Performance Measurement and Evaluation Support Plan

California Association for Coordinated Transportation ITS4US Deployment Project

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ITS4US

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16. Abstract

This project aims to address the need for riders who use demand-responsive services, rural riders, and riders with disabilities to have equal access to the real-time trip planning technologies already available for fixed-route transit, as well as Transportation Network Companies. Fixed-route transit rider information has developed quickly in the last 15 years, but is generally limited to smartphone users in urbanized areas. General Transit Feed Specification (GTFS) data, the most common transit schedule exchange data format, does not require the inclusion of accessibility information that ensures riders with vision, mobility, hearing, and cognitive disabilities can access the transit service information. This project will require that transit agencies publish data that are up to industry standards and include information that is important to riders with disabilities. This will increase access to transit for these riders by ensuring the information they need is widely available and accurate. The purpose of this document is to present and describe the proposed performance measurements (PMs) for evaluating the success of this project. This document provides an overview of the PMs, a description of anticipated confounding factors, examples for how the PMs are expected to apply to various use case scenarios, and an overview of how data will be collected and reported throughout the project.

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1. Introduction

The purpose of this document is to present and describe the proposed performance measurements (PMs) for evaluating the success of this project. This document provides an overview of the PMs, a description of anticipated confounding factors, examples for how the PMs are expected to apply to various use case scenarios, and an overview of how data will be collected and reported throughout the project.

1.1. Intended Audience

The intended audience of this document is the CALACT team, including its subcontractors and stakeholder subcommittee chairs and members, as well as the USDOT program management team. Academic and practitioner stakeholders who may find this document useful are considered as well.

1.2. Project Background

The CALACT project addresses the clear need for riders who use demand-responsive services, including riders with disabilities, to have equal access to the real-time trip planning technology that is already available for urban fixed-route transit. Nearly 300 of the over 500 transit operators in California, Oregon, and Washington deliver a form of demand-responsive service[1]. Rider characteristics of these services likely differ substantially from those on fixed-route services as rural residents and people with disabilities are more likely to be low-income, unable to use fixed-route services due to disability, and/or are living in a physically isolated environment.

The demand-response systems themselves offer a lower quality of rider experience, where would-be passengers must find a transit provider that will serve their needs, call a dispatch system to plan and reserve their trip, requiring a long lead time (typically at least a day in advance), and allowing little room for flexibility. The trip planning experience of demand-response systems is further and uniquely burdened by a complex web of determining operator coverage area, for what qualifications that operator or specific service within that operator's service menu they qualify, if the operator has availability, if they need to pay and how. Unlike fixed route services, which have a well-established data standard and a stable industry of third-party trip planning services, and private Transportation Network Companies (TNCs), which produce their own seamless and instantaneous booking and payments flows, demand-responsive transit lacks the technical solutions which could ease these burdens for their riders. There's no comparable

[1] Numbers calculated based on internal lists of agencies and metadata provided by ODOT, WSDOT, and Caltrans.

desktop or smartphone experience and no other innovations which exist to untangle these webs of availability, reservations, or payments.

Most fixed route users in the three-state region have access to real-time information about transit services through any mobile device. However, very few users have that information about public demand-responsive transit, and none have that information except through custom proprietary systems implemented at a few local agencies. Further, users of fixed-route services who would like more access to details regarding the transit system accessibility features and other amenities often cannot easily find that information.

The particular underserved communities the project focuses on are people with mobility disabilities, people with vision disabilities, people with cognitive and developmental disabilities, people with hearing disabilities, older adults, low-income populations, rural residents, veterans, and people with limited English proficiency.

This project is one of five deployments of the Complete Trip - ITS4US Deployment Program, led by the ITS JPO and supported by Office of the Secretary (OST), Federal Highway Administration (FHWA), and Federal Transit Administration (FTA). These deployments were selected to showcase innovative business partnerships, technologies, and practices that promote independent mobility for all travelers regardless of location, income, or disability. The Complete Trip - ITS4US Deployment Program is carried out in three phases over five years: Concept Development (current phase), Design and Testing, and lastly Operations and Evaluation. There is a post-deployment operations and maintenance phase for an additional five years. The intended outcomes for the CALACT deployment are to improve the user experience and cost efficiency of demand responsive transit for riders at agencies throughout Washington, Oregon, and California.

Project partner (subcontractor) organizations include:

- Oregon Department of Transportation (ODOT): Agency outreach in Oregon, member of PMT, transit directory product manager
- Washington Department of Transportation (WSDOT): Agency outreach in Washington, member of PMT, transit analysis product manager
- California Department of Transportation (Caltrans): Agency outreach in California, member of PMT, payments product manager
- Washington State Transit Association (WSTA): Support agency outreach in WA and assist with event coordination
- Trillium, an Oregon small business: Concept design, report writing and product management support
- Compiler LA, a California small business: Software systems requirements and data management lead
- Tamika L. Butler Consulting, a California small business: Internal evaluation and stakeholder engagement

- Mark Wall Associates, a California small business: Agency outreach and support for reporting and project administration
- Estolano Advisors, a California small business: Agency and stakeholder outreach support
- California Partners for Advanced Transportation Technology at UC Berkeley: Project evaluation and stakeholder safety and human use leads
- MobilityData IO, a Canadian nonprofit: Data specification development and technology readiness assessment lead
- Transit, a Canadian private corporation registered for business in the US: Technical advise on customer interface needs and development
- Navilens, a Spanish private corporation registered for business in the US: Digital accessible signage and text to speech product leads
- Google, an American public corporation (unfunded): Participation in an advisory and user testing coordination role

1.3. Scope

This document provides the performance measures that will be used to measure the success of this project. It also describes the plan for collecting and analyzing key data to report on performance of the system. Each performance measurement is discussed in detail to explain why it is a useful measurement, how it will be applied to the project, and strategies that will be used to mitigate any identified confounding factors. The document then described the data collection required for this evaluation and overviews the plan for collecting that data.

This report will be updated as new information and data are gathered. Specifically, after producing the Task 13 Integrated Complete Trip Deployment Plan and again before the beginning of Phase 3. Other dates relevant to performance measurement can be found in the table in Section 9.

1.4. Performance Measurement and Evaluation Support Plan Purpose

The purpose of the PMESP is to ensure that the project is actually promoting independent mobility for all travelers regardless of location, income, or disability. This document walks through selecting applicable and impactful performance measures and how they will be implemented and tracked.

Section 1 provides a summary and overview of the document. Section 2 describes the project's goals an objective and presents operational scenarios originally described in the Concept of Operations (ConOps) that are expected to be impacted most by project deployment. Section 3 lists and describes potential performance metrics for measuring the success of the project deployment. Section 4 identifies possible confounding factors that could interfere with the

performance measures and discusses how those factors will be addressed. Section 5 describes the process and strategy for performance analysis, including detailing experimental designs for each performance measure. Section 6 describes the connection between the project and the Independent Evaluation Effort, including steps to support and cooperate with the needs of the Independent Evaluation Effort. Section 7 overviews the data collection required for performance evaluation, including baseline data collection, and the plan for evaluating and sharing data. Section 8 describes how data and progress will be shared and provides a template for performance reporting updates. Finally, Section 9 gives the timeline for important performance measurement benchmarks and events.

2. Goals and Objectives

This section reviews the goals and objectives of the CALACT ITS4US project deployment in the context of performance measurement. It first describes the high-level goals and objectives of the project, and then reviews the operational scenarios that are expected to be impacted by the deployment and should be covered by the performance measurement approach. Section 2.1 is adapted directly from section 8.1.4 of the Concept of Operations, which initially developed the high-level goals for performance measurement of the system. Section 2.2 is adapted directly from section 6 of the ConOps in which the operational scenarios were originally specified.

2.1. Deployment Goals and Objectives

The proposed system would put into place a new transit data governance process to ensure that the GTFS published by transit agencies provides for the needs of riders with disabilities, older riders, low-income riders, rural riders, Limited English Proficiency (LEP) riders, and riders with other safety concerns. Further, the proposed governance system, which would be made up of representatives from state DOTs and other transit professionals, would provide tools and resources to allow all users to access this data and look up information regarding transit systems, and to support the development of rider applications by private parties that put that data to use. This governance system is described in detail in the ConOps Section 5.2. The goals of this proposed system are to improve the quality and breadth of data published in standardized formats which include information needed by underserved riders, and to encourage more rider applications to ingest that data and provide “complete trip” planning.

These high-level goals imply three different general approaches to measuring the performance of the system:

- Is there more GTFS data published that is in compliance with the accessibility-focused enhancements encouraged and facilitated by this project?
- Are general public and underserved users able to successfully answer their questions regarding transit services by using the tools and resources provided by the project?
- Do third-party application developers implement the accessibility features suggested by the project?

These general performance measurements will be broken down into a series of precise performance metrics, to be detailed in this Performance Measurement and Evaluation Support Plan. The data sources to be used by the project are itemized in the Data Management Plan. Generally, data for the use in performance measurement will be drawn from

- The Directory Analysis Frontend and 1st Tier Support Desk: these tools and resources sponsored by the project will create user analytics and communications data sets that can be used to evaluate the amount of data created and how it is accessed by users.

- Data sources developed in collaboration with transit operators: transit operators at deployment sites will have access to their riders and the capacity to request rider feedback through surveys conducted as part of this project, as well as provide data to the project such as rider feedback and complaints, or operational metrics such as number of riders.

- Data sources provided by software vendors: both Business to Governemt (B2G) and Business to Consumer (B2C) software vendors will have access to data from their users which may support the measurement of project performance. These data sets will need to be discussed with and licensed from third parties who own that data. More information can be found in Section 5 of the ConOps, pp. 72-85.

2.2. Use Cases/Scenarios

The following operational scenarios identified in the ConOps are expected to be most impacted by project deployment. These include all of the operational scenarios described in the ConOps with the exception of Operational Scenario 15. Each of the operational scenarios described in the ConOps describe a use case that should be covered by the system and can be considered high-impact. It is not practical to sort out a small subgroup of operational scenarios because many interrelate at different steps and all are generally served by the same key proposed system component, the enhancements to the GTFS data specification. Operational Scenario 15 is slightly lower impact than the others because it assumes a system of data specification governance is in place and that transit agencies and DOTs regularly use that system of governance in the course of their normal operations. This operational scenario is only important if the others have been successfully supported. Note that operational scenarios refer to the user needs which are defined in Section 3 of the ConOps.

Table 1. Scenario 1: Individual with a mobility disability who uses a mobility device is looking for a demand response service for the first time

	Scenario 1: Individual with a mobility disability who uses a mobility device is looking for a demand response service for the first time
Short Description	In this use case, an individual with a mobility disability who uses a mobility device discovers a dial-a-ride service in their area. They use a commercial trip planning application to plan a trip from their origin to their destination and select the option that requires the least walking. They need to discover the service name and the information they need to book the trip.
Goal	The goal of this use case is to demonstrate the discoverability of demand-response transit services on commonly used trip planning applications.
Constraints	• This user will only be searching for services relevant to their location/eligibility status. For the user to discover the appropriate service, representative data must exist, and the app of their choice must ingest and model it.

	Scenario 1: Individual with a mobility disability who uses a mobility device is looking for a demand response service for the first time
Related User Needs	RID-01 - Discover DR RID-01-1 - Book in advance RID-01-5 - DR delay RID-01-6 - DR origin and destination RID-01-7 - Book quickly RID-03 - Eligibility process RID-15 - Customer service RID-19 - Device accessible RID-19-1 - Space for mobility device RID-27 - Confidence in info RID-33 - Confirm vehicle RID-45 - Communicate without text MUL-03 - Contact information
Related Draft PMs	PM 0.1 PM 0.7

Table 2. Scenario 2: Person who uses a wheelchair planning a trip to work using fixed-route service near their home

	Scenario 2: Person who uses a wheelchair planning a trip to work using fixed-route service near their home
Short Description	In this use case, a user with a wheelchair is planning a trip to their work using the bus service near their home for the first time. They are using the agency website's embedded trip planner which forwards users to Google Maps to access information.
Goal	The goal of this use case is to illustrate pathway and vehicle accessibility information that users with mobility disabilities need to successfully plan a complete trip.
Constraints	• This user is specifically wanting to use the fixed-route bus service near their home. They are not looking to use a demand-responsive or paratransit service. • This user is planning to use this service to get to work, so their punctual arrival time is important • This user is planning to travel alone, so they need to be able to either deal with any barriers independently, know that there will be a driver or other trained person available to assist them, or know to plan an entirely different trip in the case that this is not feasible.
Related User Needs	RID-13 - App guidance RID-19 - Device accessible RID-19-1 - Space for mobility device RID-19-2 - Pathways in advance RID-19-3 - Loading mobility device RID-19-4 - Space for mobility device real-time RID-19-7 - Mobility device charging RID-19-9 - Trust pathway validation RID-27 - Confidence in info RID-33 - Confirm vehicle RID-34 - Elevators in service RID-39 - Aware of apps RID-40 - Schedule changes OP-03 - Tech sophistication not required MUL-03 - Contact information
Related Draft PMs	PM 0.2

Table 3. Scenario 3: A rider with a vision disability uses an agency's website to determine what times the local train stops near their house and receives alert en route to station.

