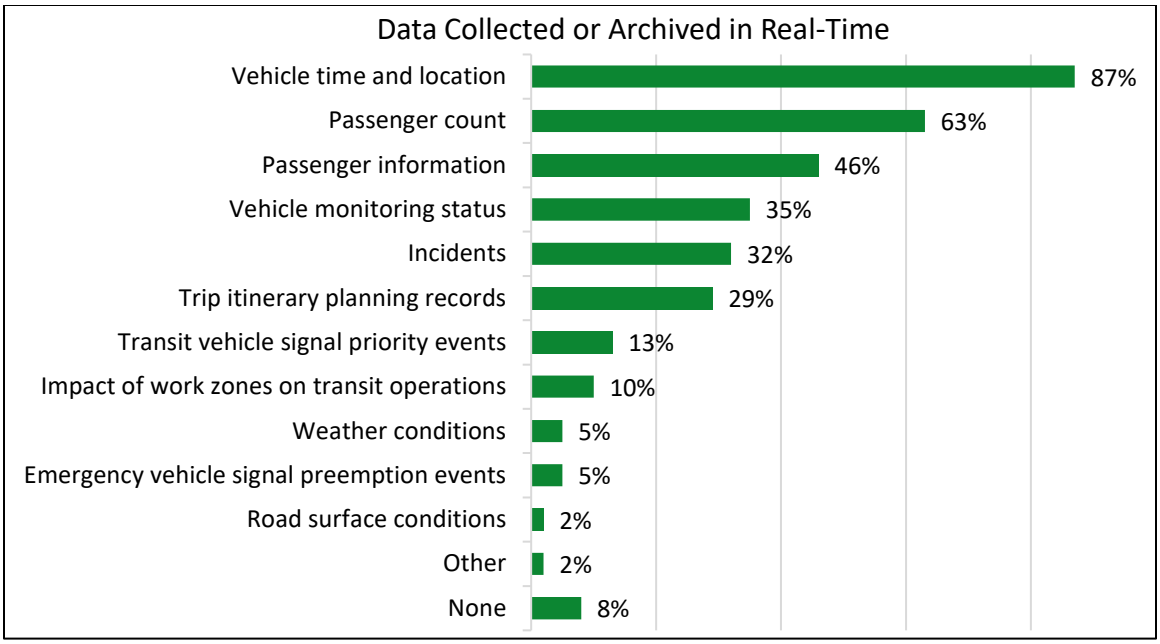
Figure 34. Integrated Corridor Management

Data Collection

Figure 35 shows a large majority of surveyed transit agencies collect and/or archive *vehicle time and location* (87 percent) data in real-time. This is not surprising given the high incidence of AVL adoption (92 percent, Figure 4). Nearly two-thirds collect and/or archive *passenger count* data (63 percent), which is in line with (though slightly less than) APC adoption (71 percent, Figure 4). Nearly one-half (46 percent) collect and/or archive *passenger information*, followed by about one-third of surveyed transit agencies that collect and/or archive *vehicle monitoring status* (35 percent), *incidents* (32 percent), and *trip itinerary planning records* (29 percent).

Significantly fewer agencies are collecting and/or archiving other types of data, such as *transit vehicle signal priority events* (13 percent)[14], *impact of work zones on transit operations* (10 percent), *weather conditions* (5 percent), *emergency vehicle signal preemption events* (5 percent), *road surface conditions* (2 percent) and *other* data (2 percent). Eight percent of surveyed transit agencies do not collect or archive any data in real-time.

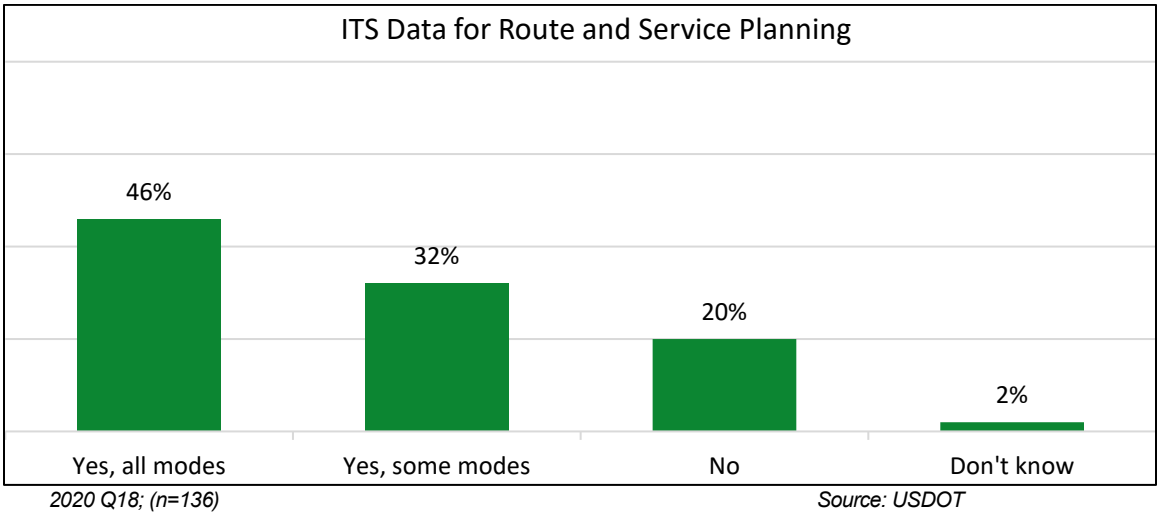
[14] Among agencies with *TSP*, 41 percent of agencies are collecting and/or archiving TSP events in real-time.



2020 Q17; (n=136) *Source: USDOT*

Figure 35. Data Collected or Archived in Real-Time

A large majority of surveyed transit agencies (78 percent) use ITS data for route and service planning, with 46 percent doing so for *all modes* and an additional 32 percent for *some modes*. Twenty percent report *not using* ITS data for route and service planning, and 2 percent *don't know* (Figure 36).



