2023 Transit Survey Instrument

Welcome to the Transit Management Survey!

Before you get started, please review the following definition:

Intelligent Transportation Systems (ITS) encompass the electronic, communication, and information processing technologies that enable transportation agencies to collect and transmit data in real time (or near real time) for use in transportation operations. ITS are deployed to support safety, mobility, environmental, and other goals. A few examples of ITS technologies for transit include automatic vehicle location (AVL), automatic passenger counters (APCs), electronic fare payment, and transit signal priority.

Navigating the Survey:
Use the “Next” and “Previous” buttons below to navigate the survey. Answers from each survey page are automatically saved when you go to the NEXT survey page.

To return to the dashboard, click on the "Return to Dashboard" button on the bottom of the page.

For many questions, there will be terms that are underlined. In this reference pdf, additional information for these terms is provided in a box below the question.

Note: The instructions in red font show the survey skip logic, which is automated in the online survey.

Transit Agency Characteristics

1. [ASK ALL – AT LEAST ONE TRANSIT MODE IS REQUIRED. IF THE MODE OPERATED BY YOUR AGENCY DOES NOT APPEAR ON THE LIST, PLEASE SELECT "OTHER" AND SPECIFY THE MODE.] **Which of the following transit modes does your agency operate in its revenue service?** *Please select all that apply.*

   - ❑ Fixed Route Bus
   - ❑ Flexible Route Bus
   - ❑ Heavy or Rapid Rail (including subway)
   - ❑ Light Rail/Streetcar
   - ❑ Commuter Rail
   - ❑ American With Disabilities Act (ADA) Complementary Paratransit
   - ❑ Demand Responsive
   - ❑ Ferry Boat
   - ❑ Other (please specify): _____

DEFINITIONS SHOWN IN HOVER BOXES:

Flexible Route Buses have a fixed route with the ability to move off route within a specified range.

2. [ASK ALL] **Does your agency provide American with Disabilities Act (ADA) Complementary Paratransit service through a partnership or agreement with another agency or organization (e.g., human service organization, regional service, etc.)?** *Please select one.*

   - ○ Yes
   - ○ No
   - ○ Don't know

Transit Vehicle Characteristics

[ASK Q3 AND Q4 SEQUENTIALLY FOR EACH QUALIFYING MODE SELECTED IN Q1 – IF BOTH FIXED ROUTE BUS AND FLEXIBLE ROUTE BUS ARE SELECTED, ASK ONLY ONCE WITH MODE = BUS (FIXED ROUTE/FLEXIBLE ROUTE).]

If you reported multiple modes in Q1, you may see the next two questions on ITS technologies (Q3) and traveler information technologies (Q4) repeated for those modes.

3. For your agency's [INSERT MODE FROM Q1] service, what percentage of revenue vehicles are equipped with each of the following technologies? *Please select one response in each row.*

Percent of Vehicles

	0%	1% to 24%	25% to 49%	50% to 74%	75% to 99%	100%
Automatic Vehicle Location (AVL)	○	○	○	○	○	○
Computer-Aided Dispatch and Scheduling (CADS)	○	○	○	○	○	○
Mobile Data Terminals (MDT), Mobile Data Computers (MDC), or Transit Control Heads (TCH)	○	○	○	○	○	○
Automatic Passenger Counters (APC) – Do not include registering fareboxes or mobile ticket readers	○	○	○	○	○	○
Maintenance Management Systems (MMS) (i.e., remote monitoring of vehicle components)	○	○	○	○	○	○
Transit Signal Priority (TSP) [ONLY IF BUS, LIGHT RAIL/STREETCAR IN Q1]	○	○	○	○	○	○
Communications-Based Train Control (CBTC) railway signaling system [ONLY IF HEAVY OR RAPID RAIL, COMMUTER RAIL, LIGHT RAIL/STREETCAR]	○	○	○	○	○	○

DEFINITIONS SHOWN IN HOVER BOXES:

Automatic Vehicle Location (AVL) is a computer-based vehicle tracking system which uses real-time location technology and a wireless data communications system to transmit location data from vehicles to a transit operations center.

Computer-Aided Dispatch and Scheduling (**CADS)** is software that incorporates routes, schedules, trip orders, and vehicle assignments to let dispatchers manage operations.

Mobile Data Terminals (MDT), **Mobile Data Computers (MDC)**, and **Transit Control Heads (TCH)** are in-vehicle computerized devices that communicate with a central dispatch office. They provide two-way text-based communications and can upload collected data during a scheduled run.

Automatic Passenger Counters (APC) are electronic machines near vehicle doors that count passengers entering and exiting at each transit stop. Common types of APC are electronic infrared beams, light beams, mechanical treadle mats, and camera-based detection.

Maintenance Management Systems (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.

Transit Signal Priority (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.

Communications-Based Train Control (CBTC) is a railway signaling system that makes use of the telecommunications between the train and track equipment for traffic management and infrastructure control. CBTC allows for a moving block system rather than a fixed block system.

[Q4 ASKED ONLY FOR FIXED ROUTE BUS, FLEXIBLE ROUTE BUS, HEAVY OR RAPID RAIL, COMMUTER RAIL, LIGHT RAIL/STREETCAR, FERRY, AND OTHER. – IF BOTH FIXED ROUTE BUS AND FLEXIBLE ROUTE BUS ARE SELECTED ASK ONLY ONCE WITH MODE = BUS (FIXED ROUTE/FLEXIBLE ROUTE).]