	Scenario 3: A rider with a vision disability uses an agency's website to determine what times the local train stops near their house and receives alert en route to station.
Short Description	In this use case, the user wants to take the train that stops near their house and is using the train agency's website to look for information about when the train comes. They retrieve that time, and are walking to the station when an alert is posted by the agency that their train has been delayed
Goal	The goal of this use case is to illustrate how online information needs to be presented in a variety of ways so that it is accessible to all users.
Constraints	• A constraint in this use case is that the user will be accessing information using a screen reader so information must be presented in a way that is accessible without seeing the visual information presented.
Related User Needs	RID-04 - Hear text annunciation RID-04-1 - Audio option RID-13 - App guidance RID-15 - Customer service RID-19 - Device accessible RID-21 - Talk to app RID-20 - Diversity of interfaces RID-27 - Confidence in info RID-28 - Limit words RID-30 - Consistent experience RID-42 - Navigation directions RID-45 - Communicate without text OP-03 - Tech sophistication not required MUL-03 - Contact information
Related Draft PMs	PM 0.11

Table 4. Scenario 4: A rider with a vision disability boards a demand responsive vehicle on a busy street and knows the right vehicle to board because the mobile application directs them to it in a line of vehicles.

	Scenario 4: a rider with a vision disability boards a demand responsive vehicle on a busy street and knows the right vehicle to board because the mobile application directs them to it in a line of vehicles.
Short Description	In this use case, the user has a vision disability and has booked a demand-responsive trip. The pickup location is on a busy urban street with many vehicles parked next to the sidewalk. The user is able to be directed to the exact vehicle and approach it with confidence because their mobile application knows the location of the vehicle and also can see the digital code for that vehicle through the phone camera.
Goal	The goal of this use case is to illustrate how riders need to know which vehicle to board through accessible information.
Constraints	• The rider has a service animal and will be bringing the animal with them on the trip.
Related User Needs	RID-04 - Hear text annunciation RID-04-1 - Audio option RID-16 - Communicate with driver RID-20 - Diversity of interfaces RID-33 - Confirm vehicle RID-42 - Navigation directions RID-43 - Service animal
Related Draft PMs	While this operational scenario will be impacted by the project, successful fulfillment of this operational scenario is not directly measured by any of the final PMs.

Table 5. Scenario 5: Person with a developmental disability wants to schedule paratransit services online to pick them up at home and drop them off at their new job.

	Scenario 5: Person with a developmental disability wants to schedule paratransit services online to pick them up at home and drop them off at their new job.
Short Description	In this use case, the user is a person with a disability who is using the internet to find and book a paratransit service to pick them up at home and drop them off at work. Once at work, they need to let their sister know that they made it safely.

	Scenario 5: Person with a developmental disability wants to schedule paratransit services online to pick them up at home and drop them off at their new job.
Goal	The goal of this use case is to illustrate the types of information that needs to be available for booking paratransit trips and how that information needs to be presented in order to be accessible to a person with a developmental disability.
Constraints	• This user is using the internet to access services. They are not calling the agency to book a ride. • This user has a developmental disability which impacts their ability to read and process information. They may be using accessibility tools like text-to-speech to understand written materials. • This user is planning to use this service to get to work, so their punctual arrival time is important • The paratransit service in this area has eligibility requirements and requirements for how far in advance the rider needs to book a trip
Related User Needs	RID-01 - Discover DR RID-01-1 - Book in advance RID-01-4 - DR wait time RID-01-5 - DR delay RID-01-6 - DR origin and destination RID-01-7 - Book quickly RID-03 - Eligibility process RID-13 - App guidance RID-13-1 - No experience necessary RID-15 - Customer service RID-16 - Communicate with driver RID-19 - Device accessible RID-20 - Diversity of interfaces RID-21 - Talk to app RID-24 - Various notifications RID-27 - Confidence in info RID-28 - Limit words RID-30 - Consistent experience RID-33 - Confirm vehicle RID-36 - Way back home RID-39 - Aware of apps RID-41 - Assistive tech awareness RID-42 - Navigation directions RID-45 - Communicate without text OP-02 - Booking through rider apps OP-03 - Tech sophistication not required OP-06 - Serve requests precisely MUL-03 - Contact information
Related Draft PMs	PM 0.3 PM 0.5 PM 0.10

Table 6. Scenario 6: A rider who is a veteran and currently on a low fixed-income is researching transit in her area to see what options are available for her to go to the VA Hospital in the most efficient and economical way possible.

	Scenario 6: A rider who is a veteran and currently on a low fixed-income is researching transit in her area to see what options are available for her to go to the VA Hospital in a nearby urban center in the most efficient and economical way possible.
Short Description	In this use case, the user is a veteran who is also low income. She is using the internet to find out what options are available to her to go to and from the VA Hospital in a nearby urban center. She is interested in services specifically for veterans, especially if there are fare discounts available. She will have a collapsible cart with her for carrying bags.
Goal	The goal of this use case is to illustrate the needs of veterans and low-income riders when assessing service options.
Constraints	• This user is low-income and needs to know fare information in advance to know if they will be able to have funds available for their trip, as well as what payment media will be required for the lowest cost service. • This user will have a cart with them and needs to know that they will be able to bring their cart onto the vehicle
Related User Needs	RID-01 - Discover DR RID-02 - Various trips RID-03 - Eligibility process RID-13 - App guidance RID-14 - Cost of service RID-14-1 - Standard payment media RID-14-2 - Cost for party RID-15 - Customer service RID-18-2 - Station patrol RID-19 - Device accessible RID-19-1 - Space for mobility device RID-19-3 - Loading mobility device RID-22 - Veteran info RID-27 - Confidence in info RID-31 - Adjust preferences RID-37 - Various options RID-38 - Expect crowding RID-39 - Aware of apps OP-02 - Booking through rider apps OP-03 - Tech sophistication not required OP-07 - Integrated fare payment MUL-01 - See full network MUL-03 - Contact information

	Scenario 6: A rider who is a veteran and currently on a low fixed-income is researching transit in her area to see what options are available for her to go to the VA Hospital in a nearby urban center in the most efficient and economical way possible.
Related Draft PMs	PM 0.4

Table 7. Scenario 7: An older rider who has a hearing disability is taking a long bus ride but realizes they need to alight early to find a restroom.

	Scenario 7: An older rider who has a hearing disability is taking a long bus ride but realizes they need to alight early to find a restroom.
Short Description	In this use case, the user is a person with a hearing disability who is on a long fixed-route bus ride. They realize they need to alight early to find a restroom, and must figure out if/where a restroom is available and communicate to the driver that they need to get off the bus.
Goal	The goal of this use case is to illustrate that riders need to be able to give and receive information in a variety of ways, and that riders need to understand their surroundings at every point in a trip.
Constraints	• This rider has a hearing disability and will need to give and receive information that does not rely on speaking or audio
Related User Needs	RID-16-1 - Communicate without voice RID-18-3 - Stops along route RID-18-5 - Restroom locations RID-19 - Device accessible RID-20 - Diversity of interfaces RID-20-3 - Visual or text RID-23 - Present location RID-25 - Safety feature hours RID-26 - Know about TTD RID-32 - Exact stop locations
Related Draft PMs	While this operational scenario will be impacted by the project, successful fulfillment of this operational scenario is not directly measured by any of the final PMs.

Table 8. Scenario 8: A rider with limited English proficiency is navigating to the correct bus stop in a transit mall.

	Scenario 8: A rider with limited English proficiency is navigating to the correct bus stop in a transit mall.
Short Description	In this use case, the user who is a recent refugee who has been granted asylum prepared for their trip beforehand and has just arrived at a transit mall. There are a variety of places to wait for a variety of transit lines and they need to find the correct one for their trip.
Goal	The goal of this use case is to illustrate that transit signage needs to be clear, transit stops need to be marked so that riders of all abilities and level of English proficiency can navigate effectively, and this information needs to be integrated into transit apps in order for users to understand the signage fully.
Constraints	1. A significant constraint in this use case is that the user is physically at the transit mall and needing to find their stop. The user did some research beforehand, but is now relying on signs physically at the transit mall. 2. Another constraint is that the user has a limited English proficiency so signs need to be designed in a way that is universally understandable 3. The user's recent immigration and trauma has led them to be wary about communicating or asking questions of people, especially uniformed staff members of the station.
Related User Needs	RID-19-2 - Pathways in advance RID-20 - Diversity of interfaces RID-20-1 - Preferred language RID-20-2 - Plain language RID-28 - Limit words RID-29 - Info before arrival RID-32 - Exact stop locations RID-33 - Confirm vehicle RID-40 - Schedule changes RID-45 - Communicate without text
Related Draft PMs	PM 0.12

Table 9. Scenario 9: A rider in a rural area without consistent internet needs to book a trip into the closest urban area for a shopping trip.

	Scenario 9: A rider in a rural area without consistent internet needs to book a trip into the closest urban area for a shopping trip.
Short Description	In this use case, the user wants to book a trip to an urban location to run errands but cannot access apps or websites that require fast or consistent internet connections. The user has a mobile device that can access internet when connected to wireless, but does not have access using data. They are able to send and receive calls and text messages.
Goal	The goal of this use case is to illustrate that not all riders have consistent access to the internet, and that riders need to be able to book trips and access information in ways that do not depend on fast or consistent internet access.
Constraints	• A significant constraint in this use case is that the user does not have consistent internet access. They will need to be able to research, book, and access their trip with limited or no internet use.
Related User Needs	RID-01 - Discover DR RID-01-4 - DR wait time RID-01-6 - DR origin and destination RID-01-7 - Book quickly RID-13 - App guidance RID-15 - Customer service RID-17 - No internet RID-17-1 - Real-time through SMS RID-17-2 - Limited internet RID-19 - Device accessible RID-19-1 - Space for mobility device RID-19-3 - Loading mobility device RID-27 - Confidence in info RID-31 - Adjust preferences RID-36 - Way back home RID-40 - Schedule changes OP-03 - Tech sophistication not required OP-04 - Phone reservations MUL-03 - Contact information
Related Draft PMs	PM 0.6

Table 10. Scenario 10: A rider who is a victim of stalking is planning a trip home from work at night using transit and their bike.

	Scenario 10: A rider who is a victim of stalking is planning a trip home from work at night using transit and their bike.
Short Description	In this use case, the user is a victim of stalking and has significant safety concerns. They are planning a trip home from their workplace at night and evaluating which options are the safest for them. They have their bike with them and are looking at all options available that use transit and their bike.
Goal	The goal of this use case is to illustrate rider safety concerns and interest in multimodal trips. Riders need to be presented with information about safety amenities and options for their trip so that they can make informed choices that work best for them.
Constraints	• This user is traveling with a bike, so they will need to confirm that they are able to bring their bike on any vehicle they are taking or can safely store their bike before boarding. • This user has personal constraints around safety that may impact locations where they do or do not feel comfortable as well as wanting to know if there will be lights, other people around, or other safety amenities.
Related User Needs	RID-01 - Discover DR RID-02 - Various trips RID-15 - Customer service RID-18 - Safety features RID-18-1 - Safety at waiting area RID-18-2 - Station patrol RID-18-3 - Stops along route RID-18-4 - Safety at intermediate points RID-19 - Device accessible RID-19-5 - Bikes on board RID-19-6 - Bikes on board real-time RID-19-8 - Bike parking RID-27 - Confidence in info RID-33 - Confirm vehicle RID-35 - Right stop RID-36 - Way back home RID-37 - Various options RID-38 - Expect crowding RID-39 - Aware of apps MUL-03 - Contact information
Related Draft PMs	PM 0.8 PM 0.13

Table 11. Scenario 11: A state DOT analyst is supporting a social service agency in identifying the transportation services available in a new operational region and their service parameters.

	Scenario 11: A state DOT analyst is supporting a social service agency in identifying the transportation services available in a new operational region and their service parameters.
Short Description	In this use case, a state DOT analyst is researching services available in an area and their eligibility requirements so that they can present that information to a local social service agency.
Goal	The goal of this use case is to illustrate how important it is for transit information to be easily accessible and what kinds of information a state analyst might need.
Constraints	• A constraint in this use case is that the analyst is only searching in one geographic area
Related User Needs	OP-01 - Integrated trip planning REG-03 - Review ridership REG-04 - Administrative contact MUL-01 - See full network MUL-03 - Contact information
Related Draft PMs	PM 0.9

Table 12. Scenario 12: A small demand response operator is transitioning to a new scheduling system.

	Scenario 12: A small demand response operator is transitioning to a new scheduling system.
Short Description	In this use case, small demand responsive transit operator of different types of general public and eligibility restricted service in a rural county is purchasing a new scheduling system to manage the scheduling of trips on their transit service.
Goal	The goal of this use case is to illustrate how procurement guidelines and state support will ease the process of vendor selection and software implementation, and result in improved technology access for riders without undue burden on transit operators.

	Scenario 12: A small demand response operator is transitioning to a new scheduling system.
Constraints	• A constraint of the use case is that the size of the operator means both the operator capacity for procurement and the number of vendors and level of vendor interest is relatively low, so an extensive and complicated procurement process to identify the right vendor is not feasible.
Related User Needs	OP-02 - Booking through rider apps OP-04 - Phone reservations OP-08 - Different types of trips OP-09 - Transfer trips OP-10 - Assess data quality OP-11 - Procure software REG-03 - Review ridership B2G-02 - Assess quality MUL-04 - Two-way exchange in booking MUL-06 - Alignment on needs
Related Draft PMs	While this operational scenario will be impacted by the project, successful fulfillment of this operational scenario is not directly measured by any of the final PMs.

Table 13. Scenario 13: A rider advocacy group is working with a specialized transportation provider to present an analysis to the DOT and legislature regarding the need for investment in underserved communities.

	Scenario 13: A rider advocacy group is working with a specialized transportation provider to present an analysis to the DOT and legislature regarding the need for investment in underserved communities.
Short Description	In this use case, a rider advocacy group that works with specialized transportation operators around a state is teaming with a particular operator to make the case that fixed route and demand responsive transit services must be expanded through additional state financial resources in order to provide a level of service adequate to rider needs and equitable with other regions.
Goal	The goal of this use case is to illustrate how the directory/analysis frontend can provide information regarding specialized transportation services, and used to present analyses on the accessibility of transit in a region.