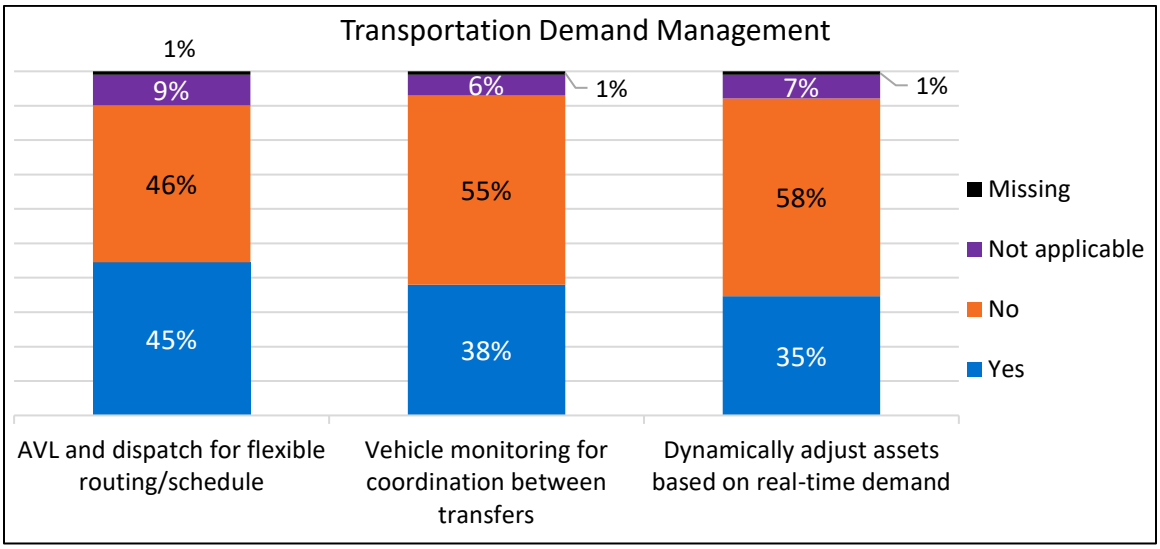
2020 Q18; (n=136) *Source: USDOT*

Figure 36. ITS Data for Route and Service Planning

Transportation Demand Management

Roughly one-third to one-half of surveyed transit agencies utilize the surveyed transportation demand management (TDM) strategies as shown in Figure 37. Most popular – at 45 percent – is the use of *AVL and dispatching and reservation technologies to allow for flexible routing and scheduling*. However, about the same number indicate they do not use this TDM strategy (46 percent), and 9 percent report *not applicable* (e.g., they may not have AVL).

Thirty-eight percent of agencies employ *vehicle monitoring and communication technologies* to hold vehicles, facilitating the coordination of passenger transfers between vehicles or between transit systems, and 35 percent report they *dynamically adjust assets based on real-time demand*. For these latter two TDM strategies, similar numbers report not using the strategy (55 percent and 58 percent, respectively) or *not applicable* (6 percent and 7 percent, respectively).



2020 Q19, Q20, Q21; (n=136) *Source: USDOT*

Figure 37. Transportation Demand Management

ITS Standards

Overall, 80 percent of surveyed transit agencies report use of at least one ITS standard shown in Figure 38, 10 percent indicate they *don't know,* and 10 percent said *no ITS standards* were used.[15] Over one-half of the surveyed transit agencies (59 percent) use *General Transit Feed Specification (GTFS)*, a de facto transit schedule standard, making it the most common of the ITS standards included in the survey. A similar number of transit agencies (54 percent) report use of real-time standards – *GTFS Real-Time* and/or *Service Interface for Real-Time Information* (*SIRI)*. Additional subgroup analysis found that among agencies providing real-time traveler information via mobile apps (75 percent, Figure 18), the use of real-time standards increases to 70 percent.

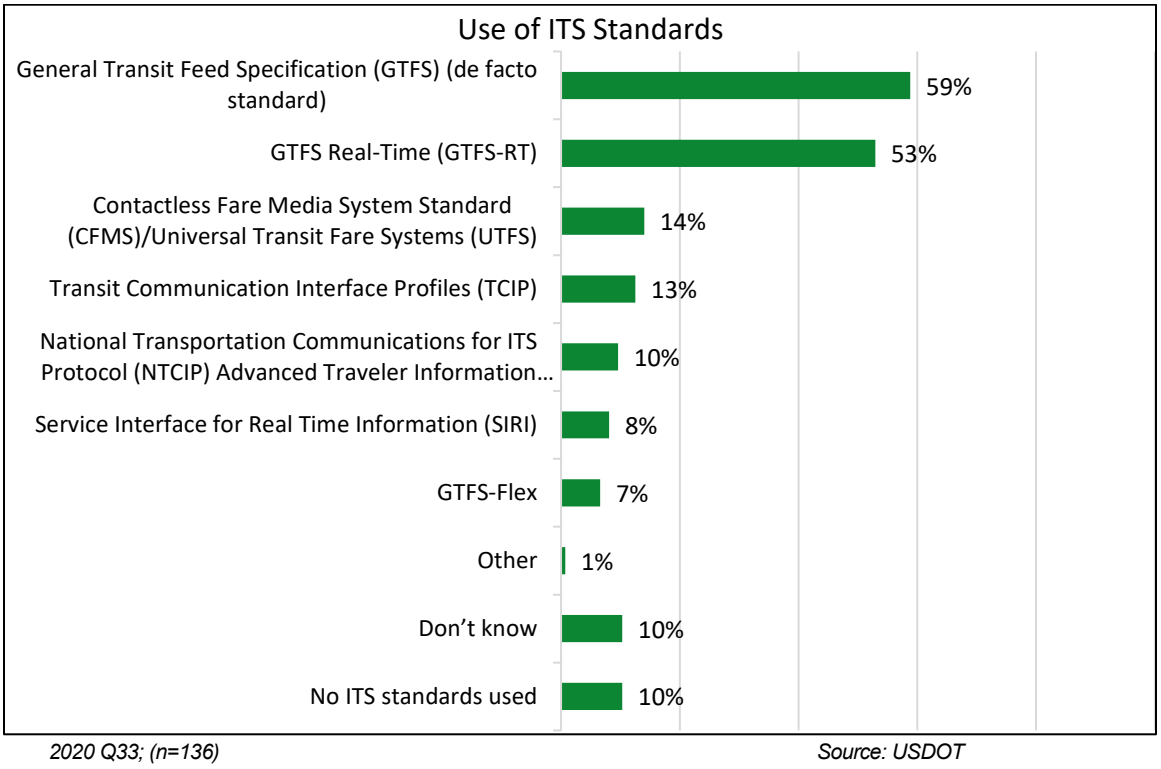
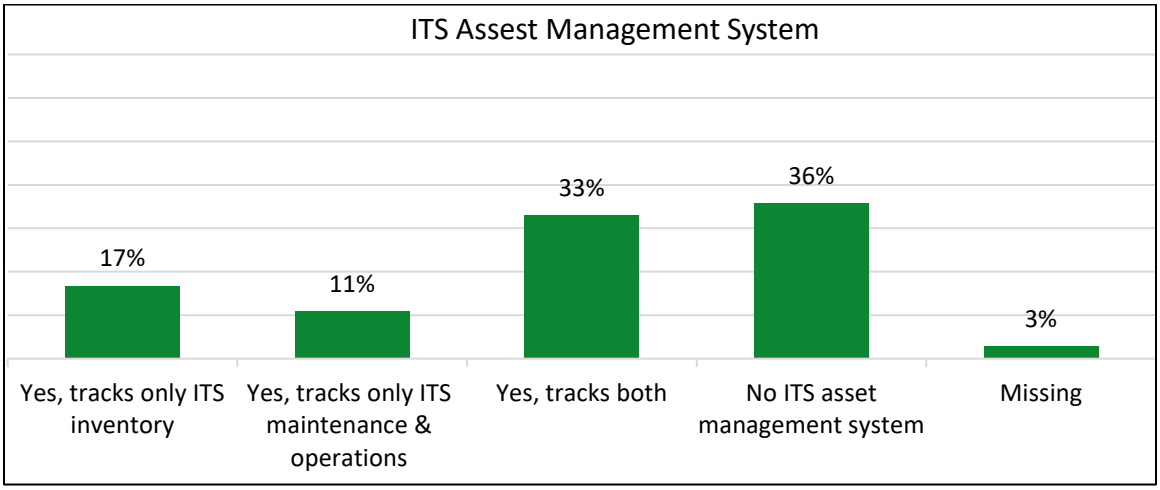


Figure 38. Use of ITS Standards

[15] The 2020 survey included a response option for *Network Timetable Exchange (NeTEx)*, which was not reported by any agencies.