4. **For your agency's** [INSERT MODE FROM Q1] **service, what percentage of revenue vehicles are equipped with each of the following real-time traveler information technologies?** *Please select one response in each row.*

	Percent of Vehicles					
	0%	**1% to 24%**	**25% to 49%**	**50% to 74%**	**75% to 99%**	**100%**
Automatic Voice Announcement (AVA) systems (e.g., automatically triggered stop name announcements and transfer information)	o	o	o	o	o	o
Dynamic electronic signage (e.g., visual displays of upcoming stops, estimated arrival times for upcoming stops, transfer information, service alerts)	o	o	o	o	o	o

DEFINITIONS SHOWN IN HOVER BOXES:

Automatic Voice Announcement (AVA) systems provide audio or recorded 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.

Dynamic electronic signage includes dynamic message signs and other visual displays inside the vehicle that provide real-time information - such as estimated arrival times for upcoming stops - and may include transfer information or service alerts.

Traveler Information

5. [EXCLUDE IF ADA AND/OR DEMAND RESPONSE ONLY] **What types of stops/stations are served by your agency's fixed route transit services?** *Please select all that apply.*

   - ❑ Bus Stops/Stations (including BRT stops/stations) [ASKED FOR FIXED ROUTE AND FLEXIBLE ROUTE BUS]
   - ❑ Rail Stops/Stations (including stations serving heavy or rapid rail (including subway), commuter rail, or light rail/streetcar) [ASKED ONLY FOR HEAVY OR RAPID RAIL, COMMUTER RAIL, LIGHT RAIL/STREETCAR]
   - ❑ Multi-modal Stations or Transfer Stations [ASKED FOR ALL EXECPT ADA AND DEMAND RESPONSE]
   - ❑ Other (please specify): _____

6. [IF BUS STOPS SELECTED IN Q5] **What percentage of your agency's bus stops/stations provide real-time traveler information (e.g., real time schedule and system information) to the public using dynamic electronic signage (e.g., visual displays of estimated arrival times, transfer information, service alerts)?** *Please select one response.*

   - o 0% of bus stops/stations
   - o 1% to 24% of bus stops/stations
   - o 25% to 49% of bus stops/stations
   - o 50% to 74% of bus stops/stations
   - o 75% to 99% of bus stops/stations
   - o 100 % of bus stops/stations

7. [IF RAIL STATIONS SELECTED IN Q5] **What percentage of your agency's rail stops/stations provide real-time traveler information to the public using dynamic electronic signage (e.g., visual displays of estimated arrival times, transfer information, service alerts)?** *Please select one response.*

   - o 0% of rail stops/stations
   - o 1% to 24% of rail stops/stations
   - o 25% to 49% of rail stops/stations
   - o 50% to 74% of rail stops/stations
   - o 75% to 99% of rail stops/stations
   - o 100 % of rail stops/stations

8. [IF MULTIMODAL STATIONS SELECTED IN Q5] **What percentage of your agency's multi-modal stations provide real-time traveler information to the public using dynamic electronic signage (e.g., visual displays of estimated arrival times, transfer information, service alerts)?** *Please select one response.*

   - o 0% of multi-modal stations
   - o 1% to 24% of multi-modal stations
   - o 25% to 49% of multi-modal stations
   - o 50% to 74% of multi-modal stations
   - o 75% to 99% of multi-modal stations
   - o 100 % of multi-modal stations

9. [ASK ALL] **Does your agency provide an open data feed (e.g., to app developers, information service providers, other agencies, or the public)?** *Please select one.*

   - o Yes
   - o No, but my agency is working on this – SKIP TO Q12
   - o No current plans for an open data feed – SKIP TO Q12

10. [IF Q9 = YES] **Which types of service modes are included in your open data feed?** *Please select all that apply.*

    - ❑ Fixed route services (e.g., bus, light rail/streetcar, commuter/heavy rail, and/or ferry)
    - ❑ Flexible route service (e.g., fixed route bus with ability to move off route within a specified range)
    - ❑ On demand service (e.g., ADA paratransit, demand responsive)

11. [If Q9 = YES] **Which of the following data element(s) are included in your agency's open data feed?** *Please select all that apply.*

    - ❑ Static data on schedule, service day, route, or transit stop locations, (e.g., system map)
    - ❑ Real time vehicle information or schedule service updates (e.g., vehicle location, crowding, service disruptions, etc.)
    - ❑ Fare price/payment information
    - ❑ Accessibility information (e.g., elevator/escalator outages, accessible entrances, availability of accessible vehicles)
    - ❑ Other (please specify): _____

This next question covers general methods your agency uses to share real-time traveler information (not including methods at stops or stations).

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

- ❑ 511
- ❑ Social media
- ❑ 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
- ❑ Kiosks
- ❑ Other (please specify): _____
- ❑ No real-time traveler information is disseminated

13. [ASK ALL] **Does your agency provide an agency-branded trip planner (web-based and/or mobile application)?** *Please select one.*

- ○ Yes
- ○ No
- ○ Don't know

14. [If Q13 = YES] **Which of the following applies to your agency's trip planner?** *Please select all that apply.*

- ❑ Incorporates real-time *transit* information (e.g., real-time transit schedule, arrival/departure, delay, passenger crowding, etc.)
- ❑ Incorporates more than one mode within your agency (e.g., rail to bus connections)
- ❑ Incorporates multiple transit systems in your area
- ❑ Incorporates real-time, schedule, or availability data of mobility service providers (e.g., bike-sharing, scooter-sharing, taxis, ride-hailing)
- ❑ Incorporates modes other than transit (e.g., walking, biking, or driving routes to stops/stations)
- ❑ Incorporates real-time *traffic* condition information
- ❑ Incorporates electronic payment of fares for your agency's services
- ❑ Incorporates electronic payment of fares for other transit systems in your area
- ❑ Incorporates integrated multimodal electronic payment of fares (e.g., mobility service providers, tolls, parking, etc.)
- ❑ Incorporates real-time alerts/announcements on accessibility that can be personalized to individuals' preferences (e.g., temporary route barriers, elevator/escalator outage information at stations, etc.)
- ❑ None of the above apply to my agency's trip planner

Electronic Fare Payment

15. [ASK ALL] **Does your agency use electronic fare payment (EFP)?** *Please select one.*

- ○ Yes
- ○ No
- ○ Don't know

DEFINITIONS SHOWN IN HOVER BOXES:

Electronic Fare Payment (EFP), also known as Automatic Fare Collection (AFC), provides an automated means of collecting and processing fares for public transportation services. EFP may include various payment media such as smart phones, magnetic stripe cards, smart cards, or credit cards to pay for transportation services.