	Scenario 13: A rider advocacy group is working with a specialized transportation provider to present an analysis to the DOT and legislature regarding the need for investment in underserved communities.
Constraints	• The capability of providing complete analyses of the transportation network in a region will depend on all transportation services being included within the directory, including services operated through contractors to a larger specialized operator. • Additionally, accessibility of a transportation network may depend on mapping information regarding curb cuts and other infrastructure not controlled by the transit agency.
Related User Needs	REG-02 - Anonymized DR trips REG-05 - Vehicle location auditing MUL-07 - Map data
Related Draft PMs	While this operational scenario will be impacted by the project, successful fulfillment of this operational scenario is not directly measured by any of the final PMs.

Table 14. Scenario 14: A vendor is calculating the potential return on investment from building a new software product for the transit market

	Scenario 14: A vendor is calculating the potential return on investment from building a new software product for the transit market
Short Description	In this use case, a software vendor is considering making an investment in a new software feature and wants to calculate the expected return on their investment possible by selling that feature to transportation services within a region.
Goal	The goal of this use case is to illustrate how vendors will be able to use the new directory/analysis interface to better plan for business expansion, and thereby provide services to transit agencies more efficiently.
Constraints	• This use case will be constrained by the presence of full and complete data for the three state region being available through the directory/analysis frontend.
Related User Needs	B2G-01 - Identify customers MUL-06 - Alignment on needs

Related Draft PMs	

3. Performance Measurements and Targets

The goal of this section is to identify the potential performance measures and describe the expected outcomes of deployment. Each performance measure is described in detail including the performance targets, data sources, and the rationale for choosing each performance target.

3.1. Identification of Potential Performance Measures and Targets

The project initially identified 13 performance measures to be developed into testable hypotheses and performance metrics. These performance measures were selected based on 30 initial potential performance questions derived from the operational scenarios in Section 2.2, considered by the project team, and reviewed along with a small group of project partners and stakeholders.

These performance measures overviewed in Table 15 and described below beginning in section 3.1.1 were later revised before being developed into the final performance measures to be used in the project. The process that further developed these performance questions into the final performance measures to be used in the project is described in Section 5.

The 17 performance questions which were eliminated to focus on the 13 in Table 15 are listed in Table 16. The initial list of 30 performance questions were drafted by the four members of the Performance Measurement task team, who included a team coordinator and three experts focused on different aspects of performance measurement: formal evaluation, small transit agency management, and underserved community representation. Subsequently, the three expert members of the team voted for up to 5 of the initial performance questions which should be developed into performance measurements, based on both the importance of those performance questions to the operational scenarios and feasibility of effectively measuring success.

Table 15. Draft PMs and Most Applicable Use Case/Scenario

Performance Measure	Derived from Operational Scenario	Impact Analysis Level	Performance Question
PM 0.1	1	System	Can riders find demand response transit and/or paratransit in commonly used trip

Performance Measure	Derived from Operational Scenario	Impact Analysis Level	Performance Question
			planning applications?
PM 0.2	2	Individual	Can riders, especially riders with mobility disabilities, know what pathways, barriers, and accessibility features they will encounter during their trip?
PM 0.3	5	System/Community	Can riders easily book paratransit services using an online application?
PM 0.4	6	System/Individual	Can riders easily discover which transit fare discounts they qualify for?
PM 0.5	5	Individual	Do new riders report having an easy process to identify transit services which are available to them?
PM 0.6	9	System/Community	Can riders without internet access research transit options?
PM 0.7	1	Individual	Can riders without internet access easily book demand responsive transit?
PM 0.8	10	Individual	Can riders easily identify multi-modal connections (drt-fixed; bike-transit) which help them

Performance Measure	Derived from Operational Scenario	Impact Analysis Level	Performance Question
			select the optimal trip for them?
PM 0.9	11	System	Can riders book trips through commonly used trip planners?
PM 0.10	5	System	Do riders from the identified disadvantaged groups use demand response transit discovery and booking tools as often as do riders from the general public?
PM 0.11	3	System	Can riders, especially riders with disabilities, easily access information about the physical amenities of transit station/stop?
PM 0.12	8	Individual	Is comprehensive information about transit services within a region efficiently available?
PM 0.13	10	Individual	Do agencies change their services to better match connecting services?

Table 16. Other Performance questions not developed into PMs

Derived from Operational Scenario	Performance Question
3	Can riders with vision disabilities easily know when a schedule has been changed/updated?
4	Can riders with vision disabilities identify the correct vehicle to board?
6	Can riders pay for discounted fare without having a special payment media?
6	Are riders able to find trips that better match the timing of medical appointments?
7	Can riders easily understand the features and amenities available to them at any point along their route?
8	Can riders with Limited English Proficiency easily navigate transit stations?
9	Are riders planning trips to and from areas less served by fixed-route transit?
7	Do riders with vision and hearing disabilities who use mobile applications understand exactly where they are along the route?
8	Can riders with Limited English Proficiency easily understand transit information?
10	Can riders easily access information on what equipment a transit vehicle can accommodate?
11	Is comprehensive information about transit services within a region easily discoverable?
12	Do procurement guidelines reduce the time to select a scheduling system vendor?
12	Do procurement guidelines reduce the time to implement a new scheduling system?
12	Do procurement guidelines result in better data?
12	Do procurement guidelines result in more complete data?

Derived from Operational Scenario	Performance Question
13 &14	Do state DOTs and other regulators or analysts reduce the time it takes to collect data?
11	Are there more interagency and intermodal transfers?

3.1.1. PM#0.1 Increase in number of transit agencies for which demand responsive transit and/or paratransit services appear in at least two open apps

Today there are no demand-response transit or paratransit services available in multiple open-data-based rider applications. Some agencies have specific services appearing within a proprietary app provided by their scheduling software vendor, and sometimes that proprietary app is based on open data or compatible with open data formats such as GTFS-flex. However, there are no agencies known that provide the ability to book riders through multiple applications.

Performance target: The project will increase the number of transit agencies providing access to booking through at least two open-data-based rider applications from the baseline (expected to be 0) to 50 across the related deployment site.

Data sources:

- Information derived from Directory/Analysis Frontend
- Testing of rider applications or reports from rider applications

Rationale for specific target: If there are at least **2** open data-based apps providing information for a service, then the replicability of the data transaction has been demonstrated. If there are at least **50** agencies participating, then it is likely that many other agencies could also participate and will be more likely to adopt this technology themselves.

3.1.2. PM#0.2 Increased rider satisfaction with regard to station and stop wayfinding as reported in rider surveys

Deployment of improved data better describing infrastructure and pathways around and within transit stops and stations should lead to a measurable increase in general rider satisfaction with wayfinding. Wayfinding satisfaction within the related deployment site will need to be baselined through initial surveys to be developed by the project and a revised performance objective defined at that time.

Performance target: The project will increase the satisfaction reported by riders with regard to stop and station wayfinding by **0.3** on a 5-point Likert scale, as reported within the related deployment site.

Data sources:

- Rider survey data prior to deployment
- Rider survey data post-deployment

Rationale for specific target: This performance objective may change based on the baseline determined during initial surveys. The current objective is an estimate assuming, based on the rider conversations leading to user needs, that many riders will report negative or neutral opinions on wayfinding. An increase over time of **0.3** will indicate that many riders have shifted to having a positive experience.

3.1.3. PM#0.3 More riders will use online or mobile booking tools for demand responsive transit and/or paratransit trips

Use of online or mobile tools for the booking of demand responsive transit or paratransit trips is relatively uncommon in rural areas. However, use of such tools relatively more widespread in urban settings. The increase in availability of booking demand responsive transit or paratransit services through open-data-based rider applications will result in a general increase in the number of trips booked through such tools, especially within rural settings.

Performance target: The project will increase the percentage of trips booked by riders on mobile booking tools for demand responsive or paratransit services by 100% from the current percentage of trips booked through those tools, or to a proportion of 10% of trips if no such rides are currently booked that way, within the related deployment site.

Data sources:

- Booking statistics from agency or vendor at the related deployment site for demand-responsive and paratransit services overall

Rationale for specific target: This performance measure is based on the assumption that making demand-responsive and paratransit trips available online and easier to book compared to the conventional telephone method will lead to an increased rate of use of online tools. The performance objective is designed to measure this increase. If the usage of these services does increase after increasing availability of booking through mobile applications, it will be possible to show that this assumption is correct and that providing such rider tools was useful to a significant number of riders.

3.1.4. PM#0.4 More trip planners will display accurate fare information, including possible discounts or eligibility restricted fares

Generally, open data-based trip planners describe the fare information that is included in GTFS, which includes full adult fare for the individual trip being planned. Enhancements to the GTFS model of fares will allow fare-capping, passes, and eligibility-restricted discounts to be displayed in apps. Trip planning application developers will have the option to display this information, as one has already agreed to do.

Performance target: The project will increase the number of proprietary or open-source trip planners displaying enhanced fare information from 0 to 2, and at least 1 of those trip planners will display eligibility restricted fares, within the related deployment site.

Data sources:

- Testing of rider applications or reports from rider applications

Rationale for specific target: By increasing the number of trip planners with complete fare information to 2 this performance measure will ensure that not only do riders have access to this information, but there is also demonstrated replicability of the use of fares data. Because eligibility-restricted fares require more complex development by rider applications, a single deployment of that information will be valuable as a proof of concept.

3.1.5. PM#0.5 Increased percentage of new riders, especially new riders from stakeholder groups, reporting satisfaction with the trip planning process

The collection of improvements and enhanced information being included within GTFS data sets should result in an improved overall experience for riders within the related deployment region who use open data-based rider applications. New riders, especially riders from target communities of this project, should report an increase in satisfaction with the trip planning experience within those applications.

Performance target: The project will increase the satisfaction reported by new riders with regard to trip planning by .2 on a 5-point Likert scale, or by .4 within stakeholder groups, as reported within the related deployment site.

Data sources:

- Rider survey data prior to deployment
- Rider survey data post-deployment

Rationale for specific target: This performance objective assumes that, based on the rider conversations leading to user needs, many riders will report negative or neutral opinions on the trip planning process prior to deployment. An increase of .2 overall or .4 within the targeted stakeholder groups will indicate that many riders who are the focus of this project have shifted to having a positive experience in the trip planning process.

3.1.6. PM#0.6 Increased satisfaction of demand responsive trip planning and booking for riders without internet access

The availability of a tool that provides transit information without access to the internet, such as the first-tier support desk accessed through SMS or by phone, should result in easier booking of demand responsive trips by riders across the related deployment site. Riders will have an improved experience when identifying the right service to book or will have an improved way to access booking services.

Performance target: The exact form of this performance objective cannot yet be specified because of the number of confounding factors and difficulty of pinpointing what should be increased or decreased. An increase in phone calls to the agency is not necessarily desirable but might represent a good trend if it indicates overall increased demand. A Likert scale could be used to track satisfaction among riders but may be difficult to baseline and also to improve. This is because riders without internet access might not perceive the move from phone calls to SMS as an improvement, even if it saves agencies time or enables booking through the support desk. Reduced agency time required to serve riders on the phone who lack internet access could be another metric to tie an objective to.

Data sources:

- To be determined

Rationale for specific target: The rationale will be determined once the performance objective has been identified.

3.1.7. PM#0.7 Equitable awareness of demand response trip planning and booking across different demographic groups

This project is expected to lead to a general increase in the availability of trip planning and booking technologies available for demand responsive services. As these technologies become available, riders from the specific underserved communities identified by this project should have similar awareness of the availability of these technologies as the general public.

Performance target: There are a number of confounding factors which will be discussed in the next section which make it difficult to identify how best to quantify this performance metric. Specifically, in some deployment areas, underserved populations may be more aware at present of demand response booking options for public transit, because those services may only be offered for ADA paratransit. This performance metric may need to be specified after defining the baseline within a particular deployment region.

Data sources:

- Rider survey data prior to deployment
- Rider survey data post-deployment

Rationale for specific target: The rationale will be determined once the performance objective has been identified.

3.1.8. PM#0.8 Increased percentage of riders, especially riders from underserved groups, reporting success at identifying desired stop features and amenities

The display of stop features and amenities within rider applications should allow riders within the region who use those applications to identify the transit stops which will support them in experiencing safety and comfort throughout their trip. Riders, especially riders from underserved

communities, should report an increased success rate in identifying desired stop features and amenities.

Performance target: The project will increase the satisfaction reported by riders with regard to identifying stop amenities by .2 on a 5-point Likert scale, or by .4 within stakeholder groups, as reported within the related deployment site.

Data sources:

- Rider survey data prior to deployment
- Rider survey data post-deployment

Rationale for specific target: This performance objective assumes that, based on the rider conversations leading to user needs, many riders will report negative or neutral opinions on their ability to identify a safe stop prior to deployment. An increase of .2 overall or .4 within the targeted stakeholder groups will indicate that many riders that are the focus of this project have shifted to having a positive experience in the process of identifying stops with desired features and amenities.

3.1.9. PM#0.9 Increase in number of transit agencies for which complete GTFS data including all project-sponsored extensions is published on an open directory

No agency currently publishes every type of GTFS data identified by this project for investment, and the publication of that data on an open directory where it can be retrieved by any user will be a clear positive outcome of the project. A developing standard process exists for assessing the completeness and quality of GTFS data, which can be used to automatically assess the number of agencies successfully publishing GTFS according to the standards identified by the project.

Performance target: The project will increase the number of transit agencies publishing complete GTFS from the baseline (believed to be 0) to 80% of the total agencies across the related deployment site.

Data sources:

- Information derived from Directory/Analysis Frontend

Rationale for specific target: This project should lead to the compliance of most transit agencies with the data publication guidelines in order to be considered successful. There may be a significant number of edge cases where some small portion of data features cannot be published, but the clear majority of all agencies identified should follow the data guidelines and have that data published through the Directory/Analysis Frontend.