ITS Asset Management

Figure 39 shows a majority of surveyed transit agencies (61 percent) have an ITS asset management system, with about one-third reporting an asset management system that tracks *both ITS inventory and related maintenance and operations* (33 percent), whereas 17 percent have a system that tracks *only ITS inventory*, and 11 percent have a system that tracks *only ITS maintenance and operations*. About one-third of surveyed transit agencies report *not having* an ITS asset management systems (36 percent)[16] and 3 percent did not provide a response.



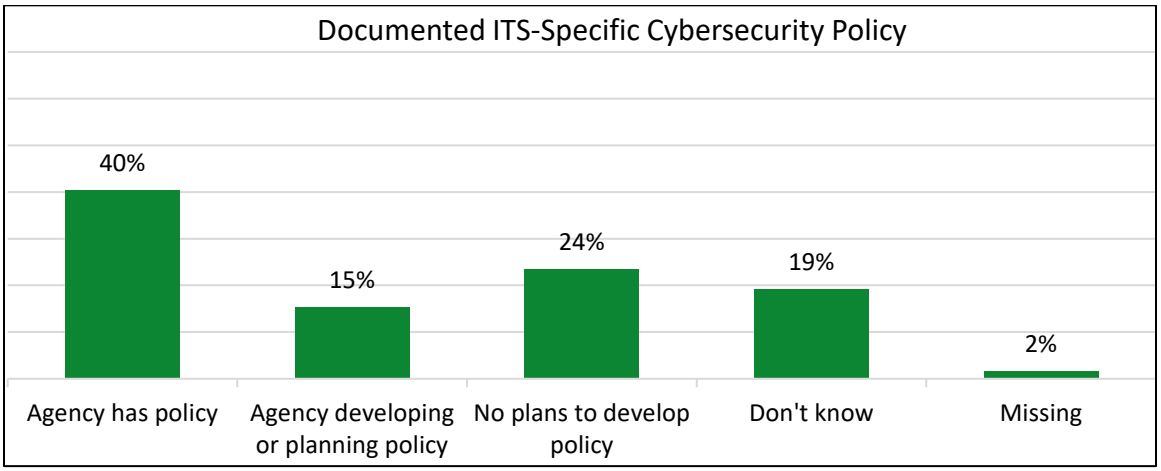
2020 Q26; (n=136) *Source: USDOT*

Figure 39. ITS Asset Management System

[16] Federal regulation requires that transit agencies have a Transit Asset Management Plan (See: 2016-16883.pdf (govinfo.gov)). However, the survey asked about asset management "systems," which are not required.

ITS Cybersecurity

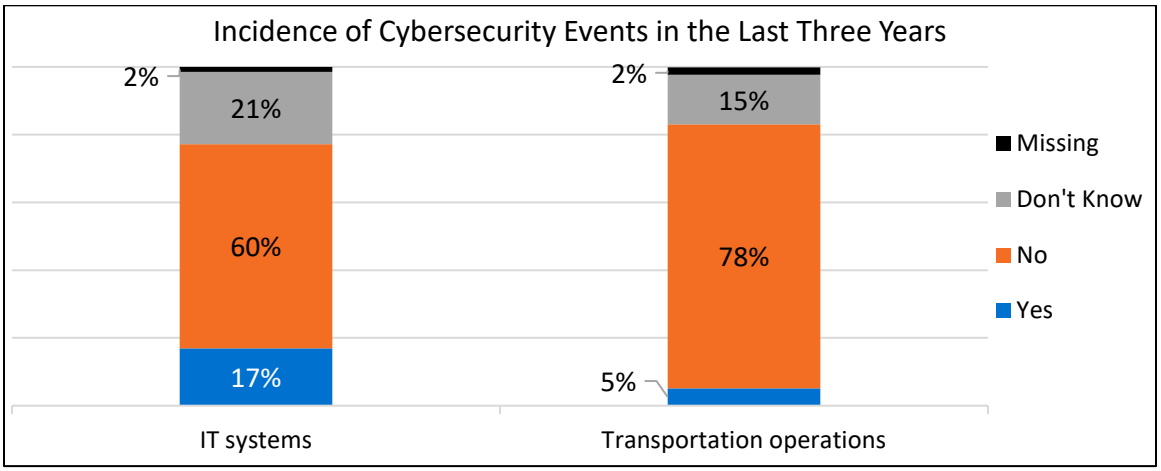
Figure 40 shows 40 percent of surveyed transit agencies have a documented *ITS-specific cybersecurity policy*, and another 15 percent are *developing a policy*. One-quarter of agencies do not have and have *no plans to develop* an ITS-specific cybersecurity policy (24 percent). Nineteen percent *don't know*, and 2 percent did not answer the question.



2020 Q23; (n=136) *Source: USDOT*

Figure 40. Documented ITS-Specific Cybersecurity Policy

Notably, 17 percent of surveyed transit agencies have experienced a cybersecurity event that affected their *IT systems* in the last three years, and 5 percent have experienced an event that affected *transportation operations* in the last three years (Figure 41). Overall, 18 percent reported experiencing either type of cybersecurity event.[17]



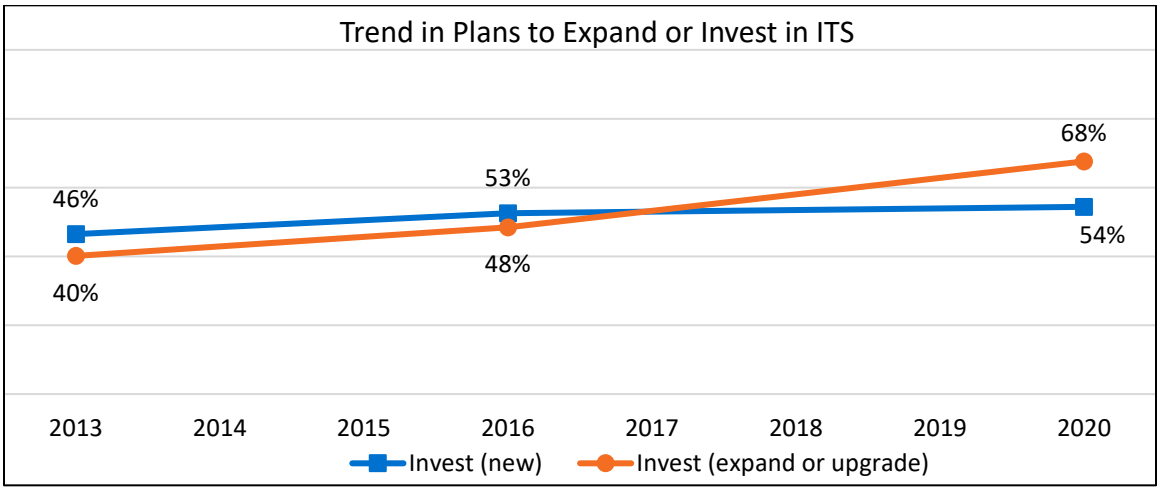
2020 Q24a, Q24b; (n=136) *Source: USDOT*

Figure 41. Incidence of Cybersecurity Events in the Last Three Years

[17] Most respondents who reported that a cybersecurity event affected their *transportation operations* also indicated an event that affected their *IT systems* (the data does not indicate whether it was the same or a different event).