16. [ASK ALL] **What types of fare media can travelers use to access your agency's transit service (e.g., at turnstile, in-vehicle)?** *Please select all that apply.*

Basic Fare Payment Methods:

- ❑ Cash (e.g., cash farebox)
- ❑ Physical tickets/tokens/vouchers (i.e., no embedded technology) [ASK Q17]

Electronic Fare Payment Methods:

- ❑ Agency branded or regional magnetic stripe cards (e.g., stored-value or time-based card) [ASK Q17]
- ❑ Agency branded or regional "smart cards" (e.g., RFID and/or chip cards) [ASK Q17]
- ❑ Contactless credit/debit cards
- ❑ Mobile wallet (e.g., Apple Pay, Google Pay)
- ❑ Mobile app (agency-approved or sponsored application)

Other

- ❑ Free/No fare media required
- ❑ Other fare payment methods (please specify): _____

17. [ASK IF Q16 = PHYSICAL TICKETS/TOKENS/VOUCHERS/PASSES, AGENCY BRANDED OR REGIONAL MAGNETIC CARD, AGENCY BRANDED OR REGIONAL "SMART CARD"] **Where can travelers purchase (or add value to) their fare media?** *Please select all that apply.*

- ❑ On transit vehicle
- ❑ Transit agency vending machine
- ❑ Transit agency customer service desk
- ❑ Transit agency website (i.e., online)
- ❑ Transit agency branded mobile app
- ❑ Third party mobile app
- ❑ Retail store (or other business)
- ❑ Other (please specify): _____

The next questions ask about different characteristics of your agency's electronic fare payment (EFP) system.

18. [ASK IF Q15 = YES]

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

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

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

- ○ Proprietary
- ○ Non-proprietary
- ○ Don't know

DEFINITIONS SHOWN IN HOVER BOXES:

Proprietary design and technology are owned by a single vendor, (i.e., EFP system can only use equipment from the vendor).

Non-proprietary design and technology use standard data-exchange protocols to enable the use of equipment from multiple vendors.

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

- ○ Stored value/card-based only
- ○ Account-based only
- ○ Both stored value/card-based and account based
- ○ Don't know

DEFINITIONS SHOWN IN HOVER BOXES:

Stored value/card-based systems hold a specific monetary value, and funds are subtracted as journeys are completed.

Account-based system architecture ties transit balances to a traveler's account through a back-office system to determine fare and settle transactions. This does not require a passenger to buy a ticket in advance of traveling, and allows operators to apply "best fare" or "fare capping".

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

- ○ Closed payments only
- ○ Open payments only
- ○ Both closed and open payments
- ○ Don't know

DEFINITIONS SHOWN IN HOVER BOXES:

Closed payments use closed loop EFP technology to accept transit agency fare media only (e.g., agency branded or reginal magnetic stripe cards, agency branded or regional smart cards, or agency tickets/tokens).

Open payments use open loop technology which accept payment methods that may be used to purchase things other than fares from one transit agency (e.g., credit cards).

19. [ASK ALL] **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

20. [ASK ALL] **Does your agency partner with any mobility service providers (e.g., ride-hailing, bike-sharing, microtransit, taxis)?** *Please select one.*

- ○ Yes
- ○ No – SKIP TO Q23
- ○ Don't know – SKIP TO Q23

21. [IF Q20 = YES] **With which mobility service providers does your agency partner?** *Please select all that apply*.

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

DEFINITIONS SHOWN IN HOVER BOXES:

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

Bike-sharing is a service in which travelers access bicycles on an as-needed basis for one-way or roundtrip travel.

Scooter-sharing is a service in which users have short-term access to electric scooters on an as-needed basis.

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

Carpool matching service allows passengers to connect with drivers of personal vehicles who have similar points of origin and destinations.

22. [IF Q20 = YES] **In what ways do these mobility service providers partner with your agency?** *Please select all that apply.*

- ❑ Partners provide subsidized or unsubsidized service to your agency's customers
- ❑ Partner services can be dispatched through your agency's system
- ❑ Partner services can be paid for on your agency's payment platform
- ❑ Other (please specify): _____

23. [ASK ALL] **Does your agency use a service coordination platform (e.g., Travel Management Coordination Center (TMCC)) to coordinate transportation for the clients of human service agencies (e.g., health, employment, etc.)?** *Please select one.*

- o Yes, agency operates a TMCC or similar service coordination platform
- o No, agency does not operate a TMCC or similar service coordination platform
- o Don't know
- o Other (please specify): _____

Connected Vehicle Technologies

This section includes questions about connected vehicle technologies.

24. [ASK ALL] **Is your agency currently developing, testing, or deploying connected vehicle (CV) technology (or partnering with other agency(ies) to develop, test, or deploy)?** *Please select one.*

- Yes – SKIP TO Q27
- No, but my agency is planning for CV
- No plans for CV – SKIP TO Q30
- Don't know – SKIP TO Q30

DEFINITION SHOWN IN HOVER BOX:

Connected vehicle (CV) technologies enable vehicles, roadway infrastructure, and mobile devices to wirelessly exchange data and "talk" to one another. Connected vehicles encompass vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-pedestrian (V2P) communications, collectively known as "V2X." When integrated into a vehicle, roadway infrastructure, or mobile devices, these technologies can deliver significant transportation safety, mobility, and environmental benefits.