3.1.10. PM#0.10 Increase in connectivity between fixed route and demand response

The performance measure is based on the hypothesis that by improving the availability of multi-modal trip planning that includes demand-responsive transit, more riders will use trip planning

tools to plan multi-modal trips. Increasing connectivity between demand-responsive transit and fixed-route transit will increase availability of both types of transit, thus allowing riders to access more options that cover a wider network in a larger area.

Performance target: The project will increase the % of origins or destinations of demand response trips that service key fixed route transfer locations by 10% from the baseline

Data sources:

- Booking statistics from agency or vendor at the related deployment site 3 for demand-responsive services

Rationale for specific target: This performance objective is based on the hypothesis that if a demand-responsive trip has either an origin or destination entered that is near a fixed-route transfer location, that some of those origins or destinations are servicing rides for people who are transferring to or from the fixed route vehicles. An increase of 10% from the baseline would indicate that more riders are using trip planning tools to plan multi-modal trips.

3.1.11. PM#0.11 Increase in apps or other services providing notifications to riders about exactly when to disembark

Automated notification to disembark is an app feature that exists in a few, but not a majority of, transit applications. This feature tracks the rider's progress along their route in real time, and as the rider approaches their stop the app gives them a notification that they are approaching and have arrived at their stop. This means that riders can disembark at the correct stop without needing to know about their surroundings, enabling riders to reach the correct destination even if they have a vision disability, they are unfamiliar with the area, they are not seated near a window, or it's nighttime and there's limited visibility.

Performance target: The project will increase the number of known rider applications or other automated services providing notifications of approaching destination from 2 (Google Maps and Transit app) to 8.

Data sources:

- Testing of rider applications or reports from rider applications

Rationale for specific target: This specific objective is based on an approximation of the baseline number of apps offering this feature, which will need to be established specifically in the early stages of data collection. The objective also mentions "other automated services," to include possibilities like text messaging to accomplish this goal for riders without consistent internet access. Regardless of the baseline, showing considerable increase in the number of apps or other services offering this feature would indicate that substantially more riders have access to this type of real time information and assistance with their trips.

3.1.12. PM#0.12 Increase in rider satisfaction with trip planning information among riders with Limited English Proficiency

Riders should be able to reliably and safely access transit regardless of their English-proficiency levels. Baseline data should be collected from non-English speakers and those with limited ability to read English (even native English speakers) about their ability to read signage and trip planning resources. Improvements to access and data related to transit trip planning will not positively impact this target community if they cannot understand the information being provided.

Performance target: The project will increase the satisfaction reported by riders with limited English proficiency with regard to stop and station wayfinding and use of trip planning resources by **0.2** on a 5 point Likert scale, as reported within the related deployment site.

Data sources:

- Rider survey data prior to deployment
- Rider survey data post-deployment

Rationale for specific target: This performance objective assumes that, based on the rider conversations leading to user needs, many riders with limited English proficiency will report negative or neutral opinions on their ability to navigate transit when doing so relies on being able to read and speak English, An increase of .2 overall or .4 within the targeted stakeholder groups will indicate that many riders that are the focus of this project have shifted to having a positive experience in the process of identifying stops with desired features and amenities.

3.1.13. PM#0.13 Increase in rider satisfaction with multi-modal options

Many transit users report a need for multiple modes of transportation to complete their trip. Often, an inability to make multi-modal connections can present barriers for those who want to use public transit. An inability to easily plan trips that require multiple modes can make a trip impossible or infeasible because of timing implications of transfers between modes--or inability to determine timing. Knowing what transportation modes and transfers between modes are available as their options will enable riders to plan more efficient trips and ultimately increase their transit use.

Performance target: The project will increase the satisfaction reported by riders with regard to the use of trip planning resources and an ability to complete trips using multiple modes by **0.2** on a 5-point Likert scale, as reported within the related deployment site.

Data sources:

- Rider survey data prior to deployment
- Rider survey data post-deployment

Rationale for specific target: This performance objective assumes that, based on the rider conversations leading to user needs, many who rely on multiple modes of transportation to complete trips report negative or neutral opinions on their ability to navigate transit when doing so necessitates multiple modes. An increase of .2 overall or .4 within the targeted stakeholder groups will indicate that many riders that are the focus of this project have shifted to having a positive experience in the process of identifying connections between transportation modes.

3.2. Relationship between Performance Measures and Technologies/Services/Components

The initial performance measures primarily relate to four data sources: one component of the system, and also data available through three types sources that are not part of the system proposed in the ConOps.

- Data APIs and Directory/Analysis Frontend: this system component ingests and makes available GTFS data published by agencies within the three-state region.
- Rider surveys: surveys questions could be asked of riders by either agencies or vendors, or by the project itself, through a rider application or through another custom process.
- Agency partnerships: data owned by an agency could be retrieved through a partnership with the agency.
- Vendor partnerships: data owned by a vendor could be retrieved through a partnership with the vendor.

Table 17. PMs to Technologies/Services/Components

Performance Measure	***Data APIs and Directory/Analysis Frontend***	***Rider survey***	***Agency partnerships***	***Vendor partnerships***
PM 0.1	*X*			*X*
PM 0.2		*X*		
PM 0.3			*X*	*X*
PM 0.4	*X*		*X*	*X*
PM 0.5		*X*		
PM 0.6				
PM 0.7		*X*		
PM 0.8		*X*		
PM 0.9	*X*			
PM 0.10			*X*	*X*
PM 0.11				*X*

PM 0.12		*X*		
PM 0.13		*X*		

3.3. Potential Constraints

The primary constraints on measuring performance are budgetary. In order to focus project resources on the development of the system, while measuring performance related to the operational scenarios defined in Section 2.2, it will be important to select a small number of highly-relevant performance measures, at least some of which can be tracked with minimal added labor or expense.

Rider surveys will be important to ensure that the end users of the data promoted by the system are in fact well served, but should be streamlined, accessible to all respondents, and use simple questions to ensure that statistically relevant results can be attained without difficulty. Published measures should be easy to describe and understand, so that few resources are required to create understandable and impactful performance reports.

A major potential constraint on the system and performance measures will be the willingness of transit agencies to participate. Transit agency staff are often overburdened with administrative responsibilities, and additional responsibilities may not be adhered to. Additionally, for some agencies, demand-responsive services in particular are not the focus of marketing efforts because they are relatively expensive to operate on a per trip basis. This means that in some cases, promoting demand-responsive transportation may be undesirable. These concerns may be barriers to the collection of performance reporting data from agency partnerships. This concern will be addressed by an outreach approach to be described in the Outreach Plan which centers on the ease of adoption of data guidelines and the usefulness to riders high quality data consistent across the region.

4. Confounding Factors and Mitigation Approaches

This section first describes the identified confounding factors related to proposed performance measures, then identifies the mitigation or minimization approaches required to manage those confounding factors.

4.1. Confounding Factors

Below are each of the identified confounding factors with a description of the factors and performance measures to which they relate.

4.1.1. Confounding Factor #1: Agencies adopt open-data-based apps and data extensions through efforts unrelated to the project

Many of the performance measures proposed rely on encouraging agencies to adopt new technologies, based on the hypothesis that easier access to better transit technology will improve transit for riders. However, agencies may choose to adopt new technologies for reasons that are unrelated to the efforts of this project. If this occurs, especially if it occurs at a high rate, the post-deployment data collected could show the results of improved technology, implying that the project was successful, when in reality the success was due to factors completely outside of the project.

This confounding factor is most likely to impact performance measures 0.1, 0.4, 0.9, and 0.11.

4.1.2. Confounding Factor #2: Agencies adopt open-data-based apps through data standards unrelated to the project

Similar to confounding factor #1, it is possible that agencies will choose to adopt new open-data-based apps for reasons that are unrelated to the efforts of this project. If this occurs, especially if it occurs at a high rate, the post-deployment data collected could imply that the project was successful when in reality the success was due to factors completely outside of the project.

This confounding factor is most likely to impact performance measures 0.1, 0.4, and 0.11.

4.1.3. Confounding Factor #3: Agency consolidation or new transit agencies

Several PMs involve measuring a change in how many transit agencies have adopted a certain technology or practice. A confounding factor is that the actual number of transit agencies could

increase or decrease at the same time, through either agency consolidation or creating of new agencies, making it difficult to track adoption of new technologies in a consistent manner. Both agency consolidation and new agencies do routinely happen but the change in the total number of agencies in the deployment region generally changes by less than 1% per year, meaning that it is unlikely that this confounding factor will affect performance measurement.

This confounding factor is most likely to impact performance measures 0.1 and 0.9.

4.1.4. Confounding Factor #4: Infrastructure improvements unrelated to the project

Similar to confounding factors #1 and #2, it is possible that agencies or local governments will choose make infrastructure improvements for reasons that are unrelated to the efforts of this project. If this occurs, especially if it occurs at a high rate, the post-deployment data collected could imply that the project was successful when in reality the success was due to factors completely outside of the project.

This confounding factor is most likely to impact performance measures 0.2, 0.8, 0.10, and 0.13.

4.1.5. Confounding Factor #5 System design changes unrelated to the project

Similar to confounding factors #1, #2, and #4 it is possible that agencies or local governments will implement system design changes for reasons that are unrelated to the efforts of this project. If this occurs, especially if it occurs at a high rate, the post-deployment data collected could imply that the project was successful, when in reality the success was due to factors completely outside of the project.

This confounding factor is most likely to impact performance measures 0.2, 0.5, 0.8, 0.10 and 0.13.

4.1.6. Confounding Factor #6: Increased or decreased demand response transit service or awareness of service (absolute or vs fixed route service)

This project is based on the hypothesis that increasing the ease of accessing transit technology will encourage more riders to use public transit options. However, riders could start using demand-responsive services because there is an increase in demand-responsive services offered and/or increase in rider awareness of these services. This would show an increase in riders accessing these services without that increase being related to improved technology or the efforts of this project.

This confounding factor is most likely to impact performance measures 0.3, 0.7, 0.10, and 0.13.

4.1.7. Confounding Factor #7: Subjectivity of answers provided and change in survey participants

Several of the proposed PMs will rely on a rider survey given before and after deployment. The survey responses will be based on the subjective experiences of the rider taking the survey, meaning that the results will be specific to the person instead of presenting an objective measurement. Additionally, the group of riders taking the survey pre-deployment will not perfectly match the group of riders taking the survey post-deployment, adding to the variation in experiences and responses.

This confounding factor is most likely to impact performance measures 0.2, 0.5, 0.6, 0.8, 0.12, and 0.13.

4.1.8. Confounding Factor #8: Increased technology savviness of riders

This project is based on the hypothesis that increasing the ease of accessing transit technology will encourage more riders to use public transit options. If riders become more tech-savvy, they may start accessing more technologies without any need for improvements to those technologies. This would make creating more accessible technology less important to increasing access to public transit.

This confounding factor is most likely to impact performance measures 0.3, 0.5, 0.6, 0.7, 0.8, and 0.13.

4.1.9. Confounding Factor #9: Interfaces measured by the project are confusing or poorly developed

The project assumes that the availability of new tools will yield an increase in the use of those tools However, if the tools developed by this project or by others who leverage open-data standards promoted by the project are of poor quality, then riders may not use new tools even though they are available.

This confounding factor is most likely to impact performance measures 0.3, and 0.11.

4.1.10. Other Confounding Factors not considered

Some confounding factors related to potential performance measures 0.3, 0.6, and 0.7 were not considered further, because they do not relate to one of the six performance measures identified for research in section 5. These confounding factors include

- Change in how many people regularly use online or mobile devices
- Degraded transit access for people without internet access as internet access becomes more common
- Change of internet access within Deployment Sites

4.2. Mitigation Approaches

This project will accept that other projects may impact certain PMs and contribute to the overall success of the project. This should be counted no differently than changes directly attributable to the project. This means that confounding factors #1 and #2 will be ignored. Additionally, confounding factor #8 actually describes an expected outcome the project – that riders will become more technologically savvy in part because they have better technology to use – and will be ignored as well.

Other confounding factors will be addressed by employing different strategies to mitigate their impact:

Table 18: Mitigation Approaches

Confounding Factor	Explanation
Confounding factor #1	The project will accept that other projects will contribute to this goal, and that if another project contributes to this performance metric that should be counted no differently than changes to this metric directly attributable to the project. This approach is in line with best practices of community-driven standards development, in which multiple organizations and projects are simultaneously working on adoption in overlapping and complementary efforts.
Confounding factor #2	Other data specifications proposals may arise during the course of or in response to this project and the standards which it promotes, and those specifications may be chosen by standards bodies as the best specifications to be used by the industry for the goals of this project and others. Adoption of any standard for the goals of this project would be considered a success from the perspective of project evaluation, as the purpose is to promote standardization not particular data specifications, so this factor can be ignored.
Confounding factor #3	This project will track the number of transit agencies during the course of deployment, and if this number changes significantly then the nature of the specific changes will be investigated. This confounding factor will not matter if the performance metric is surpassed significantly, but there may be some extreme cases when the effects of this confounding factor must be further considered.
Confounding factor #4	This project will track planned and recent infrastructure improvements during the course of deployment and investigate the nature of the specific changes in the event that the changes are significant. This confounding factor will not matter if the performance metric is surpassed significantly.
Confounding factor #5	This project track system planned and recent changes during the course of deployment and specific changes will be investigated to determine potential and degree of impacts, if any. In extreme cases, analysis of survey results may need to incorporate reported satisfaction with system changes to account for this factor.
Confounding factor #6	This confounding factor could actually be considered a related performance measure. Increased demand-responsive services and/or increased awareness of these services is expected unless other factors reduce awareness by some groups or reduce demand-responsive use (such as replacing some demand-responsive

	services with multi-modal connectivity). The project team will monitor planned changes within the deployment sites during the project. In the case that there is a significant change in the service, the rider satisfaction with this service should probably be analyzed and accounted for within survey data results interpretation, but the increase of service related to improved service satisfaction could also be considered a compounding success factor related to the project.
Confounding factor #7	This project will work to minimize the impact of this confounding factor through survey design and by using a consistent selection process for survey recipients to minimize fluctuation in the participant group.
Confounding factor #8	It is anticipated that an outcome of the project will be increased technology awareness and use by some riders and that this confounding factor can be ignored.
Confounding factor #9	While there is always a risk that user interfaces will not be effective at meeting user needs, this project will focus on the use of user design best practices and agile development in order to mitigate the risk that interfaces sponsored by the project are ineffective. In general, the project will leverage the interfaces developed by professional developers such as Google Maps and Transit App, which can be expected to meet design best practices and effectively meet rider needs.