Future ITS Investment

Figure 42 shows significant growth in the percent of surveyed transit agencies planning to *expand or upgrade their current ITS* in the next three years, from 40 percent in 2013 to 68 percent in 2020. About half (54 percent) of transit agencies have plans to *invest in new ITS* in the next three years. The trend shows moderate growth (8 percentage points) since 2013.



2020 Q34, Q35; (n=136) *Source: USDOT*

Figure 42. Trend in Plans to Expand or Invest in ITS

Chapter 4. Conclusions

The 2020 DTS is the latest survey in an ongoing effort by the USDOT ITS JPO to monitor the progress of ITS adoption and deployment among freeway, arterial, and transit agencies in 108 large and medium size metropolitan areas across the US. The surveys have been conducted for more than twenty years, and while the questions have evolved and new questions have been added over time, trend data are available for many of the technologies. The pandemic did not appear to significantly impact survey response rates; however, it is unclear what impact, if any, the pandemic has had or will have on ITS adoption or plans for adoption. Future surveys may add clarity and additional insight on this issue. The surveys provide insights on where agencies are deploying proven ITS as well as where technical assistance or outreach may be needed to increase adoption of newer ITS technologies. Survey responses and data trends can also raise questions that may merit further research and investigation.

Growth in Transit ITS

There has been a significant increase in agency adoption of *CADS* and *APC* since 2016, and more moderate growth of *AVL* and *TSP*. With the exception of TSP, these transit ITS technologies are adopted by a large majority of agencies. Coverage on fleets is also high, and for some technologies and fleet types, coverage is universal.

Transit agencies also are increasingly using different methods to disseminate real-time traveler information, with significant increases in the use of *mobile apps*, s*ocial media*, *websites*, and *email or text alerts* since 2013. There has also been growth in the use of *DMS in stations*, at stops, and *in vehicles* since 2010.

Agency Partnerships

While the overall number of transit agencies engaging in partnerships with private transportation services has remained stable since 2016 (about one-third), the average number of partnerships per agency has increased, and there has been significant growth in partnering with *ride-hailing companies*. Among the surveyed transit agencies who report partnering with private transportation services in 2020 (30 percent), the most common type of partnership is one that *provides subsidized or unsubsidized service to agency customers*.

Areas to Watch – Fare Payment and Cybersecurity

Nearly three-quarters (72 percent) of transit agencies are planning to upgrade their fare payment systems in the *next five years*, with one-quarter planning to do so in the *next year*.

On cybersecurity, less than half of transit agencies (40 percent) have a documented *ITS-specific cybersecurity policy*, and 15 percent are *currently developing a policy*. Notably, 17 percent report

experiencing a cybersecurity event that affected their *IT systems* and 5 percent report an event affecting *transportation operations*. Given the relatively large number of agencies that still have not developed an ITS-specific cybersecurity policy, there is room for growth in this area.

Appendix A. Transit Survey Instrument

Landing Page

Welcome to **the 2020 Intelligent Transportation Systems Deployment Tracking Survey** (DTS), sponsored by the U.S. Department of Transportation (DOT) Intelligent Transportation Systems (ITS) Joint Program Office (JPO) and administered by Resource Systems Group, Inc. (RSG).

The survey will take approximately 20 to 25 minutes to complete. We encourage you to review the questionnaire (see link below) and to consult with colleagues, as needed, to gather the requested information before completing the online survey.

You can return to this dashboard to access your survey at any time. If you start a survey and need to come back later, your progress will be saved.

Thank you in advance for your time and effort! We greatly appreciate your participation.

If you have any questions, please feel free to contact us:

- For overall survey questions: [CONTENT REMOVED]
- For technical support related to the survey tool: [CONTENT REMOVED]

For your reference, a PDF version of this online survey:
https://rsgsurvey.com/its_dts_dashboard/pdfs/ITSDTS_FreewaySurvey.pdf

For more information about the Deployment Tracking Statistics, please see:
https://www.itskrs.its.dot.gov/deployment

Privacy/Consent

Thank you for participating in this survey!

We are committed to protecting the confidentiality, integrity, and security of your personal information. We take this responsibility seriously. Our privacy documentation is intended to help you understand how we collect, share, and safeguard your information. Information about privacy for this study can be found here. [LINK NO LONGER ACTIVE.]

This study is conducted by RSG, an independent market research firm. RSG's privacy policy can be found here. [LINK NO LONGER ACTIVE.]

Use the “Next” and “Previous” buttons below to navigate the survey. Do **NOT** use your browser's “forward” and “back” buttons because your answers will **NOT** be recorded.

By clicking “Next”, I consent to participate in the survey.

Questionnaire

Thank you for participating in the **Transit Management survey**, administered on behalf of the US Department of Transportation (DOT), Intelligent Transportation Systems (ITS) Joint Program Office (JPO). Please review the survey questions and consult with colleagues, as needed, to gather the requested information before the completing the online survey.

Transit Agency Characteristics

1. What is the total number of vehicles used in revenue service for each of the following modes? *If none for a mode, please enter '0.'*

	Total number
Fixed Route Bus	_____
Heavy or Rapid Rail (including subway)	_____
Light Rail	_____
ADA Complementary Paratransit	_____
Demand Responsive	_____
Commuter Rail	_____
Streetcar	_____
Ferry Boat	_____
Other (please specify): _____	_____

[A RESPONSE TO Q. 1 IS REQUIRED TO PROCEED TO Q2.]

Transit Vehicle Characteristics

If you reported multiple modes in Q. 1, you may see the next two questions on ITS technologies (Q. 2) and traveler information technologies (Q. 3) repeated for those modes.