25. [IF Q24 = NO, BUT PLANNING FOR CV] **Does your agency have any documented plans (e.g., internal planning documents, State Transportation Improvement Plan (STIP), etc.) to develop, test, or deploy CV technology?** *Please select one.*

- Yes
- No
- Don't know

26. [IF Q24 = NO, BUT PLANNING FOR CV] **When do you expect to begin developing, testing, or deploying connected vehicle technology?** *Please select one.*

- Within the next 3 years – SKIP TO Q30
- In 3 to 6 years – SKIP TO Q30
- In 7 or more years – SKIP TO Q30
- Don't know – SKIP TO Q30

27. [IF Q24 = YES] **Is your agency deploying (or is your agency partnering with other agencies to deploy) roadside units (RSUs) to support connected and/or automated vehicle testing/deployment?**

- Yes, deploying or partnering to deploy RSUs
- No
- Don't know

28. [IF Q24 = YES] **Is your agency developing, testing, or deploying (or partnering with other agencies to develop, test, or deploy) any connected vehicle applications, including in-vehicles (i.e., using an on-board unit (OBU), Human Machine Interface (HMI), or similar) or among pedestrians or cyclists (i.e., using a handheld device)?** *This may include applications that your agency is testing either on its own fleet or in partnership with other agencies or automakers/original equipment manufacturers. Please select one.*

- Yes
- No – SKIP TO Q30
- Don't know – SKIP TO Q30

29. [IF Q28 = YES] **Which connected vehicle (CV) applications is your agency developing, testing, or deploying (or partnering to develop, test, or deploy)?** *This may include applications that your agency is testing either on its own fleet or in partnership with other agencies or automakers/original equipment manufacturers. Please select all that apply.*

Safety Applications (Vehicle to Infrastructure (V2I)):

- ❑ Curve Speed Warning (CSW)
- ❑ Pedestrian in Signalized Crosswalk Warning
- ❑ Red Light Violation Warning (RLVW)
- ❑ Reduced Speed/Work Zone Warning (RSWZ)

Safety Applications (Vehicle to Vehicle (V2V)):

- ❑ Blind Spot/Lane Change Warning (BSW/LCW)
- ❑ Emergency Electronic Brake Lights (EEBL)
- ❑ Forward Collision Warning (FCW)
- ❑ Intersection Movement Assist (IMA)
- ❑ Vehicle Turning Right in Front of Bus Warning (VTRFBW)

Mobility Applications:

- ❑ Integrated Dynamic Transit Operations (IDTO) (e.g., Connection Protection (T-CONNECT), Dynamic Transit Operations (T-DISP), and Dynamic Ridesharing (D-RIDE))
- ❑ Intelligent Traffic Signal System (I-SIG)
- ❑ Queue Warning (Q-WARN)
- ❑ Transit Signal Priority

Environment Applications:

- ❑ Dynamic Eco Routing
- ❑ Eco-Approach and Departure at Signalized Intersections

Agency and Road Weather Applications:

- ❑ Agency Data Applications (e.g., probe data collection, CV-enabled data collection etc.)
- ❑ Road Weather Warnings (e.g., Motorist Advisories and Warnings (MAW); Enhanced Maintenance Decision Support System (MDSS))

Other CV Applications being developed, tested, or deployed:

- ❑ Please specify any other CV applications: _____

DEFINITIONS SHOWN IN HOVER BOXES:

Curve Speed Warning (CSW) alerts a driver if current speed is too fast for an approaching curve.

Pedestrian in Signalized Crosswalk Warning notifies a driver when a pedestrian is using a crosswalk in the vehicle's projected path.

Red Light Violation Warning (RLVW) issues a warning when a driver is about to run a red light.

Reduced Speed/Work Zone Warning (RSWZ) alerts a driver to use caution when traveling through a work zone.

Blind Spot/Lane Change Warning (BSW/LCW) alerts a driver changing lanes if there is a vehicle in the driver's blind spot.

Emergency Electronic Brake Lights (EEBL) application notifies a driver if there is a sudden-braking vehicle ahead (or several vehicles ahead).

Forward Collision Warning (FCW) alerts a driver when a vehicle ahead is stopped or traveling slower and there is a risk of a rear-end collision.

Intersection Movement Assist (IMA) warning notifies a driver if it is not safe to enter an intersection - for example, if another vehicle is running a red light or making a sudden turn.

Vehicle Turning Right in Front of Bus Warning (VTRFBW) notifies a bus driver when a vehicle attempts to turn right in front of the bus as the bus pulls away from a bus stop.

Integrated Dynamic Transit Operations (IDTO) includes three applications that improve transit mobility, operations, and services: Transfer Connection Protection dynamically holds vehicles at bus stops to meet with connecting passengers; Dynamic Transit Operations adjusts transit routing to pick up passengers or avoid congestion; and Dynamic Rideshare facilitates first-mile and last-mile shared riders.

Intelligent Traffic Signal System (I-SIG) uses high-fidelity data collected from vehicles (through V2V and V2I wireless communications), pedestrian, and non-motorized travelers to control traffic signals and maximize flows in real time, and may also seek to optimize overall network performance (i.e., accommodating transit or freight signal priority, preemption, and pedestrian movements).

Queue Warning (Q-WARN) provides a vehicle operator with sufficient warning of an impending queue backup, allowing the operator to brake safely, change lanes, or modify the route such that secondary collisions can be minimized or even eliminated. It is distinct from collision warning, which pertains to events or conditions that require immediate or emergency actions.

Transit Signal Priority is an application that allows transit agencies to manage bus service by granting buses priority at intersections. Decisions are made using information communicated by the transit vehicle (e.g., passenger count data, service type, scheduled and actual arrival time, and heading information) to roadside equipment via an on-board device.