5. System Deployment Impact Analysis Design

The CALACT ITS4US project should have a simple, easily tracked and communicated performance measurement approach that demonstrates that the system accomplishes the core outcomes regarding the standardization of data publication, that riders from underserved groups perceive a benefit from enhanced data standardization, and that riders' actions change based on those perceived benefits. To develop a set of performance measures fitting those criteria, it will be important to focus on a small number of performance measures which can be measured with confidence and clarity. This section will describe a specific experimental design approach to each performance metric defined above, which will be used to track progress towards the performance target.

5.1. Approach/Strategies for Focused Performance Analysis

Working from the list of 13 performance measurements considered in section 3, the project identified 7 performance metrics to be pursued across the 4 project deployment sites through the following process. These 7 final performance measures are identified below in Table 19, and reflect an evolved approach to the performance measurement of the project after the constraints, confounding factors, and deployment plans of the project were considered, as documented in the above sections.

A range of 6-10 final performance measures was identified as a reasonable number of performance measures to track credibly through the course of the deployment period, taking into account the expected limitations of project budget capacity, the complexity of the system and deployment approach, and granted the feasibility of individual measures to be tracked without extensive labor and development beyond that required for the system. At the same time, the project team agreed that the general impact of the system on all or nearly all of the Operational Scenarios identified in the ConOps should be considered within the project measurement approach. Thus the selection process included both a quantitative approach to identify the Operational Scenarios with the greatest breadth and depth of relationship to the operational scenarios and a qualitative approach to balance different project goals and evaluate the project from the System, Community, and Individual perspective.

First, each of the 13 performance measures was related to the 15 Operational Scenarios included in the ConOps. Each performance measure was rated as having no relation, a notable relationship, or an integral relationship with each individual Operational Scenario.

- No relation to one operational scenario: Success with regard to this performance measure would not necessarily reflect an improvement in the functioning of the operational scenario

- Notable relation to one operational scenario: Success with regard to this performance measure would likely reflect an improvement in the functioning of the operational scenario

- Integral relation to one operational scenario: Success with regard to this performance measure would almost certainly reflect an improvement in the functioning of the operational scenario

The ratings of each performance measure to each operational scenario was reviewed by the Performance Measurement task team. Each performance measure that had 4 or more notable or integral relationships with Operational Scenarios was identified as a high priority performance measure. Two Operational Scenarios with 3 relationships, where 2 of those relationships were integral, were identified as likely alternatives. The remaining performance measures did not relate to any operational scenarios for which where weren't at least 2 other relations with different performance measures, and this initial group of 8 performance measures were considered sufficient.

Through discussion with the Project Leadership Committee and Stakeholder Committee Chairpersons, consideration of the practical ability of the project to track the performance measures, and consideration of balancing measurement between the System, Community, and Individual levels of analysis, additional changes were made to the slate of proposed performance measures for the project. The qualitative investigation of the Performance Measurement task team reviewed key points including:

- Two operational scenarios were only affected by 2 notable relationships with performance measures, and no integral relationships. These were Operational Scenarios 8 and 10 relating to individuals with Limited English Proficiency and people without dependable internet access, respectively.

- One of the initially selected performance measures (0.7), related to promoting equitable awareness of trip planning among different demographic groups did not have a clear performance metric associated with it.

- Survey-based performance measurements must be used within deployment sites where there is a strong likelihood that a sufficient number and diversity of users will be present to allow for a credible analysis.

- The initial list of 8 performance measures had strong representation of System and Individual level analysis, but not Community level analysis.

- One of the proposed performance measures (0.8) overlapped with another performance measure (0.2) and provided operational scenario relationships that already existed with other performance measures.

Based on these considerations,

- Performance measures 0.7 and 0.8 were removed from the analysis

- Performance measures 0.2 and 0.5, which were based on rider surveys, were expanded to include 3 different metrics, related to the general population, people with disabilities,

and people using a device language other than English. This incorporated a notable relationship with Operational Scenario 8 into each of these performance measures.

- No change was made based upon concern regarding the relationship of Operational Scenario 10 to only 2 of the performance measures, with only notable relationships. This is considered a possible gap in the project slate of performance measures.
- The performance measures were identified as relating to at least one of the project deployment sites
    - Deployment Site 1: Three state wide region
    - Deployment Site 2: Urban “community transit” region (Puget Sound)
    - Deployment Site 3: Rural and small urban microtransit region (SW Oregon)
    - Deployment Site 4: Suburban multimodal station connection region (San Bernardino County)[2]

Table 19. Final performance measures overview

Initial PM ID	New PM ID	Performance Measure	Analysis Level	Site 1	Site 2	Site 3	Site 4
1	1.1	Increase in number of transit agencies for which demand responsive transit and/or paratransit services appear with a booking option in at least two open-data-based apps	System	X			
2	2.1 and 4.1	Increased rider satisfaction with regard to station and stop wayfinding as reported in rider surveys (among general public, riders with disabilities, riders with device language =/= English)	Individual/ Community		X		X
3	3.1	More riders will use online or mobile booking tools for demand	Individual			X	

[2] These 4 deployment sites have been tentatively selected, but there is not an official write up on them in a delivered report yet. This citation and the description can be updated to reference the report in which more details are provided when available.

Initial PM ID	New PM ID	Performance Measure	Analysis Level	Site 1	Site 2	Site 3	Site 4
		responsive transit and/or paratransit trips					
5	2.2 and 4.2	% of riders reporting satisfaction with the trip planning process (among general public, riders with disabilities, riders with device language =/= English)	Individual/ Community		X		X
9	1.2 and 1.3	Increase in number of transit agencies for which complete GTFS data including all project-sponsored extensions is published on an open directory	System	X			
10	3.2	Increase in origins and destinations of demand responsive trips near key fixed-route transfer locations	System			X	

5.2. Experimental Design

A full description of the experiments designed around the Performance Measures described listed in Table 19. Final performance measures overview.

5.2.1. Performance Measure #1.1

Table 20. Performance Measure #1.1

	Performance Measure #1.1: Increase in number of transit agencies for which demand responsive transit and/or paratransit services appear with a booking option in at least two open-data-based apps
Description	The project will increase the number of transit agencies providing access to booking through two open-data-based rider applications from the baseline to 50 across Deployment Area 1 (three-state region).
Data Needs	This performance measure will require information derived from Directory/Analysis Frontend and testing of rider applications or reports from rider applications to establish a baseline number of apps offering access to booking through two open-data-based rider applications prior to deployment and then again after deployment. • Count of agencies with GTFS-flex data from Directory/Analysis frontend: this data flow will be available through the Directory/Analysis Frontend APIs and will provide a proxy for the number of agencies which could be represented within open-data-based apps.

	Performance Measure #1.1: Increase in number of transit agencies for which demand responsive transit and/or paratransit services appear with a booking option in at least two open-data-based apps
	• Manual testing and count of agencies live within open-data-based apps: confirming that agencies which have their services represented in GTFS-flex data actually appear in open-data-based apps will require staff members of the project to test those apps and confirm agencies are included with booking options.
Experimental Design	This PM will be measured by establishing a baseline number of agencies in the Deployment Area offering booking through two open-data-based rider applications before deployment and then annually thereafter during and after deployment. This will show how much the number of agencies and apps offering this information increase through project activities.
Participants	Participants for this experiment are transit agencies within the three-state region. No recruitment of transit agency participants within this deployment site is necessary, because all agencies will be tracked as potential data publishers regardless of whether they produce GTFS-flex data.
Modeling/Tools	Time-series count of data elements, with first count halfway through Phase 2, and annual counts thereafter.
Hypothesis	It is expected that by requiring enhanced GTFS-flex data and providing support to agencies to publish that data will incentivize the development of rider applications which use that data, and that the number of agencies which use these tools will increase post-deployment.
Baseline Conditions	At present, there are no open data standards used within the three-state region for exchanging demand-response information with rider facing applications, to the knowledge of project partners. Thus, the baseline for this performance metric is 0.
Targets	If there are at least 2 open-data-based apps providing information for a service, then the replicability of the data transaction has been demonstrated. If there are at least 50 agencies participating, then it is likely that most other agencies could also participate. The second of these numbers is more subjective and fungible than the first. Thirty, 20, or even only 10 agencies participating might not be considered project failure, but fewer than 2 open-data-based apps using the GTFS-flex would constitute project failure.
Deployment Site	The purpose of this performance measure is to track the publication and use of data for the benefit of riders across the three-state region. Thus, deployment site 1 is the only appropriate deployment site in which to consider this performance measure.
Risks and Constraints	Some agencies may simply not wish to participate in digitization and data standardization. Rider applications may be hesitant to adopt demand-responsive booking on account of technical complexity and limited users in some markets.
Confounding Factors	This PM is at risk for being impacted by:

	Performance Measure #1.1: Increase in number of transit agencies for which demand responsive transit and/or paratransit services appear with a booking option in at least two open-data-based apps
	Confounding Factor #1 – that agencies adopt open-data-based apps and data extensions through efforts unrelated to the project. This would mean that while data would indicate that the project deployment was successful, the success would actually be due to outside efforts. While this is a possibility, this project is based on the belief that community partners, agencies, and vendors will be pursuing their own efforts concurrently with this project, and ultimately the goal is to increase the number of transit agencies providing access to booking through two open-data-based rider applications regardless of why the agencies choose to do so. Confounding Factor #2 – that agencies adopt open-data-based apps through data standards unrelated to the project. This would mean that while data would indicate that the project deployment was successful, the success would actually be due to outside efforts. This could be either acceptable or problematic, and actions would need to be taken in response to this factor arising regardless. If another standard is more successful than the specification adopted by this project, then this project should convert to that competing standard. If that were to happen, then while more directly attributable to that other effort, standardization meeting the needs of identified in the ConOps would be achieved and thus successful. However, if there are two competing specifications which remain after the project, that could cause confusion for the industry, thus it is important that this confounding factor be closely monitored. Confounding Factor #3 – that agencies may consolidate or new agencies may form. This may change the number of agencies present in the deployment site but will not likely be significant enough to warrant monitoring.
Summary of Impact on Operational Scenarios	This experiment relates to 4 operational scenarios defined in the ConOps. • Integral relationship with operational scenarios 1 and 12 • Notable relationship with operational scenarios 5 and 9 Operational scenario 1: Concerns a rider who uses a mobility device looking for a demand responsive service for the first time, which will be directly impacted by the presence of those services within rider applications. Operational scenario 5: Concerns a rider with a developmental disability booking a paratransit trip online, which will be impacted but only by the availability of paratransit services in open-data-based apps. Operational scenario 9: Concerns a rider in a rural area looking for a transit service into an urban center, which is reasonably likely to be a demand responsive service. Operational scenario 12: Concerns a demand responsive operator procuring a scheduling service, which will be considerably easier if a

	Performance Measure #1.1: Increase in number of transit agencies for which demand responsive transit and/or paratransit services appear with a booking option in at least two open-data-based apps
	desired feature (online booking) is standardized within the market of vendors.
Discussion and Possible Expansion of Performance Measure	The target of 50 agencies represented in 2 open data-based apps is designed to demonstrate that a market exists for interoperable demand-responsive trip planning. 2 apps using the same data standard would provide options to riders as well as demonstrate the viability of the technology for other commercial rider apps to enter the market. 50 agencies would be enough to show that different agency types and sizes are able to use the open data format. Because of the above, we have not complicated this performance measure with additional considerations regarding the distribution among agencies or specifications regarding the apps. However, it is possible that further specification of this performance measure would be required, and the details of this performance measure will be reviewed and finalized during the first year of phase 2 by the project team, according to the following considerations: • Should more apps be required, or should particular apps or apps of a certain market penetration be specified? For example, there could be the requirement that one of the two apps is available in more than 1000 cities (i.e., Google Maps or Apple Map), or 3 minor apps with less reach may better demonstrate the competitive market which is intended to be fostered. • Should a certain distribution of transit systems be required? For example, should a certain percentage of transit systems be in rural areas. • Should a certain level of functionality be included within the booking option. For example, must there be real-time booking, or must there be advanced booking, or must there be both?