2. For your agency's [INSERT MODE] service, what is the number of revenue vehicles equipped with each of the following technologies? *If none for a technology, please enter '0.'*

[INSERT MODE] revenue vehicles equipped with:

Total number

a. Automated Vehicle Location (AVL)
DEFINITION*:* AVL systems are computer-based vehicle tracking systems which use real-time location technology and a wireless data communications system to transmit location data from vehicles to a transit operations center. _____

b. Computer Aided Dispatch and Scheduling (CADS)
DEFINITION: CADS is software incorporating routes, schedules, trip orders, and vehicle assignments to let dispatchers know where vehicles are. _____

c. Mobile Data Terminals (MDTs) or Mobile Data Computers (MDCs)
DEFINITION: MDTs, or MDCs, are computerized devices that communicate with a central dispatch office. They provide two-way text-based communications and the ability to upload collected data during a scheduled run. _____

d. Automatic Passenger Counters (APC) – *Do not include registering fareboxes or mobile ticket readers.*
DEFINITION: APC systems are electronic machines near vehicle doors that count passengers entering and exiting at each transit stop. Common types of APC systems are: electronic infrared beams, light beams, mechanical treadle mats, and camera-based detection. _____

e. Maintenance Management Systems (MMS) (i.e., remote monitoring of vehicle components)
DEFINITION: MMS can monitor vehicle components (e.g., fuel and fluid levels) and can alert operators of mechanical failures. Advanced systems capture conditions such as temperature and voltage to help predict when parts might fail. _____

f. [IF BUS, LIGHT RAIL, OR STREETCAR IN Q. 1] Transit Signal Priority (TSP)
DEFINITION: TSP refers to the use of sensors or signal timing to detect approaching transit vehicles and grant them priority at signalized intersections. TSP systems can extend green lights, provide an early green light, or use bypass (or queue jump) lanes for transit vehicles. _____

[THE NUMBER PROVIDED FOR EACH MODE IN Q. 2 CANNOT EXCEED THE TOTAL NUMBER OF VEHICLES FOR THAT MODE REPORTED IN Q. 1].

3. What is the total number of [INSERT MODE: BUS, HEAVY RAIL, LIGHT RAIL, COMMUTER RAIL, STREETCAR, OTHER] revenue vehicles equipped with the following traveler information technologies? *If none for a traveler information technology, please enter '0.'*

Total number

a. [INSERT MODE-] revenue vehicles equipped with Automatic Voice Announcement (AVA) systems (e.g., automatically triggered stop name display and announcement) _____

DEFINITION: AVA systems provide audio (i.e., recorded announcements) and visual announcements that are schedule- or location-based, such as upcoming stops or major intersections. AVA may also include exterior display and announcement of route numbers & destinations.

b. [INSERT MODE] revenue vehicles equipped with dynamically updating passenger information displays (e.g., visual displays of estimated arrival times for upcoming stops, transfer information, service alerts) _____

DEFINITION: These are visual displays, or dynamic message signs, inside the vehicle that provide real-time information, such as estimated arrival times for upcoming stops, and may include transfer information or service alerts.

c. [INSERT MODE] revenue vehicles equipped with dynamically triggered automated announcements (e.g., audio of delays on the current or other connecting routes) _____

DEFINITION: These are audio announcements that are triggered based on real-time information. For example, an audio announcement might inform riders of the estimated time of arrival at a major transfer location, based on real-time traffic conditions.

[THE NUMBER PROVIDED FOR EACH MODE IN Q.3 CANNOT EXCEED THE TOTAL NUMBER OF VEHICLES FOR THAT MODE REPORTED IN Q. 1].

4. What is the total number of the following facilities served by your agency? *If none for a specific facility type, please enter '0.'*

	Total Number
a. Bus Stops (including BRT stops/stations)	_____
b. Rail Stations (including stations serving heavy, light and commuter rail and/or streetcars)	_____
c. Multi-modal Stations or Transfer Stations	_____

5. What is the total number of your agency's facilities where dynamic traveler information (e.g., real-time schedule and system information) is provided to the public using the following methods? *If none for a specific type of traveler information display or delivery, please enter '0.'*

	Electronic Signage or displays	SMS/text	Mobile application
Total number of bus stops:	_____	_____	_____

[RESPONSES TO Q. 5a CANNOT EXCEED THE TOTAL NUMBER OF BUS STOPS REPORTED IN Q. 4a].

Total number of rail stations:	_____	_____	_____

[RESPONSES TO Q. 5b CANNOT EXCEED THE TOTAL NUMBER OF RAIL STATIONS REPORTED IN Q. 4b].

Total number of Multi-modal Stations or Transfer Stations:	_____	_____	_____

[RESPONSES TO Q. 5c CANNOT EXCEED THE TOTAL NUMBER OF MULTIMODAL OR TRANSFER STATIONS REPORTED IN Q. 4c].

Traveler Information

6. What methods does your agency use to disseminate real-time traveler information to the public, including transit schedule adherence or arrival and departure times? *Please select all that apply.*

- ☐ 511
- ☐ Social media (e.g., Twitter, Facebook)
- ☐ Email or text/SMS alert
- ☐ Agency-branded mobile application (e.g., white-label commercial app, custom built)
- ☐ Third-party mobile app (e.g., Google Maps, Moovit, Transit)
- ☐ Website
- ☐ Dynamic message signs in station
- ☐ Dynamic message signs in-vehicle
- ☐ Dynamic message signs at stop
- ☐ Kiosks
- ☐ Other (please specify): _____
- ☐ Agency does not provide real time data about the transit system

7. Has your agency deployed or does your agency maintain a trip planner (web-based and/or mobile application) to assist travelers in planning trips? *Please select one.*

- ☐ Yes
- ☐ No [SKIP TO Q. 8]

7a. Which, if any, of the following applies to your agency's trip planner tool(s)? *Please select all that apply.*

- ☐ Incorporates more than one mode within your agency (e.g., demand responsive to bus connections)
- ☐ Incorporates multiple transit systems in your area
- ☐ Incorporates modes other than transit (e.g., walking, biking, or driving routes to stops/stations)
- ☐ Incorporates real-time traffic condition information
- ☐ Incorporates private mobility service providers (e.g., bikesharing, scooter-sharing, taxis, ride-hailing)
- ☐ Incorporates payment of fares for agency services
- ☐ Incorporates payment of fares to other mobility providers
- ☐ None of the above

DEFINITION: Ride-hailing: also known as Transportation Network Companies (TNCs) or ridesourcing services, provide on-demand or pre-arranged transportation services where drivers of personal vehicles are compensated by riders, connected through an application

Electronic fare payment

8. What types of fare media are currently accepted by your agency? *Please select all that apply.*

- ☐ Cash
- ☐ Magnetic stripe cards
- ☐ Agency or regional branded "smart cards"
- ☐ Contactless credit/debit cards
- ☐ Mobile Wallet (e.g., Apple Pay, Google Pay)
- ☐ Mobile App Payment (payment within agency-approved or sponsored application)
- ☐ Other (please specify): _____

8a. Does your agency use electronic fare payment? *Please select one.*

- ☐ Yes
- ☐ No [SKIP TO Q. 10]

9. This question asks about different characteristics of your agency's electronic fare payment (EFP) system.

9a. Which of the following best describes the system scope of your agency's EFP system? *Please select one.*

- ☐ Single agency
- ☐ Multiagency
- ☐ Don't know

9b. Which of the following best describes the design and technology of your agency's EFP system? *Please select one.*

- ☐ Proprietary
- ☐ Standards-based
- ☐ Don't know

9c. Which of the following best describes the system architecture of your agency's EFP? *Please select one.*

- ☐ Stored value/Card-based
- ☐ Account-based
- ☐ Don't know

9d. Which of the following best describes the payment architecture of your agency's EFP? *Please select one.*

- ☐ Closed payments
- ☐ Open payments
- ☐ Don't know

10. Is your agency planning to upgrade its fare payment system to accept additional or different types of fare media in the next 5 years? *Please select one.*

- ☐ Yes, in the next year
- ☐ Yes, within the next 1 to 3 years
- ☐ Yes, within the next 3 to 5 years
- ☐ No
- ☐ Don't know

Agency Partnerships

11. Does your agency partner with any private transportation services (e.g., ride-hailing, bikesharing, microtransit)? *Please select one.*

- ☐ Yes
- ☐ No [SKIP TO Q. 14]

DEFINITION: Microtransit: Service featuring privately or publicly operated technology-enabled transit service, typically using multi-passenger shuttles or vans to provide services with either dynamic or fixed routing.