Dynamic Eco-Routing application determines the most eco-friendly route, in terms of minimum fuel consumption or emissions, for individual travelers. This application recommends routes that produce the fewest emissions or reduce fuel consumption based on historical, real-time, and predicted traffic and environmental data (e.g., prevailing weather conditions).

Eco-Approach and Departure at Signalized Intersections is an application that uses traffic signal phase and timing (SPaT) data to determine speed advice that can be presented to drivers, allowing them to adapt their vehicle's speed to pass the next traffic signal on green or to decrease to a stop in the most eco-friendly manner.

Agency Data Applications include applications used to collect, transmit, analyze, or report local data related to traffic conditions, road conditions, travel patterns, or other metrics. Examples include: Probe-based Pavement Maintenance, Probe-based Traffic Monitoring, CV-enabled Origin-destination Studies, Work Zone Travel Information applications, etc.

Road Weather Warnings issue alerts and advisories to travelers about deteriorating road and weather conditions on specific roadway segments.

Automated Vehicle Technologies

This section asks about automated vehicle tests and deployments; your responses should also include any pilots or demonstrations related to automated vehicles.

30. [ASK ALL] **Has your agency participated in any automated vehicle (AV) tests or deployments in the last five years?** *Please select all that apply.*

- Yes, my agency is leading or has led AV testing/deployments (i.e., completed or in progress) - SKIP TO Q33
- Yes, my agency is supporting or has supported the planning or execution of AV testing/deployments - SKIP TO Q33
- No, my agency is not participating in any AV testing/deployment
- Don't know -

DEFINITION SHOWN IN HOVER BOX:

Automated vehicles (AVs) are those in which at least some aspect of a safety-critical control function (e.g., steering, throttling, or braking) occurs without direct driver input. AVs may include light-duty vehicles, transit vehicles, commercial motor vehicles, and small delivery devices, among others. Automated vehicles are widely categorized by their levels of driving automation defined by the Society of Automotive Engineers (SAE). These levels begin with Level 0 (no driving automation) and conclude with Level 5 (full driving automation).

31. [IF Q30 = NO OR DON'T KNOW] **Does your agency have any documented plans (e.g., internal planning documents, State Transportation Improvement Plan (STIP), etc.) to participate in automated vehicle (AV) testing or deployment in the future?** *Please select one.*

- Yes, my agency has a documented plan
- No, but my agency is considering AV testing or deployment
- No, my agency is not considering AV testing or deployment – SKIP TO Q36
- Don't know – SKIP TO Q36

32. [IF Q31 = YES HAS DOCUMENTED PLAN OR CONSIDERING] **When does your agency expect to participate in automated vehicle testing or deployment?** *Please select one.*

- Within the next 3 years – SKIP TO Q36
- In 3 to 6 years – SKIP TO Q36
- In 7 or more years – SKIP TO Q36
- Don't know – SKIP TO Q36

33. a. [IF Q30 = AGENCY SUPPORTING (AND ONLY OPTION 2 SELECTED)]: **Which entity(ies) are/were leading the automated vehicle testing or deployment?** *Please select all that apply.*

33. b. [IF Q30 = AGENCY LEADING (OPTION 1 ONLY) OR BOTH OPTIONS 1 AND 2]: **For the automated vehicle testing or deployment that your agency is/was leading, what other entity(ies) are/were you partnering with?** *Please select all that apply.*

- ❑ Automakers or Original Equipment Manufacturers (OEMs), including Transit Vehicle Manufacturers
- ❑ Advanced Driver Assistance Systems (ADAS) Developers (or Driver Support Features Developers)
- ❑ Automated Driving Systems (ADS) Developers
- ❑ Transportation Network Companies (TNCs) (e.g., Uber or Lyft)
- ❑ State agencies
- ❑ Metropolitan Planning Organizations (MPOs)
- ❑ Universities
- ❑ Other transit agencies
- ❑ Other local agencies
- ❑ Private sector consultants (please specify): _____
- ❑ Other (please specify): _____
- ❑ Don't know

34. [IF Q30 = AGENCY LEADING OR SUPPORTING] **Which of the following automated vehicle (AV) tests or deployments has your agency led or supported in the last five years?** *Please select all that apply.*

- ❑ Automated Bus Rapid Transit (BRT)
- ❑ Automated Passenger Fixed Route
- ❑ Automated Passenger On-Demand
- ❑ Automated Maintenance and Bus Yard Operations
- ❑ Other AV test/deployment (please specify): _____

DEFINITIONS SHOWN IN HOVER BOXES:

Automated Bus Rapid Transit (BRT) applies rail transit concepts to automated buses to deliver fast and efficient service. These concepts focus on eliminating causes of delay that typically slow regular bus services and may include dedicated lanes, busways, traffic signal priority, off-board fare collection, platforms, and enhanced stations.

Automated Passenger Fixed Route service provides rides along a single route with pre-defined stops and a set schedule. The route may be limited to closed environments, such as parking lots, busways, campuses, and retirement communities, or it may operate in mixed traffic on public roads in areas such as business parks or downtown districts.

Automated Passenger On-Demand provides on-demand service between any two addresses within a defined service area. The concept is similar to the automated passenger fixed route service; however, it is not restricted to predefined routes or schedules - users can request pick-ups and drop-offs on demand (e.g., using an application on a smartphone, tablet, or kiosk).

Automated Maintenance and Bus Yard Operations is the deployment of automated driving systems (ADS) on transit vehicles for use within the domain of the bus yard. Use cases may include precision movement for fueling/recharging, maintenance, disinfection/bus wash, or automated parking and recall.

35. For your [INSERT TYPE FROM Q34] test or deployment, which type of vehicle is being used?
Please select all that apply.