5.2.2. Performance Measure #1.2

Table 21. Performance Measure #1.2

	Performance Measure #1.2: Increase in number of transit agencies for which complete GTFS data including all project-sponsored extensions is published on an open directory
Description	The project will increase the number of transit agencies publishing GTFS data including all project-sponsored extensions (appropriate to the agency) to an open directory of data from the baseline to 80% of all agencies across Deployment Site 1.
Data Needs	This performance measure will require information derived from the Directory/Analysis Frontend to establish a baseline number of agencies offering access to GTFS data including all project-sponsored extensions. • Count of agencies with GTFS data including all project sponsored extensions from Directory/Analysis frontend: this data flow will be available through the Directory/Analysis Frontend

	Performance Measure #1.2: Increase in number of transit agencies for which complete GTFS data including all project-sponsored extensions is published on an open directory
	APIs and will provide both a count of the number of agencies which exist in the Deployment Site, and a count of the agencies for which data including all project-sponsored extensions is available.
Experimental Design	This PM will be measured by establishing a baseline percentage of agencies in the Deployment Site offering GTFS data including all project-sponsored extensions. Tracking this metric will show an increase in the percentage of agencies publishing this data over time.
Participants	Participants for this experiment are transit agencies within the three-state region. No recruitment of transit agency participants within this deployment site is necessary, because all agencies will be tracked as potential data publishers regardless of whether they produce GTFS data including all project-sponsored extensions.
Modeling/Tools	Time-series count of data elements, with first count nine months into Phase 2, and quarterly counts thereafter.
Hypothesis	It is expected that helping each agency in the development of data covered by project-sponsored accessibility extensions and providing support for publishing that data with their own vendors through the publication of Data Guidelines will enable agencies to continue maintaining that data after the deployment of the system.
Baseline Conditions	At present, there are no known agencies publishing all project-sponsored GTFS extensions, to the knowledge of project partners. Thus, the baseline for this performance metric is 0.
Targets	100% publication of GTFS including all project-sponsored extensions is most likely not reasonable within the timeframe of the project, due to the limited technical capacity or disinterest of some transit agencies. However, the goal of the project is to ensure that accessible transit data is widely available to nearly all agencies and riders. An 80% target would suggest that in the industry has accepted the publication of all project-sponsored GTFS extensions as best practice, and that many software vendors are supporting the publication of this data. From that point the system can be expected to have demonstrated clear value to many agency and vendor stakeholders, and the project-sponsored extensions will likely continue to be published in the long-term. A lower percentage of data extension adoption would be a lesser degree of success, but not necessarily a failure. Even a large minority of agencies (e.g. 35%) could indicate the growing success of the project, depending on the adoption curve (e.g. adoption is increasing quickly near end of evaluation period).
Deployment Site	The purpose of this performance measure is to track the publication and use of data for the benefit of riders across the three-state region. Thus, Deployment Site 1 is the only appropriate deployment site in which to consider this performance measure.
Risks and Constraints	Some agencies may simply not wish to participate in digitization and data standardization
Confounding Factors	This PM is at risk for being impacted by: Confounding Factor #1 – that agencies adopt data extensions through efforts unrelated to the project. This would mean that while data would

	Performance Measure #1.2: Increase in number of transit agencies for which complete GTFS data including all project-sponsored extensions is published on an open directory
	indicate that the project deployment was successful, the success would actually be due to outside efforts. While this is a possibility, this project is based on the belief that community partners, agencies, and vendors will be pursuing their own efforts concurrently with this project, and ultimately the goal is to increase the number of transit agencies providing enhanced GTFS data regardless of why the agencies choose to do so. Confounding Factor #3 – that agencies may consolidate or new agencies may form. This may change the number of agencies present in the deployment site but will not likely be significant enough to warrant monitoring.
Summary of Impact on Operational Scenarios	This experiment has a notable relationship to all operational scenarios defined in the ConOps, with the exception of Operational Scenario 15. All operational scenarios relate to the publication of data, use of apps which leverage that data, etc. The consistent publication of data sponsored by this project and availability of that data through an open directory will be reasonably likely to support all operational scenarios, although not sufficient to ensure effective operations in any one of them.
Discussion and Possible Expansion of Performance Measure	This performance measure is not likely to be significantly adjusted during the course of Phase 2. 80% is understood to be a somewhat arbitrary threshold (75% or 85% would not necessarily be better or worse), and fine tuning of this number would not be valuable. However, this performance measure will be specified base on the progress of the project in promoting open data standards. During the course of Phase 2 and Phase 3, as specific extensions are adopted into the data and procurement guidelines, the definition of what qualifies as a data set that includes all project-sponsored extensions will be amended and incorporated into this performance measure.

5.2.3. Performance Measure #1.3

Table 22. Performance Measure #1.3

	Performance Measure #1.3: Quantified and increased GTFS data quality within the deployment region
Description	The project will increase the average quality of GTFS data published by transit agencies across Deployment Site 1.
Data Needs	This performance measure will require information derived from the Data APIs as well as a supplementary and partially manual data quality review process to establish a baseline average quality and distribution of quality for GTFS data sets within the deployment site..

	Performance Measure #1.3: Quantified and increased GTFS data quality within the deployment region

	• GTFS data quality on a per operator basis will be a quantitative figure defined from automated and manually collected components.
	  ○ GTFS validity – this is an automated score based on the use of an industry standard GTFS validator software which reviews for compliance with specification syntax
	  ○ GTFS completeness – this is an automated score based on the use of an industry standard GTFS validator software which reviews for the presence of fields useful to riders
	  ○ GTFS rider usefulness – this is a manually determined score based on a sampling of GTFS attributes reviewing those attributes for whether they are accurate and appropriate for rider needs
	  ○ GTFS publication accessibility – this is a manually determined score based on a review of GTFS endpoints available compared against best practices for publication.

Experimental Design	This PM will be measured by establishing a baseline average and distribution of quality across Deployment Site 1. Tracking of this metric overtime will show an increase in the average quality of GTFS data sets as well as a decrease in the variance of data quality.
Participants	Participants for this experiment are transit agencies within the three-state region. No recruitment of transit agency participants within this deployment site is necessary, because all agencies will be tracked as potential data publishers regardless of whether they produce GTFS data including all project-sponsored extensions.
Modeling/Tools	Time-series count of data elements, with first count twelve months into Phase 2, and annual counts thereafter.
Hypothesis	It is expected that helping each agency in the development of data covered by project-sponsored accessibility extensions and providing support for publishing that data with their own vendors through the publication of Data Guidelines will enable agencies to continue maintaining that data after the deployment of the system.
Baseline Conditions	The GTFS quality scoring process has not yet been fully specified, so the baseline cannot be determined until the first time-series count during Phase 2. The GTFS scoring approach will be based on the GTFS grading scheme being developed by MobilityData[3], but will be further developed to include the extensions promoted by and user research performed by this project.
Targets	A target will be established for this metric both for average data set quality as well as the distribution of quality among agencies, but those targets cannot be defined until the grading scheme has been designed and tested, and the baseline has been established.

[3] See https://github.com/MobilityData/gtfs-grading-scheme

	Performance Measure #1.3: Quantified and increased GTFS data quality within the deployment region
Deployment Site	The purpose of this performance measure is to track the publication and use of data for the benefit of riders across the three-state region. Thus, Deployment Site 1 is the only appropriate deployment site in which to consider this performance measure.
Risks and Constraints	Some agencies may simply not wish to participate in digitization and data standardization. The GTFS quality review approach requires a manual process which means that there will be a budgetary limit to the number of fields which can be reviewed.
Confounding Factors	This PM is at risk for being impacted by: Confounding Factor #1 – that agencies improve data quality through efforts unrelated to the project. This would mean that while data would indicate that the project deployment was successful, the success would actually be due to outside efforts. While this is a possibility, this project is based on the belief that community partners, agencies, and vendors will be pursuing their own efforts concurrently with this project, and ultimately the goal is to increase the number of transit agencies providing enhanced GTFS data regardless of why the agencies choose to do so. Confounding Factor #3 – that agencies may consolidate or new agencies may form. This may change the number of agencies present in the deployment site but will not likely be significant enough to warrant monitoring.
Summary of Impact on Operational Scenarios	This experiment has a notable relationship to all operational scenarios defined in the ConOps, with the exception of Operational Scenario 15. All operational scenarios relate to the publication of data, use of apps which leverage that data, etc. The consistent publication of data sponsored by this project and availability of that data through an open directory will be reasonably likely to support all operational scenarios, although not sufficient to ensure effective operations in any one of them.
Discussion and Possible Expansion of Performance Measure	This performance measure will be defined only within the course of Phase 2 of the project, due to a dependency on the further development of a standard GTFS grading scheme. The scoring methodology must be fully determined by nine months after the beginning of Phase 2 in order to meet the project timeline.

5.2.4. Performance Measure #2.1/4.1

Table 23. Performance Measure #2.1/4.1

	Performance Measure #2.1/4.1: Increased rider satisfaction with regard to station and stop wayfinding as reported in rider surveys (among general public, riders with disabilities, riders with device language is not English)
Description	The project will increase the satisfaction reported by riders across different demographic groups with regard to stop and station wayfinding by 0.3 on a 5-point Likert scale, without an increase in the variance of satisfaction, as reported within Deployment Sites 2 and 4.

Data Needs	This performance measure will require information derived from the rider surveys to be developed in coordination with agencies and vendors participating within the project Deployment Sites.
	• Performance measure question: the exact phrasing of the performance measure-related questions will be determined in collaboration with the survey designer and administrator prior to establishing the baseline and beginning data collection, but it will use a 5-point Likert scale and related to satisfaction with station and stop wayfinding from the perspective of the user.
	  ○ In order to reduce the subjectivity of data collected by riders, performance measure questions will be focused on discrete aspects of the wayfinding process. For example, performance questions will consider specifically:
	  ▪ Satisfaction with wayfinding on non-familiar routes
	  ▪ Satisfaction with the path to stop versus on-the-ground reality
	  ▪ Satisfaction with transfer path
	  ▪ Other specific performance components as identified during preparatory research
	• Demographic information: the survey results must include whether the respondent identifies as a person with a disability.
	• Device information: the survey result must capture whether the language on the user's device was set to a language other than English.

Experimental Design	This PM will be measured by establishing a baseline satisfaction with wayfinding among users within the Deployment site on a 5-point Likert scale. Subsequent surveys when analyzed will track the increase or decrease in satisfaction among participants. The baseline will include both an average satisfaction score as well as a distribution shape and variance of scores. Both the distribution shape and variance will be tracked during each time-series collection of data elements.
Participants	Participants for this experiment are riders within the specific regions of Deployment Sites 2 and 4, who use the specific application(s) through which the survey is performed. The rider applications available in each Deployment Site are different and which rider applications will participate in the survey will not be determined until the first half of Phase 2. It is expected that rider applications used will provide a significant user base such that participant recruitment can be automated and all response groups are sufficiently large to provide statistically valid results.

	Performance Measure #2.1/4.1: Increased rider satisfaction with regard to station and stop wayfinding as reported in rider surveys (among general public, riders with disabilities, riders with device language is not English)
Modeling/Tools	Time-series survey of data elements, with first survey halfway through Phase 2, and annual surveys thereafter.
Hypothesis	It is expected that the additional data provided through rider applications regarding wayfinding directions and stop amenities, as well as digital signage information on bus stops and at stations, will support increased satisfaction among riders regarding wayfinding within the Deployment site. Further, this increase will be at least as large among riders with disabilities and riders with Limited English Proficiency as among the general public, and the overall distribution of responses will not increase in variance.
Baseline Conditions	Baseline conditions will need to be established during deployment, through the same survey instrument as is used to collect further time series data elements during the deployment period.
Targets	It is clear that the exact target should be relative to the baseline, but unclear exactly what the target should be. A 0.3 increase would be far too conservative a target if the baseline were 1.0 and the survey question were framed specifically with regard to wayfinding at a particular location where substation digital signage investments have been made. However, it would be a possibly ambitious target if the question were more generally regarding wayfinding within the system and the baseline was 3.7. Thus the exact target must be determined during the first half of Phase 2 when the exact details of survey implementation are known. The target for the variance of satisfaction distribution will be equal to or lower than the baseline variance, thus cannot be precisely determined until the baseline is established.
Deployment Site	This performance measure must include the participation of riders within a single (or small number of) rider application interface(s) but must also provide a sufficiently large sample size to ensure statistically valid results throughout the deployment period. Deployment Sites 2 and 4 both provide regional and agency boundaries necessary for the former and the populous and diverse regions necessary for the latter.
Risks and Constraints	The most important constraint on a survey instrument of this type would be the ability to maintain a sufficiently large and diverse sample population of participants throughout the course of the study period. Deployment Sites 2 and 4 have been selected because they would be least affected by this constraint.
Confounding Factors	This PM is at risk for being impacted by: Confounding Factor #4 – that there are infrastructure or signage improvements unrelated to the project. Such improvements might be executed after system deployment and result in improved rider satisfaction with wayfinding unrelated to the project. This confounding factor will be mitigated through identifying specific investments which might impact rider satisfaction, and potentially account for those

	Performance Measure #2.1/4.1: Increased rider satisfaction with regard to station and stop wayfinding as reported in rider surveys (among general public, riders with disabilities, riders with device language is not English)
	improvements by an adaptation in survey methodology during the course of the project. Confounding Factor #5 – that there are system design changes unrelated to the project. Such changes might be executed after system deployment and result in improved rider satisfaction with wayfinding unrelated to the project. This confounding factor will be mitigated through identifying specific investments which might impact rider satisfaction, and potentially account for those improvements by an adaptation in survey methodology during the course of the project. Confounding Factor #7 – that the survey questions are too subjective or survey population changes so survey questions are interpreted differently. This factor could result in results that do not reflect a true increase in rider satisfaction with wayfinding. This factor will be minimized by careful definition of survey questions and a sufficiently large sample size to allow for statistically relevant results.
Summary of Impact on Operational Scenarios	This experiment has an integral relationship to 5 Operational Scenarios defined in the ConOps, 2, 3, 4, 7, and 8. Operational scenario 2: Concerns a rider who uses a mobility device planning a fixed route trip near their home. The identification of a safe stop to board, alight, and transfer at will support the effective fulfillment of this scenario. Operational scenario 3: Concerns a rider with a vision disability planning a trip from a train station. Providing this user with directions on pathways prior to boarding will support the success of this operational scenario. Operational scenario 4: Concerns a rider with a vision disability navigating to a particular vehicle on a busy street. The connection from a train platform to another transit vehicle including the wayfinding to the street could be considered a form of this operational scenario. Operational scenario 7: Concerns an older rider needing to find a stop near an available restroom while in the middle of the trip. An improvement in information regarding stop amenities will directly correlate to the success of this operational scenario. Operational scenario 8: Concerns a rider with Limited English Proficiency navigating to the proper bus stop in a busy transit mall. Improved station wayfinding satisfaction among user with a device language other than English will correspond to success in this operational scenario.
Discussion and Possible Expansion of Performance Measure	This performance measure will be more precisely defined during the course of Phase 2 of the project. The exact survey instrument and deployment and evaluation teams will collaborate to define the exact survey questions asked and the approach to distributing and collecting the survey. However, the survey methodology will not be substantially altered from this proposal, only refined, as it must be consistent throughout the deployment timeframe in order to gain valid results.