12. With which private transportation services does your agency partner? Please select all that apply.

- ☐ Ride-hailing/Ridesourcing/Transportation Network Company (TNC)
- ☐ Bikesharing
- ☐ Scooter-sharing
- ☐ Microtransit
- ☐ Taxis
- ☐ Parking (municipal or privately-owned)
- ☐ Carpool matching service
- ☐ Other (please specify): _____

DEFINITIONS:
Bikesharing: Service in which travelers access bicycles on an as-needed basis for one-way or roundtrip travel.

Scooter-sharing: Service in which users have short-term access to scooters on an as-needed basis.

Carpool matching service: Service allowing passengers to connect with drivers of personal vehicles who have similar origins and destinations.

13. In what ways do these private transportation services partner with your agency? *Please select all that apply.*

- ☐ Provide subsidized or unsubsidized service to agency customers
- ☐ Integrate real-time, schedule, or availability data in trip planning tools
- ☐ Integrate dispatching
- ☐ Share payment platforms
- ☐ Share traveler information through an app
- ☐ Other (please specify): _____

14. Does your agency operate a Travel Management Coordination Center (TMCC) or similar service coordination platform that works with other entities to coordinate mobility services for the transportation disadvantaged? These other entities may include social service agencies, Health and Human Services, non-emergency medical transportation services (NEMTs), or private transportation providers, among others. *Please select one.*

- ☐ Yes, agency operates a TMCC or similar service coordination platform
- ☐ No, agency does not operate a TMCC or similar service coordination platform
- ☐ Other (please specify): _____

Integrated Corridor Management

This next question focuses on Integrated Corridor Management (ICM). ICM is an approach that manages a transportation corridor as a multimodal system (**freeway, arterial, and public transit**), integrating operations such as traffic incident management, work zone management, traffic signal timing, managed lanes, real-time traveler information, and active traffic management to maximize the capacity of all facilities and modes across the corridor.

For the purposes of this survey, a corridor is defined as: a largely linear geographic band and a bounded travel shed of (mostly) commute and daily trips. The corridor must include **freeway, arterial and public transit facilities,** with cross-facility connections.

You can find more information about ICM at: https://rosap.ntl.bts.gov/view/dot/38816

15. Has your agency deployed Integrated Corridor Management (ICM) in one or more corridors (i.e., integrating operations across networks (freeways, major arterials, and public transit) to actively manage travel demand and capacity in the corridor as a whole)? *Please select one.*

- ☐ Yes, my agency has deployed ICM
- ☐ No, but my agency plans to deploy ICM
- ☐ No, my agency has no plans to deploy ICM

ITS Data Use and Collection/Archiving

16. Does your agency provide an open data feed (e.g., to app developers, information service providers or the public)?

- ☐ Yes
- ☐ No, but my agency is working on this
- ☐ No current plans for an open data policy

17. What information does your agency collect and/or archive <u>in real-time</u>, if any? *Please select all that apply.*

- ☐ Vehicle time and location
- ☐ Vehicle monitoring status (i.e., vehicle diagnostics and health)
- ☐ Passenger count
- ☐ Trip itinerary planning records
- ☐ Passenger information (e.g., fare transactions, trip origin/destination location)
- ☐ Road surface conditions (e.g., wet, icy)
- ☐ Emergency vehicle signal preemption events
- ☐ Transit vehicle signal priority events
- ☐ Weather conditions (e.g., snow, fog, rain)
- ☐ Incidents
- ☐ Impact of work zones on transit operations
- ☐ Other (please specify): _____
- ☐ My agency does not collect and/or archive data in real time.

18. Does your agency currently use ITS data for route and service planning? Examples of ITS data include: fare transaction data, on-time performance and delays captured by automatic vehicle location (AVL), and/or crowding and stop utilization captured by automatic passenger counters (APCs). *Please select one.*

- ☐ Yes, for all modes
- ☐ Yes, but only for some modes
- ☐ No
- ☐ Don't know

Transportation Demand Management

19. Does your agency employ automated vehicle location, combined with dispatching and reservation technologies to provide flexible routing and scheduling? *Please select one.*

- ☐ Yes
- ☐ No
- ☐ Not applicable

20. Does your agency employ vehicle monitoring and communication technologies to hold vehicles to facilitate the coordination of passenger transfers between vehicles or between transit systems (e.g., connection protection)? *Please select one.*

- Yes
- No
- Not applicable

21. Does your agency dynamically adjust the assignments of assets (e.g., buses) based on real-time demand to cover the most overcrowded sections of the network? *Please select one.*

- Yes
- No
- Not applicable

Telecommunications

22. What type of telecommunications technologies does your agency use to communicate between any ITS devices, and/or between ITS roadside devices and a central processing location? *Please select all that apply.*

Wired:
- Coaxial
- Fiber optic cable
- Twisted copper pair/Twisted wire pair
- Digital subscriber line (DSL)
- Data cable over modem

Wireless:
- 5G New Radio and Small cell infrastructure
- Cellular (LTE-4G)
- Cellular (GPRS – 2G or 3G)
- LTE-Cellular V2X (LTE-CV2X)
- Wi-Fi
- Dedicated short range communications (DSRC)
- Mobile or Fixed service satellite (FSS)
- Ultra-wideband (UWB)
- Microwave
- Other telecommunications (wired and/or wireless) (please specify): _____

Cybersecurity

23. Does your agency have a documented cybersecurity policy specific to ITS equipment? *Please select one.*

- ☐ Yes, my agency has a policy
- ☐ No, but my agency is developing a policy
- ☐ No, my agency does not have/is not developing a policy
- ☐ Don't know

24a. Has your agency had any cybersecurity events (e.g., ransomware, data breach) affecting IT systems in the last three years? *Please select one.*

- ☐ Yes
- ☐ No
- ☐ Don't know

24b. Has your agency had any cybersecurity events (e.g., ransomware, data breach, tampering of field devices) affecting transportation operations in the last three years? *Please select one.*

- ☐ Yes
- ☐ No
- ☐ Don't know

[IF: (Q.23=HAS OR IS DEVELOPING POLICY) AND (Q. 24a AND/OR Q. 24b=YES), ASK Q. 25]:

25. Has your agency's policy on cybersecurity (specific to ITS equipment) changed since these cybersecurity event(s) took place? *Please select all that apply.*

- ☐ Yes, policy was developed or is being developed as a result of the event(s)
- ☐ Yes, policy has been updated as a result of the event(s)
- ☐ No, event(s) did not have an impact on policy
- ☐ Don't know

Maintenance of Transit ITS Technology

26. Does your agency utilize an asset management system to track ITS inventory and/or related maintenance and operations activity? *Please select one.*