- ❑ Full-sized transit bus
- ❑ Articulated bus
- ❑ Motorcoach (over-the-road bus)
- ❑ Cutaway bus or minibus
- ❑ Novel-design low-speed shuttle
- ❑ Light-duty passenger vehicle (e.g., car, van, SUV)
- ❑ Other (please specify): _____
- ❑ Don't know

Telecommunications

36. [ASK ALL] What type of telecommunications technologies does your agency use to enable Intelligent Transportation Systems (ITS)? *Please select all that apply.*

Wired:

- ❑ Coaxial – OMIT FROM Q37
- ❑ Fiber-optic cable – OMIT FROM Q37
- ❑ Twisted copper pair/Twisted wire pair
- ❑ Digital subscriber line (DSL)
- ❑ Data cable over modem

Wireless:

- ❑ 5G New Radio and 5G small cell infrastructure
- ❑ Cellular (LTE-4G)
- ❑ Cellular (GPRS – 2G or 3G)
- ❑ LTE-Cellular V2X (LTE-CV2X)
- ❑ Dedicated short range communications (DSRC)
- ❑ Wi-Fi
- ❑ Mobile or Fixed service satellite (FSS) – OMIT FROM Q37
- ❑ Ultra-wideband (UWB)
- ❑ Microwave – OMIT FROM Q37
- ❑ Other telecommunications (wired and/or wireless) (please specify): _____ – OMIT FROM Q37
- ❑ Don't know – SKIP TO Q38
- ❑ No telecommunications used to enable ITS – SKIP TO Q38
- ❑ Not applicable, no ITS infrastructure or devices are deployed – SKIP TO Q38

DEFINITIONS SHOWN IN HOVER BOXES:

Coaxial cable is mainly used to provide communications between field controllers and a central controller. Coaxial cables have an inner conductor, insulating layer, conductive shielding, and protective outer jacket.

Fiber-optic cables transmit large amounts of information over long distances (e.g., camera images) through use of many super-thin strands of optical glass fiber.

Twisted copper pair/Twisted wire pair is composed of two insulated copper wires twisted around one another. This is mainly used to provide basic telephone services and ethernet over short distance.

Digital subscriber line (DSL) is a wireline transmission technology that uses existing infrastructure to provide integrated traffic video and field device communications. This includes all forms of DSL (e.g., ADSL, RADSL, HDSL, SDSL).

Data cable over modem service enables operators to provide broadband using standard cable lines (e.g., 56 kilobits/second).

5G New Radio and 5G small cell infrastructure (which communicates over very short distances) represents the newest generation of cellular data communication. The 5G New Radios can operate within and share existing 4G LTE infrastructure in non-standalone (NSA) mode (e.g., cell towers). The other critical component of 5G, small cell infrastructure, consists of small antennae placed in the public right-of-way to act as a high-speed intermediary between a field device and the larger cell tower.

Cellular (LTE-4G) is the fourth generation of cellular data communication. LTE (Long Term Evolution) is standard to 4G and is both forward and backward compatible. Cellular LTE 4G operates in the 600 MHz, 700 MHz, 850 MHz, 1.7 GHz, 1.9 GHz, 2.3 GHz, 2.5 GHz spectrum.

Cellular GPRS – 2G or 3G are the older generations of cellular data communications and are being phased out. These generations of cellular rely on radio signals in a digital format and operate in the 470-690 MHz, 690-805 MHz, 1.850-1.995 GHz spectrum.

LTE-Cellular V2X (LTE-CV2X) operates in the reduced 5.895-5.925 GHz spectrum, known as the Safety Band (dedicated for safety-of-life and public benefit transportation purposes). LTE-CV2X is intended to service connected vehicle technology.

Dedicated short range communications (DSRC) is a two-way radio communication operating in the reduced 5.895-5.925 GHz spectrum, currently known as the Safety Band (dedicated for safety-of-life and public benefit transportation purposes). The Federal Communications Commission (FCC) is planning to phase out DSRC in the future.

Wi-Fi provides wireless high-speed internet access or communications between devices (point-to-point or point-to-multipoint). It includes agency-installed Wi-Fi access points and client devices, or subscription-based Wi-Fi in the 2.4 GHz, 5.8 GHz, and (recently) 6 GHz spectrum.

Mobile or Fixed service satellite (FSS) provides radio communication between two or more fixed or mobile receivers. MSS or FSS allows uploading/downloading data across a wide range (137 MHz-51.4 GHz) of spectrum in the form of space-to-earth, earth-to-space, or broadcast communications.

Ultra-wideband (UWB) is a short-range communication technology ideal for transmitting data at high speeds between devices 10 to 30 meters apart, using any spectrum as unlicensed communications (similar to radar).

Microwave (also known as Ultra High Frequency (UHF) or Extremely High Frequency (EHF)) communicates as fixed point-to-point backhaul or as very short-range, line-of-sight radar/Lidar communications, typically between 300 MHz and 300 GHz spectrum.

37. [FOR EACH TELECOM TECH CHECKED IN Q36 EXCEPT FOR COAXIAL, FIBER OPTIC CABLE, FSS, AND MICROWAVE] **Please indicate how your agency is using the telecommunication technology(ies) shown below to enable ITS.**

Each of the use cases listed is based on Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) service packages. Click this link for more information: https://www.arc-it.net/html/servicepackages/servicepackages-areaspsort.html. *Please select all that apply in each column*.

- ❑ Data Management
- ❑ Maintenance and Construction
- ❑ Parking Management
- ❑ Public Safety
- ❑ Public Transportation
- ❑ Support
- ❑ Sustainable Travel
- ❑ Traveler Information
- ❑ Vehicle Safety
- ❑ Weather
- ❑ Other (please specify): _____
- ❑ Don't know

DEFINITIONS SHOWN IN HOVER BOXES:

Data Management: Two relevant service packages are ITS data warehouse and performance monitoring.