5.2.5. Performance Measure #2.2/4.2

Table 24. Performance Measure #2.2/4.2

	Performance Measure #2.2/4.2: % of riders reporting satisfaction with the trip planning process (among general public, riders with disabilities, riders with device language is not English)
Description	The project will increase the satisfaction reported by riders, across different demographic groups with regard to trip planning by 0.3 on a 5-point Likert scale, without an increase in the variance of satisfaction, as reported within Deployment Sites 2 and 4.

Data Needs	This performance measure will require information derived from the rider surveys to be developed in coordination with agencies and vendors participating within the project Deployment Sites.
	• Performance measure question: the exact phrasing of the performance measure-related question will be determined in collaboration with the survey designer and administrator prior to establishing the baseline and beginning data collection, but it will use a 5-point Likert scale and related to user satisfaction with the trip planning user experience within rider applications.
	  ○ In order to reduce the subjectivity of data collected by riders, performance measure questions will be focused on discrete aspects of the wayfinding process. For example, performance questions will consider specifically:
	  ▪ Satisfaction with multi-modality of options presented
	  ▪ Satisfaction with real-time data
	  ▪ Satisfaction with pre-trip overview
	  ▪ Satisfaction with accuracy of mobility accessibility information
	• Demographic information: the survey results must include whether the respondent identifies as a person with a disability.
	• Device information: the survey result must capture whether the language on the user's device was set to a language other than English.

Experimental Design	This PM will be measured by establishing a baseline satisfaction with trip planning among users within the Deployment site on a 5-point Likert scale. Subsequent surveys when analyzed will track the increase or decrease in satisfaction among participants. The baseline will include both an average satisfaction score as well as a distribution shape and variance of scores. Both the distribution shape and variance will be tracked during each time-series collection of data elements.
Participants	Participants for this experiment are riders within the specific regions of Deployment Sites 2 and 4, who use the specific application(s) through which the survey is performed. The rider applications available in each Deployment Site are different and which rider applications will participate in the survey will not be determined until the first half of Phase 2. It is expected that rider applications used will provide a significant user base

	Performance Measure #2.2/4.2: % of riders reporting satisfaction with the trip planning process (among general public, riders with disabilities, riders with device language is not English)
	such that participant recruitment can be automated and all response groups are sufficiently large to provide statistically valid results.
Modeling/Tools	Time-series survey of data elements, with first survey halfway through Phase 2, and annual surveys thereafter at the same time of year as previous surveys.
Hypothesis	It is expected that the additional data provided through rider applications will support increased satisfaction among riders regarding trip planning within the Deployment site. Further, this increase will be at least as large among riders with disabilities and riders with Limited English Proficiency as among the general public, and the overall distribution of responses will not increase in variance.
Baseline Conditions	Baseline conditions will need to be established before deployment, through the same survey instrument as is used to collect further time series data elements during the deployment period.
Targets	It is clear that the exact target should be relative to the baseline, but unclear exactly what the target should be, for similar reasons to those expressed regarding PM 2.1/4.1. Generally, the target of 0.3 is probably more dependable within this PM, because unlike wayfinding a single system change is not likely to very significantly affect rider satisfaction with trip planning. However, this target should be evaluated after the exact survey methodology is known and baseline is established. The target for the variance of satisfaction distribution will be equal to or lower than the baseline variance, thus cannot be precisely determined until the baseline is established.
Deployment Site	This performance measure must include the participation of riders within a single (or small number of) rider application interface(s) but must also provide a sufficiently large sample size to ensure statistically valid results throughout the deployment period. Deployment Sites 2 and 4 both provide regional and agency boundaries necessary for the former and the populous and diverse regions necessary for the latter.
Risks and Constraints	The most important constraint on a survey instrument of this type would be the ability to maintain a sufficiently large and diverse sample population of participants throughout the course of the study period. Deployment Sites 2 and 4 have been selected because they would be least affected by this constraint.
Confounding Factors	This PM is at risk for being impacted by Confounding Factor #4 – that there are infrastructure or signage improvements unrelated to the project. Such improvements might be executed after system deployment and result in improved rider satisfaction with trip planning unrelated to the project. This confounding factor will be mitigated through identifying specific investments which might impact rider satisfaction, and potentially account for those improvements by a adaptation in survey methodology during the course of the project.

	Performance Measure #2.2/4.2: % of riders reporting satisfaction with the trip planning process (among general public, riders with disabilities, riders with device language is not English)
	Confounding Factor #5 – that there are system design changes unrelated to the project. Such changes might be executed after system deployment and result in improved rider satisfaction with trip planning unrelated to the project. This confounding factor will be mitigated through identifying specific investments which might impact rider satisfaction, and potentially account for those improvements by an adaptation in survey methodology during the course of the project. Confounding Factor #7 – that the survey questions are too subjective or survey population changes so survey questions are interpreted differently. This factor could result in results that do not reflect a true increase in rider satisfaction with trip planning. This factor will be minimized by careful definition of survey questions and a sufficiently large sample size to allow for statistically relevant results.
Summary of Impact on Operational Scenarios	This experiment has a notable relationship all rider Operational Scenarios, and an integral relationship to Operational Scenario 8 Operational scenarios 1-7, 9,10: These operational scenarios involve riders with disabilities or general public riders with specific trip planning needs using rider applications to successfully complete their trips. An increase in rider satisfaction, especially among people with disabilities, would demonstrate that many of the riders in scenarios similar to these are able to use rider applications successfully. Operational scenario 8: Concerns a rider with Limited English Proficiency navigating to the proper bus stop in a busy transit mall. Improved station trip planning satisfaction among user with a device language other than English will correspond to success in this operational scenario.
Discussion and Possible Expansion of Performance Measure	This performance measure will be more precisely defined during the course of Phase 2 of the project. The deployment and evaluation teams will collaborate to define the exact survey questions asked and the approach to distributing and collecting the survey. However, the survey methodology will not be substantially altered from this proposal, only refined, as it must be consistent throughout the deployment timeframe in order to gain valid results.

5.2.6. Performance Measure #3.1

Table 25. Performance Measure #3.1

	Performance Measure #3.1: More riders will use online or mobile booking tools for demand responsive transit and/or paratransit trips
Description	The project will increase the percentage of trips booked by riders on online or mobile booking tools for demand responsive or paratransit services by 100%, or to a proportion of 10% of trips if no such rides are currently booked that way, within Deployment Site 3.
Data Needs	This performance measure will require information derived agency or vendor records within Deployment Site 3. • Count of trips booked through application: within the deployment site, some number of applications with a mobile or online interface will be used by riders to book demand responsive transit trips. For each application, either the vendor or the agency will need to provide accurate counts of number of trips booked through online and mobile interfaces. The agency will provide a total count of all demand-responsive trips booked during the period. These particular statistics are not sensitive or difficult to collect, and it is expected that it will be possible to collect these figures for every related application within the Deployment Site, and that particular data agreements can be made during the first half of Phase 2.
Experimental Design	This PM will be measured by establishing a baseline count of trips booked through online or mobile interfaces during a time period prior to system deployment, and then analyzing the change in the count of trips booked during the same time period (in terms of length and seasonality) after deployment.
Participants	Participants for this experiment include users of the mobile or online booking interfaces provided by agencies within the deployment site. However, participants will not have any information regarding their particular trips stored on behalf of this performance measurement and will not need to take any action other than booking their trip as intended.
Modeling/Tools	Time-series count of data elements over a monthly or 3-month period, beginning by halfway through Phase 2 and continuing for every such time period until the end of Phase 3.
Hypothesis	It is expected that providing access to online and mobile booking tools through rider trip planning applications will increase the use of those booking tools.
Baseline Conditions	Baseline conditions will need to be established during deployment, through the first count of trips booked through online or mobile interfaces.
Targets	The presence of trip booking within trip planning apps, if convenient for riders, should result in a major increase in trips booked through those interfaces. A doubling of use during the deployment period in the case that there is already some use of online or mobile trip booking would reflect such a change. Less than a 100% increase would be considered poor project performance unless baseline usage were very high, such as greater than 30% of all trips booked. Because Deployment Site 3 does have a mobile interface currently in use for trip booking, it should be possible to establish a baseline greater than 0 trips and identify a 100% increase target relative to that baseline. The target however must be officially adopted after the identification of the baseline.

	Performance Measure #3.1: More riders will use online or mobile booking tools for demand responsive transit and/or paratransit trips
Deployment Site	Deployment Site 3 is the appropriate place to test this experiment because it will include at least one demand responsive service that will be integrated into at least one rider trip planning application.
Risks and Constraints	Transit agency hesitancy towards launching demand responsive booking through trip planning applications may limit the speed of adoption and prevent successful use of those tools by riders.
Confounding Factors	This PM is at risk for being impacted by: Confounding Factor #6 – that there is an increase in demand responsive service or awareness in the Deployment Site. Confounding Factor #8 – that there is an increase in technology savviness among users in the Deployment Site. Both these confounding factors also correlate with goals of the project (awareness, technology use and savviness). Thus it is likely both factors can be ignored. However, an extreme increase in service (CF 6) would warrant an increase in the performance target as more usage would be required to demonstrate a significantly larger system.
Summary of Impact on Operational Scenarios	This experiment relates to 3 operational scenarios defined in the ConOps. • Integral relationship with operational scenarios 1 and 9 • Notable relationship with operational scenarios 5 Operational scenario 1: Concerns a rider who uses a mobility device looking for a demand responsive service for the first time, which will be directly impacted by the presence of those services within rider applications. Operational scenario 5: Concerns a rider with a developmental disability booking a paratransit trip online, which will be impacted but only by the availability of paratransit services in open-data-based apps. Operational scenario 9: Concerns a rider in a rural area looking for a transit service into an urban center, which is reasonably likely to be a demand responsive service.
Discussion and Possible Expansion of Performance Measure	This performance measure is conservatively defined, focusing on the major constraint identified above that the demand-responsive booking application will not be owned by the project and thus limited data may be available from the appropriate vendor. However, it is notable that this allows the development of a performance measurement approach which will be applicable to other deployment sites without extensive access to the data from their vendors. During the course of Phase 2, if more data related to this performance measure can be acquired from the software vendor, this performance measurement approach will be expanded to include additional metrics.

5.2.7. Performance Measure #3.2

Table 26. Performance Measure #3.2

	Performance Measure #3.2: Increase in origins and destinations of demand responsive trips near key fixed-route transfer locations
Description	The project will increase the % of origins or destinations of demand-response trips that service key fixed route transfer locations by 10% from the baseline.
Data Needs	This performance measure will require information derived agency or vendor records within Deployment Site 3. • Count of origins or destinations of demand responsive trips near key fixed-route transfer locations: within the deployment site, certain demand responsive scheduling applications will be capable of tracking the number of trips for which an origin or destination of the trip falls within a specified distance from key transfer locations, or the vendor or agency will be able to calculate this number based on data from the system. It will be required to define exactly what qualifies as near, and what qualifies as a key fixed-route transfer location, but these should be defined within the context of the deployment site in coordination with the agency and possibly also the vendor.
Experimental Design	This PM will be measured by establishing a baseline count of trip origins or destinations near a key fixed-route transfer location during a time period prior to system deployment, and then analyzing the change in the count of such trip origins and destinations during the same time period after deployment.
Participants	Participants for this experiment include users of the mobile or online booking interfaces provided by agencies within the deployment site. However, participants will not have any information regarding their particular trips stored on behalf of this performance measurement and will not need to take any action other than booking their trip as intended.
Modeling/Tools	Time-series count of data elements over a monthly or 3-month period, beginning by halfway through Phase 2 and continuing for every such time period until the end of Phase 3.
Hypothesis	It is expected that providing access to online and mobile booking tools through rider trip planning applications where they appear along with fixed route services will result in more users using fixed route and demand-response services together, and that this change will result in more demand-responsive trips beginning or ending near key fixed-route transfer locations.
Baseline Conditions	Baseline conditions will need to be established during deployment, through the first count of trip origins and destinations near key fixed-route transfer locations through online or mobile interfaces.
Targets	Many trips on demand-responsive services will continue to be used separately from fixed route service, however, there should be a statistically significant increase in trips which begin or end near a key fixed-route transfer location if the hypothesis is true. To the knowledge of project partners there are not many other examples of similar performance measures in published research projects, and setting the precise target is difficult. A 10% increase would be a significant increase

	Performance Measure #3.2: Increase in origins and destinations of demand responsive trips near key fixed-route transfer locations
	demonstrating an increase, but less is likely to indicate that riders did not change their behavior in the manner expected.
Deployment Site	Deployment Site 3 is the appropriate place to test this experiment because it will include at least one demand responsive service connected to fixed route service that will be integrated into at least one rider trip planning application.
Risks and Constraints	Transit agency hesitancy towards launching demand responsive booking through trip planning applications may limit the speed of adoption and prevent successful use of those tools by riders.
Confounding Factors	This PM is at risk for being impacted by: Confounding Factor #4 – that there are infrastructure or signage improvements unrelated to the project. Such improvements might be executed after system deployment and result in more connections with the key fixed route location unrelated to the project efforts. This confounding factor will be mitigated through identifying specific investments which might impact rider behavior, and potentially account for those improvements by a change in the performance target. Confounding Factor #5 – that there are system design changes unrelated to the project. Such changes might be executed after system deployment and result in more connections with the key fixed route location unrelated to the project efforts. This confounding factor will be mitigated through identifying specific investments which might impact rider behavior, and potentially account for those improvements by a change in the performance target. Confounding Factor #6 – that there is an increase in demand responsive service or awareness in the Deployment Site. This confounding factor would also correlate with goals of the project (awareness, technology use and savviness). An extreme increase in service would warrant an increase in the performance target as more usage would be required to demonstrate a significantly larger system.
Summary of Impact on Operational Scenarios	This experiment has a notable relationship with 4 operational scenarios: 1, 4, 6, and 9. Operational scenario 1: Concerns a rider who uses a mobility device looking for a demand responsive service for the first time, which will be directly impacted by the presence of those services within rider applications. Operational scenario 4: Concerns a rider with a vision disability transferring to a vehicle on a busy street, which would be a common experience when transferring from a fixed-route hub to a demand responsive trip. Operational scenario 6: Concerns a veteran seeking the most efficient and economical way to a VA hospital, and the presence of fixed route to

	Performance Measure #3.2: Increase in origins and destinations of demand responsive trips near key fixed-route transfer locations
	demand responsive connections would provide new trip options for the rider to consider which would sometimes be faster or cheaper than previous alternatives. Operational scenario 9: Concerns a rider in a rural area looking for a transit service into an urban center, which is reasonably likely to be a demand responsive service.
Discussion and Possible Expansion of Performance Measure	This performance measure is conservatively defined, focusing on the major constraint identified above that the demand-responsive booking application will not be owned by the project and thus limited data may be available from the appropriate vendor. However, it is notable that this allows the development of a performance measurement approach which will be applicable to other deployment sites without extensive access to the data from their vendors. During the course of Phase 2, if more data related to this performance measure can be acquired from the software vendor, this performance measurement approach will be expanded to include additional metrics.