- ☐ Yes, system tracks only ITS inventory
- ☐ Yes, system tracks only ITS maintenance and operations activity
- ☐ Yes, system tracks both
- ☐ No, my agency does not have an ITS asset management system

27. Who installs, inspects, maintains, and repairs your agency's ITS equipment in the field? *Please select all that apply.*

- ☐ Agency staff [ASK Q. 28a]
- ☐ Contractor(s) [ASK Q. 28b]
- ☐ Other (please describe) _____

28a. Which job titles best describe the agency staff that perform this work (i.e., install, inspect, maintain, and repair your agency's ITS equipment in the field)? *Please select all that apply.*

- ☐ Engineer
- ☐ Electrician
- ☐ IT Specialist
- ☐ Software Engineer
- ☐ Traffic Signals Technician
- ☐ Maintenance Technician
- ☐ GIS Specialist
- ☐ Field Technician
- ☐ Planner
- ☐ Other (please specify): _____
- ☐ Don't know

28b. Approximately what percentage of all ITS field equipment work (i.e., installation, inspection, maintenance, and repair) is contracted out? *Please select one.*

- ☐ 0% to 25%
- ☐ 26% to 50%
- ☐ 51% to 75%
- ☐ 76% to 100%
- ☐ Don't know

Independent Travel for People with Disabilities

29. Has your agency implemented or piloted any technologies or services to support independent travel for people with disabilities? *Please select all that apply.*

- ☐ Automated announcement and display of bus routes and rail lines and stops/stations
- ☐ Audio- and braille-equipped fare/ticket vending machines
- ☐ Accessible agency-owned websites and/or mobile applications (e.g. adjustable text sizes, screen reader capable, image descriptions, and other features outlined in Web Content Accessibility Guidelines V2.0 or higher. Click here to view guidelines.) *link "here" to: https://www.w3.org/WAI/standards-guidelines/wcag/#intro*
- ☐ Trip reservation systems with ways to reserve trips in addition to a phone call with customer service representative and TTY/TDD [telecommunications device for the deaf] line [ASK Q. 30]
- ☐ Indoor navigation support [ASK Q. 31]
- ☐ Flexible/on-demand mobility services, including microtransit, operated by your agency or through formal partnerships with taxis or ride-hailing companies (must include wheelchair-accessible vehicle options)
- ☐ Travel training and independent travel support applications
- ☐ Augmentative and alternative communication (AAC) aids provided to operators and managers to support communication with customers
- ☐ Other (please specify): _____
- ☐ No technologies or services are currently implemented or being piloted

[IF "TRIP RESERVATION SYSTEMS WITH…" RESPONSE SELECTED IN Q. 29, ASK Q. 30]:

30. Which of the following features are included with your trip reservation system? *Please select all that apply.*

- ☐ Interactive Voice Response system [IVR]
- ☐ Live agent or artificial intelligence-enabled chat pod
- ☐ Mobile or website application
- ☐ Other (please specify): _____

[IF "INDOOR NAVIGATION SUPPORT" SELECTED IN Q. 29, ASK Q. 31]:

31. Which of the following types of indoor navigation support does your agency provide? *Please select all that apply*.

- ☐ Wayfinding beacons
- ☐ GPS-enabled mobile application
- ☐ Digital mapping of accessible pathways (e.g., providing accessible routing information through General Transit Feed Specification (GTFS) Pathways, Indoor Geographic Markup Language (GML), or Building Information Models [BIM])
- ☐ Audio-tactile mapping applications
- ☐ Assistive robots
- ☐ Other (please specify): _____

[IF "TRAVEL TRAINING AND INDEPENDENT TRAVEL SUPPORT APPLICATIONS" SELECTED IN Q. 29, ASK Q. 32]:

32. Which of the following travel training and independent travel support applications does your agency provide? *Please select all that apply.*

- ☐ Pre-trip planning applications (provides reminders to users for pre-departure steps, including notices of times to leave)
- ☐ En-route navigation applications (provides dynamic step-by-step instructions to the user)
- ☐ Virtualization applications such as Mixed, Augmented, or Virtual Reality (allows users to practice independent travel through virtual environments, including virtual reality and web interfaces)
- ☐ Subscriptions for third-party navigation applications with accessibility features
- ☐ Other (please specify): _____

Standards

33. Please select any of the following transit-related ITS standards implemented by your agency. *Please select all that apply.*

- ☐ Transit Communication Interface Profiles (TCIP)
- ☐ National Transportation Communications for ITS (Intelligent Transportation Systems) Protocol (NTCIP) Advanced Traveler Information System (ATIS)
- ☐ Contactless Fare Media System Standard (CFMS) / Universal Transit Fare Systems (UTFS)
- ☐ General Transit Feed Specification (GTFS) (*de facto* standard)
- ☐ GTFS Real-Time (GTFS-RT)
- ☐ GTFS-flex (proposed/prototype extension of GTFS to model demand-responsive transportation services)
- ☐ Service Interface for Real Time Information (SIRI)
- ☐ Network Timetable Exchange (NeTEx)
- ☐ Other (please specify): _____
- ☐ Don't know
- ☐ No ITS standards used

Future Deployment Planning

34. Does your agency plan to <u>expand or upgrade current ITS</u> during the next three years (2021 through 2023)? *Please select one.*

- ☐ Yes
- ☐ No
- ☐ Don't know

35. Does your agency plan to invest in new or emerging ITS during the next three years (2021 through 2023)? *Please select one.*

- ☐ Yes
- ☐ No [SKIP TO Q. 36]
- ☐ Don't know [SKIP TO Q. 36]

35a. Please describe new or emerging ITS technologies.

Additional Comments

36. Please use the space below to provide any additional comments regarding your agency's deployment, operations, or maintenance of ITS. Please be as specific as possible when commenting on particular ITS technologies.

37a. Can we contact you if we have any follow-up questions about your agency's experience deploying ITS?

- ☐ Yes
- ☐ No [SKIP TO Q. 38]

Thank you. How can we best reach you if we have follow-up questions about your agency's experience deploying ITS?

37b. Your preferred phone number. If this is not your preferred email, please type in your preferred email address:

37c. Your preferred email address. If this is not your preferred email, please type in your preferred email address:

38. Please confirm if you are ready to submit your responses. *Please select one.*

- ☐ Yes, I have completed the survey and I would like to submit my final responses (Note: if you click this button, you will not be able to return to the survey).
- ☐ No, I am still working on the survey and will complete it later.

Thank you for your time and effort in completing this survey! The ITS JPO and the U.S. DOT Volpe Center greatly appreciate your participation.

Appendix B. Survey Sample Sizes

Table 2. Survey Sample Sizes

Survey Year	Transit	Transit - Fixed Route Bus	Transit – ADA Paratransit	Transit - Demand Responsive
2002	210	-	-	-
2004	213	-	-	-
2005	203	-	-	-
2006	211	-	-	-
2007	206	-	-	-
2010	143	117	84	34
2013	142	124	97	37
2016	99	86	66	23
2020	136	124	100	45

Appendix C. 2020 Transit Frequencies

This Appendix includes the frequencies for questions that are not reported in the main body of the Report, as well as transit mode profiles.