Maintenance and Construction: Examples include maintenance and construction vehicle maintenance, winter maintenance, roadway maintenance and construction, work zone management, maintenance and construction signal priority, asset tracking, etc.

Parking Management: Examples include parking space management, smart park and ride system, parking electronic payment, regional parking management, etc.

Public Safety: Examples include the monitoring of transportation infrastructure or assets, emergency response and recovery, and disaster response and recovery, etc.

Public Transportation: Examples include dynamic transit operations, transit fare collection management, transit security, transit fleet management, transit signal priority, intermittent bus lanes, etc.

Support: Examples include connected vehicle system monitoring and management, map management, ITS communications, location and time, security and credentials management, field equipment maintenance, etc.

Sustainable Travel: Examples include emissions monitoring, eco-traffic signal timing, roadside lighting, electric charging stations management, etc.

Traveler Information: Examples include broadcast traveler information, dynamic route guidance, infrastructure-provided trip planning and route guidance, dynamic ridesharing, and shared use transportation, etc.

Vehicle Safety: Examples include autonomous vehicle safety systems, V2V basic safety, situational awareness, curve-speed warning, pedestrian and cyclist safety, stop sign gap assist, automated vehicle operations, etc.

Weather: Examples include weather data collection, weather information processing and distribution, spot weather impact warning, etc.

38. [ASK ALL] **If your agency has any notes or additional information about its use of telecommunications, please provide below.**

Maintenance of Transit ITS Technology

39. [ASK ALL] **What is your agency's primary approach for conducting maintenance activities on Intelligent Transportation Systems (ITS) assets?** *Please select one.*

- My agency primarily schedules maintenance based on the regularly monitored condition of ITS assets.
- My agency primarily schedules maintenance of ITS assets based on regular intervals.
- My agency primarily conducts maintenance in response to reported ITS asset failures or events, such as a vehicle collision or component failure.
- My agency does not have ITS assets
- Other (please specify): _____
- Don't know

Cybersecurity

40. [ASK ALL] **Does your agency have a documented cybersecurity policy that explicitly addresses Intelligent Transportation Systems (ITS) technologies/equipment?** *Please select one*

- My agency has a cybersecurity policy which explicitly addresses ITS. – SKIP TO Q42
- My agency's general cybersecurity policy (i.e., for information technology (IT)) is applied to ITS.
- My agency's ITS is not covered by a cybersecurity policy.
- My agency has not deployed ITS technologies/equipment – SKIP TO Q43b
- Don't know – SKIP TO Q42

41. [IF Q40 = OPTIONS 2 OR 3] **Is your agency planning to develop a cybersecurity policy that explicitly addresses ITS?** *Please select one.*

- Yes
- No
- Don't know

42. [EXCLUDE IF Q40 = OPTION 4 (NO ITS)] **In the last five years, has your agency conducted incident response exercises that include ITS equipment/technologies to prepare for ITS cybersecurity events?** *Please select one.*

- Yes, my agency's incident response exercises have included ITS equipment/technologies
- No, my agency's incident response exercises have **not** included ITS equipment/technologies
- My agency has not conducted incident response exercises in the last five years
- Don't know

DEFINITION SHOWN IN HOVER BOX

Incident response exercises are agency-run tests of protocols that mitigate violations of security policies and recommended practices.

43.

a. [EXCLUDE IF Q40 = OPTION 4 (NO ITS)] **In the last three years, has your agency had any cybersecurity events or attacks (e.g., ransomware, data breach) that affected its information technology (IT) system and/or ITS technologies/equipment?** *Please select all that apply. If your agency has experienced multiple events or attacks, please respond based on all experiences.*

- ❑ Yes, affecting IT system – SKIP TO Q44
- ❑ Yes, affecting ITS technologies/equipment – SKIP TO Q44
- ❑ No – SKIP TO Q46
- ❑ Don't know – SKIP TO Q46

b. [ASK IF Q40 = OPTION 4 (NO ITS)] **In the last three years, has your agency had any cybersecurity events or attacks (e.g., ransomware, data breach) that affected its information technology (IT) system?** *If your agency has experienced multiple events or attacks, please respond based on all experiences.*

- ○ Yes – SKIP TO Q45
- ○ No – SKIP TO Q46
- ○ Don't know – SKIP TO Q46

DEFINITION SHOWN IN HOVER BOX:

Information technology (IT) systems include personal computers or commercial servers along with the network equipment to connect this equipment together.

44. [IF Q43a = YES (OPTIONS 1 OR 2)] **What was (or were) the initial point(s) of entry for the cybersecurity event(s) or attack(s)?** *Please select all that apply. If your agency has experienced multiple events or attacks, please respond based on all experiences.*

- ❑ IT system
- ❑ ITS equipment/technologies
- ❑ Don't know

45. [IF Q43a = YES (OPTIONS 1 OR 2) OR Q43b = YES] **Did any of the cybersecurity event(s) or attack(s) affect transportation system operations?** *Please select one.*

- ○ Yes
- ○ No
- ○ Don't know

Integrated Corridor Management

This 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.