Frequencies

Q25. Has your agency's policy on cybersecurity changed since the cybersecurity event(s) took place?

Table 3. Cybersecurity Policy

Cybersecurity Plan	Percent of Transit Agencies Base: Agencies who have/are developing a policy AND have experienced a cybersecurity event
Yes, policy was developed or is being developed as a result of the event(s)	56%
Yes, policy has been updated as a result of the event(s)	25%
No, events did not have impact on policy (mutually exclusive option)	19%
Don't know (mutually exclusive option)	0%
Missing	0%

n=16 *Source: USDOT*

Q27. Who installs, inspects, maintains, and repairs your agency's ITS equipment in the field?

Table 4. Installs, Inspected, Maintains, and Repairs ITS Equipment

Install, Inspect, and Maintain	Percent of Transit Agencies
Agency Staff	80%
Contractors	56%
Other	5%
Missing	6%

n=136 *Source: USDOT*

Q28a. Which job titles best describe the agency staff that perform this work (i.e., install, inspect, maintain, and repair your agency's ITS equipment in the field)?

Table 5. Types of Agency Staff

Types of Agency Staff	Percent of Transit Agencies Base: Agencies with Agency Staff working with ITS equipment in the field
IT Specialist	58%
Maintenance Technician	55%
Field Technician	30%
Engineer	24%
Electrician	17%
Software Engineer	15%
Traffic Signals Technician	8%
Planner	7%
GIS Specialist	3%
Other	8%
Don't know (mutually exclusive option)	2%
Missing	1%

n=110 *Source: USDOT*

Q28b. Approximately what percentage of all ITS field equipment work (i.e., installation, inspection, maintenance, and repair) is contracted out?

Table 6. Percentage of Field Work Contracted Out

Percentage of Field Work Contracted Out	Percent of Transit Agencies Base: Agencies with Contractors working with ITS equipment in the field
0% to 25%	29%
26% to 50%	14%
51% to 75%	14%
76% to 100%	21%
Don't Know	17%
Missing	4%

n=76 *Source: USDOT*

Q31. Which of the following types of indoor navigation support does your agency provide?

Table 7. Types of Indoor Navigation Support

Types of Indoor Navigation Support	Percent of Transit Agencies Base: Agencies with indoor navigation support
Digital mapping of accessible pathways (e.g., providing accessible routing information through General Transit Feed Specification (GTFS) Pathways, Indoor Geographic Markup Language (GML), or Building Information Models [BIM])	71%
GPS-enabled mobile application	57%
Wayfinding beacons	14%
Audio-tactile mapping applications	0%
Assistive robots	0%
Other	0%
Missing	14%

n=7 *Source: USDOT*

Mode Profiles

Table 8. Fixed Route Bus Profile

Fixed Route Bus	Mean	Min	Max
Number of Vehicles	225	0	5,973
AVL (vehicles)	221	0	5,800
CADS (vehicles)	212	0	5,800
MDT (vehicles)	162	0	1,566
APC (vehicles)	172	0	2,500
MMS (vehicles)	130	0	5,800
TSP (vehicles)	83	0	2,198
Automatic Voice Announcements (vehicles)	190	0	3,000
Dynamically updating passenger information displays (vehicles)	101	0	3,000
Dynamically triggered automated announcements (vehicles)	94	0	3,000
Bus Stops (facilities)	2,424	0	37,500
Multi-Modal Stations (facilities)	7	0	100

2020 Q1, Q2, Q3, Q4 *Source: USDOT*

Table 9. Heavy or Rapid Rail Profile

Heavy or Rapid Rail	Mean	Min	Max
Number of Vehicles	1,410	40	6,483
AVL (vehicles)	168	0	450
CADS (vehicles)	164	0	450
MDT (vehicles)	8	0	40
APC (vehicles)	4	0	24
MMS (vehicles)	29	0	120
Automatic Voice Announcements (vehicles)	344	40	1,036
Dynamically updating passenger information displays (vehicles)	0	0	0
Dynamically triggered automated announcements (vehicles)	281	0	1,036
Rail Stations (facilities)	174	13	472
Multi-Modal Stations (facilities)	27	0	100

2020 Q1, Q2, Q3, Q4 *Source: USDOT*

Table 10. Light Rail Profile

Light Rail	Mean	Min	Max
Number of Vehicles	109	9	230
AVL (vehicles)	77	0	230
CADS (vehicles)	65	0	215
MDT (vehicles)	61	0	215
APC (vehicles)	75	0	215
MMS (vehicles)	30	0	215
TSP (vehicles)	49	0	224
Automatic Voice Announcements (vehicles)	85	0	224
Dynamically updating passenger information displays (vehicles)	18	0	150
Dynamically triggered automated announcements (vehicles)	13	0	91
Rail Stations (facilities)	85	7	305
Multi-Modal Stations (facilities)	29	0	100

2020 Q1, Q2, Q3, Q4 *Source: USDOT*

Table 11. ADA Complementary Paratransit Profile

ADA Complementary Paratransit	Mean	Min	Max
Number of Vehicles	121	2	2,027
AVL (vehicles)	79	0	1,300
CADS (vehicles)	79	0	1,300
MDT (vehicles)	81	0	1,300
APC (vehicles)	6	0	388
MMS (vehicles)	8	0	388

2020 Q1, Q2 *Source: USDOT*

Table 12. Demand Responsive Profile

Demand Responsive	Mean	Min	Max
Number of Vehicles	44	2	452
AVL (vehicles)	34	0	452
CADS (vehicles)	32	0	452
MDT (vehicles)	26	0	135
APC (vehicles)	10	0	285
MMS (vehicles)	3	0	92

2020 Q1, Q2 *Source: USDOT*

Table 13. Commuter Rail Profile

Commuter Rail	Mean	Min	Max
Number of Vehicles	208	6	1127
AVL (vehicles)	205	6	1094
CADS (vehicles)	67	0	480
MDT (vehicles)	67	0	480
APC (vehicles)	71	0	434
MMS (vehicles)	19	0	100
Automatic Voice Announcements (vehicles)	160	0	739
Dynamically updating passenger information displays (vehicles)	98	0	739
Dynamically triggered automated announcements (vehicles)	13	0	100
Rail Stations (facilities)	87	6	250
Multi-Modal Stations (facilities)	19	1	100

2020 Q1, Q2, Q3, Q4 *Source: USDOT*

Table 14. Streetcar Profile

Streetcar	Mean	Min	Max
Number of Vehicles	9	1	32
AVL (vehicles)	9	0	32
CADS (vehicles)	8	0	32
MDT (vehicles)	7	0	32
APC (vehicles)	4	0	10
MMS (vehicles)	2	0	7
TSP (vehicles)	3	0	10
Automatic Voice Announcements (vehicles)	9	0	32
Dynamically updating passenger information displays (vehicles)	1	0	7
Dynamically triggered automated announcements (vehicles)	2	0	7
Rail Stations (facilities)	63	2	305
Multi-Modal Stations (facilities)	11	1	48

2020 Q1, Q2, Q3, Q4 *Source: USDOT*

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FHWA-JPO-20-893

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