46. [ASK ALL] **Has your agency partnered with freeway and/or arterial agencies to deploy Integrated Corridor Management (ICM) in one or more corridors (i.e., integrating operations across freeways, arterials, and public transit networks) to actively manage travel demand and capacity in the corridor as a whole?** *Please select one.*

- ○ Yes, my agency has partnered to deploy ICM
- ○ No, but my agency plans to partner to deploy ICM
- ○ No, my agency has no plans to partner to deploy ICM

Service Planning

47. [ASK ALL] **Does your agency use any of the following Intelligent Transportation Systems (ITS) data for service planning?** *Please select all that apply.*

- ❑ Vehicle time and location (e.g., on-time performance)
- ❑ Vehicle monitoring status (i.e., vehicle diagnostics and health)
- ❑ Passenger count and load
- ❑ Trip itinerary planning records (e.g., from apps or trip planners)
- ❑ Passenger trip 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 use ITS data for service planning

Transportation Demand Management

48. [ASK ALL] **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 (i.e., connection protection)?** *Please select one.*

- ○ Yes
- ○ No
- ○ Don't know
- ○ Not applicable

49. [ASK ALL] **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
- ○ Don't know
- ○ Not applicable

Independent Travel for People with Disabilities

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

- ❑ Automated announcements (i.e., audio) of approaching transit vehicle in stops/stations
- ❑ Trip reservation systems with ways to reserve trips that account for an individual's mobility needs in addition to a phone call with customer service representative and TTY/TDD [telecommunications device for the deaf] line
- ❑ Indoor navigation support (e.g., wayfinding beacons, digital mapping)
- ❑ Travel training and independent travel support applications (e.g., pre-trip planning applications, en-route navigation applications with dynamic step-by-step instructions, Virtualization applications)
- ❑ Augmentative and alternative communication (AAC) aids provided to operators and managers to support communication with customers
- ❑ Other (please specify): _____
- ❑ No technologies or services to support independent travel for people with disabilities are currently implemented or piloted

Intelligent Transportation Systems (ITS) Standards

51. [ASK ALL] **Does your agency implement transit-related Intelligent Transportation Systems (ITS) standards or specifications?** *Please select all that apply.*

- ❑ Transit Communication Interface Profiles (TCIP)
- ❑ National Transportation Communications for ITS 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)
- ❑ General Bikeshare Feed Specifications (GBFS)
- ❑ Service Interface for Real Time Information (SIRI)
- ❑ Transactional Data Specification (TDS)
- ❑ Other (please specify): _____
- ❑ Don't know
- ❑ No ITS standards or specifications are implemented

DEFINITION SHOWN IN HOVER BOX

Transit Communication Interface Profiles (TCIP) is an interface standard. Its primary purpose is to define standardized mechanisms for exchanging data among transit business systems, subsystems, components, and devices. https://www.arc-it.net/html/comm/profile68.html

National Transportation Communications for Intelligent Transportation System (ITS) Protocol (NTCIP) is a family of standards that provides both the rules for communicating (called protocols) and the vocabulary (called objects) necessary to allow electronic traffic control equipment from different manufacturers to operate with each other as a system. https://www.ntcip.org/about/

Advanced Traveler Information Systems (ATIS) is the upper-layer standard required to implement traveler information communications. https://www.arc-it.net/html/comm/profile68.html

Contactless Fare Media System Standard (CFMS) provides for a consistent and uniform method for storing and retrieving information from smart cards used in transit applications. The standard consists of 5 parts which are designed to be implemented together as part of a foundation for end-to-end integration of fare collection information processing. https://www.apta.com/research-technical-resources/standards/technology/APTA-IT-UTFS-S-001-07/

General Transit Feed Specification (GTFS) (de facto standard) is a data specification that allows public transit agencies to publish their transit data in a format that can be consumed by a wide variety of software applications. Otherwise known as GTFS Schedule, the data primarily consist of static information like stops, routes, schedule, and fares. https://gtfs.org/

GTFS Realtime (GTFS RT) is a feed specification that allows public transportation agencies to provide real-time updates about their fleet to application developers. GTFS RT was designed around ease of implementation, good GTFS interoperability, and a focus on passenger information. https://gtfs.org/realtime/

GTFS-Flex is a proposed extension that adds modeling of demand response, continuous stops, route deviation, and other non-fixed-route services to GTFS. A GTFS-Flex-enabled trip planner can read these additional categories of transit data and generate matching itineraries, giving a user more trip options in search results. https://trid.trb.org/view/1858112

General Bikeshare Feed Specifications (GBFS) is a real-time data specification that allows micromobility providers to publicly present service information, including vehicle and dock location and availability. https://gbfs.mobilitydata.org/

Service Interface for Real Time Information (SIRI) covers transit communications between centers and their transit vehicles. SIRI provides traveler information on real-time transit vehicle location, predicted transit-vehicle arrival/departure, and predicted transit-trip travel time. https://ops.fhwa.dot.gov/publications/fhwahop13046/sec4.htm

Transactional Data Specification (TDS) is a set of rules that explain how, and in what format, computer systems exchange data needed to fulfill individual demand-responsive transportation trip requests and responses. https://www.trb.org/Main/Blurbs/180593.aspx

Future Deployment Planning

52. [ASK ALL] **Does your agency plan to expand or upgrade current Intelligent Transportation Systems (ITS) during the next three years (2024 through 2026)?** *Please select one.*

- o Yes
- o No
- o Don't know
- o Not applicable, my agency has not deployed ITS

53. [ASK ALL] **Does your agency plan to invest in new or emerging ITS during the next three years (2024 through 2026)?** *Please select one.*

- o Yes
- o No – SKIP TO Q55
- o Don't know – SKIP TO Q55

54. [IF Q53 = YES] **Please describe the new or emerging ITS technologies your agency plans to invest in.**

Additional Comments

55. 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.

56. Can we contact you if we have any follow-up questions about your agency's experience deploying ITS? *Please select one.*

- o Yes
- o No – SKIP TO Q57

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

56a. The phone number we have on file is [RESPONDENT PHONE]**. If this is not your preferred phone number, please provide your preferred phone number below:**

56b. The email address we have on file is [RESPONDENT EMAIL]**. If this is not your preferred email, please provide your preferred email address below:**

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

- o 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).
- o No, I am still working on the survey and will complete it later.

Thank you for your time and effort in completing this survey!