6. Support to Independent Evaluation Effort

Over the course of Phase I, II and III of the program, CALACT will provide access to all drafts and final reports to the independent evaluator (IE) for review and possible comment. This will be accomplished in the normal course of submission of the documents to ITS JPO. Furthermore, the BAA states *"performance against baseline measurements and targets are anticipated to be routinely and publicly reported throughout Phase 3. Summaries/dashboards of performance to date covering key measures are anticipated to be required features in all Phase 3 deployment sites."* The IE anticipates using that information in the final Performance Results Assessment (which is a report the Volpe Center will prepare during Phase III of the deployment) as well. Occasionally, CALACT will provide additional information (such as data sources or availability of baseline data) or clarification at the request of the IE, in coordination with the site COR and ITS JPO.

In addition to providing access to site deliverables and performance measurements, the IE will conduct two sets of interviews, one during pre-deployment and one during post deployment. The IE anticipates that the site will identify individuals and provide contact information and possibly introductions. The IE will coordinate the logistics of the interviews. These interviews will be used to better understand the goals, experiences, and results for each of the deployment sites. At this point in time, the IE anticipates it will conduct interviews with 2-3 deployment managers. Sites will also identify key deployment partners (deployment agency staff, technology partners, universities, government or policymakers, or others). As of this writing, the IE plans on developing a questionnaire to send to 3-5 project stakeholders for each site. CALACT will collaborate with the IE to ensure all appropriate staff participate in interviews, and provide contact information to the IE for, or coordinate with, project stakeholders as needed.

Finally, in subsequent drafts of the document this section will serve as a repository of information regarding any agreements/decisions, documentation, and scheduling between CALACT and the IE, with coordination by the COR and ITS JPO.

7. Data Collection Plan

Based on the data needs identified in Section 5, this section discusses how data will be collected, processed, stored, and shared, including risk discussion to support the performance measures at a system and individual impact level.

7.1. Data Needed

The identified performance measures will require the data outlined in the table below.

Table 27. Data Needs and Sources

PM #	Data Collected	Data Source	Frequency
1.1	Number of transit agencies providing access to booking through two open-data-based rider applications	Data APIs and Directory/Analysis Frontend	Annual beginning halfway through Phase 2 and proceeding through Phase 3 with the last data count coming at the end of Phase 3
1.2	Percentage of transit agencies publishing enhanced GTFS data to Directory.	Data APIs and Directory/Analysis Frontend	Quarterly beginning nine months into Phase 2 and proceeding through Phase 3 with the last data count coming at the end of Phase 3
2.1 4.1	Satisfaction reported by riders with regard to the wayfinding experience	Rider surveys	Annual beginning halfway through Phase 2 and proceeding through Phase 3 with the last data count coming at the end of Phase 3
2.2 4.2	Satisfaction reported by riders with regard to the trip planning experience	Rider surveys	Annual beginning halfway through Phase 2 and proceeding through Phase 3 with the last data count coming at the end of Phase 3
3.1	Number of trips booked through	Agency or vendor partnerships	Quarterly or monthly beginning halfway through Phase 2 and proceeding through Phase 3 with the

PM #	Data Collected	Data Source	Frequency
	online or mobile applications		last data count coming at the end of Phase 3
3.2	Percentage of trips with origin or destination at key fixed-route transfer location	Agency or vendor partnerships	Quarterly or monthly beginning halfway through Phase 2 and proceeding through Phase 3 with the last data count coming at the end of Phase 3

7.2. Baseline Data Collection

All baseline data collection will proceed through and establish the same data collection processes to be used to collect time-series data during the course of the deployment.

Baseline rider satisfaction levels will be measured using a pre-deployment rider survey. This survey will ask riders to respond to statements using a 5-point Likert scale. The Likert scale asks riders to rate the accuracy of a statement using options like strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. This method will be used to establish baseline rider satisfaction for PMs 2.1/4.1 and 2.2/4.2.

Baseline data that is not related to rider opinion, such as the number of transit agencies providing access to booking through two open-data-based rider applications, will be established through testing of rider applications, reports from rider applications, booking statistics from agency or vendors, and the Directory/Analysis Frontend.

7.3. Deployment Data Collection

This section details the data collection processes for each type of data collected.

7.3.1. Data Collected Through Deployment System

PM 1.1 and PM 1.2 rely primarily on data collected through the deployment system. The following data will be collected within the deployment system:

- **Number of transit agencies publishing complete GTFS and GTFS-flex**: These data will be collected through a process that is specifically defined within low-level system design during Phase 2. The Data APIs will include endpoints to retrieve answers to queries such as “List all agencies”, “List all agencies with their GTFS data fetch locations” and “List all agencies providing GTFS data that complies this publishing standard”. Thus, the performance reporting team will be able to define a specific series of API requests that will provide exactly the information needed to retrieve most of the data required for PM 1.1 and all the data required for PM 1.2.

7.3.2. Data Collected Outside Deployment System

PM 3.1 and PM 3.2 rely on data collected outside the deployment system. PM 1.1 additionally requires some information from outside the deployment system. The following data will be collected from outside the deployment system:

- **Number of trips booked by riders on mobile booking tools for demand responsive or paratransit service**: These data will be collected from booking software applications which can easily track these counts. The data will be collected only in aggregate over the timeframe defined in section 5 of this report, which means that no PII will be collected for this purpose. The data may be collected through a partnership with an agency or a partnership with a vendor, depending on who owns the relevant data.

- **% of origins or destinations of demand response trips near key fixed route transfer locations**: These data will be collected from booking software applications which can reasonably easily track these counts. The data will be collected only in aggregate over the timeframe defined in section 5 of this report, which means that no PII will be collected for this purpose. There are details about the collection process which must be defined during the course of Phase 2 (definitions of “near” and “key fixed-route transfer locations”). The data may be collected through a partnership with an agency or a partnership with a vendor, depending on who owns the relevant data.

- **Number of transit agencies providing access to booking through two open-data-based rider applications**: These data may be collected through two means: informally through conversations with application developers, in order to identify which applications should be reviewed, and manually through the planning of trips within rider applications by staff members of the project, in order to confirm that those applications provide access to booking.

7.3.3. Data Collected Through Survey/Interview

PM 2.1/4.1 and PM 2.2/4.2 rely on data collected through rider surveys. The following data will be collected from outside the deployment system:

- **Satisfaction reported by riders with regard to stop and station wayfinding**: These data will be collected through an automated mobile or online collection form, using a 5-point Likert scale. Users of a rider application will be given the option to opt in, or if necessary participants may be recruited through stakeholder organizations. Survey response data will contain only the specific data points required for the purpose of performance measurement and will not contain any PII.

- **Satisfaction reported by riders with regard to the trip planning experience:** These data will be collected through an automated mobile or online collection form, using a 5-point Likert scale. Users of a rider application will be given the option to opt in, or if necessary, participants may be recruited through stakeholder organizations. Survey response data will contain only the specific data points required for the purpose of performance measurement and will not contain any PII.

- **Disability identity of respondent**: Respondents to the surveys containing either of the above questions will be asked whether they identify as a person with a disability and be given the option of not answering the question. This information will be included along with records of rider satisfaction described above but will not be linked to any PII.

- **Language setting on device used by respondent**: Respondents to the surveys containing either of the above questions will be informed through the survey privacy policy that the survey will track their device language. This information will be included along with records of rider satisfaction described above but will not be linked to any PII.

7.4. Cost Data

It is not certain at the time of report publication how cost data will be tracked and reported during the project. The proposed system is a system of governance that could (and would) be open to replication or open membership after deployment, but the unit cost metrics which would be desired and their magnitudes cannot yet be known.

In theory, the unit cost of joining the system for an agency after deployment in Phase 3 would be 0. All software would be available on the open market and would replace previous market software solutions. Applications replaced (scheduling applications and rider applications) would be substantively similar and require few different operational processes, at least for attaining some basic level of effectiveness. Many agencies are likely to, even unknowingly, join the system in this “free” manner.

However, the more relevant cost data that a reader of future reports published by the project would want to investigate would be the cost of maintaining higher quality data, and the cost of a State DOT to maintain a support program for agencies within their states. These are important cost data points that are likely to be investigated by the project evaluation team but cannot plausibly have a process for their collection designed prior to Phase 3. They require knowledge of numerous low-level system design decisions which will be made and changed through an agile process during the course of Phase 2. This section will be later updated to describe the developing methodology for the sharing of cost data.

7.5. Data Quality Check Approach

Where possible, this performance measurement framework leverages data for which there is a data quality check approach already applying to the data through normal operations. This is the case for all data collected through the deployment system, as confirming the fulfillment of low-level requirements (i.e., that an API endpoint provides the right data) will also cover the data quality process needed for the data collected through the system.

Surveys and other data collected outside of the system will need an additional data quality check approach, which because of the simplicity of these data will not need to be extensive. Because they rely on agency and vendor partners not yet specified, they should be defined with precision when the details of data collection are defined in the first half of Phase 2.

7.6. Data Sharing Framework

At this point in the development of the CALACT ITS4US project, there is no intention around keeping one or more datasets private in their entirety and not shared with the public. Data within the system used for performance reporting (such as through the Data APIs) is non-sensitive and should be published under an open-source license, such as CC-BY. No data defined in this report includes PII, and all could be published openly without restriction. However, subsets of particular

datasets could potentially contain Restricted data (see Table below for definition) in certain circumstances.

For example, some determinations about vendors have not been made, including vendors that will partner on the project on providing rider applications. Some of these vendors have systems (e.g., databases) that will provide usage statistics and the vendors may desire stricter access controls to the data, going so far as to desire the data be confidential and not available for public use. Still, datasets that represent rider-level usage statistics are not indented to contain any individual-level records.

While the project does not anticipate collecting or using PII such as full names or legal names, phone numbers, addresses, and/or email addresses, to operate one or more parts of the proposed system, there is some anticipation around the collection and use of geographic identifiers, such as IP address or nearest transit center or bus stop, demographic or health information, such as health-related conditions like physical or cognitive disabilities, and information on languages spoken (i.e., signaling LEP riders, one of the project's target populations) which could be used by data users to falsely assume characteristics about race/ethnicity or citizenship. While these demographic data elements would not be collected along with PII, *the combination of* IP address, primary language spoken, and other identifiers such as gender identity and disability could infer personal identity, *especially in areas with relatively small populations of transit users* (e.g., paratransit users). For these reasons, datasets with this type of user-level information, such as the rider surveys, may be classified as Restricted and be subject to additional rules and processes for accessing.

Table 28. Data Access Tier Information

Access Category	Definition	Impact
Tier 1: Public	Data is open to the public, with unrestricted access and unconstrained use.	No known impacts, risks, jeopardy, or adversity to individuals and/or organizations if disclosed or breached. No public laws, regulations, or contracts restrict access.
Tier 2: Restricted	Data are available for public use, but may be limited to specific types of users, under specific circumstances (e.g., for a given purpose), and/or may be redacted to facilitate access and use.	Impacts, risks, jeopardy, or adversity to individuals and/or organizations could be reasonably anticipated if data were released without redaction or sanitization. While no public laws or regulations restrict access, a contract, including consent procedures, could restrict use.
Tier 3: Confidential	Data are not available for public use.	Impacts, risks, jeopardy, or adversity to individuals and/or organizations are reasonably anticipated if data were released. Public laws, regulations, contracts, including consent procedures, restrict use. Data may be proprietary to the owner.

Data will be published and shared with the USDOT on the timeline described in Section 9.

8. Performance Reporting

Performance reporting will be conducted on the timeline detailed in Section 9. Throughout the data collection and analysis process, progress will be reported in the following ways:

- Public webinar on performance metrics presented in Fall 2021 (pre-deployment): This webinar will further clarify the final Performance Measurement plan and publicly present that plan for consideration and feedback.

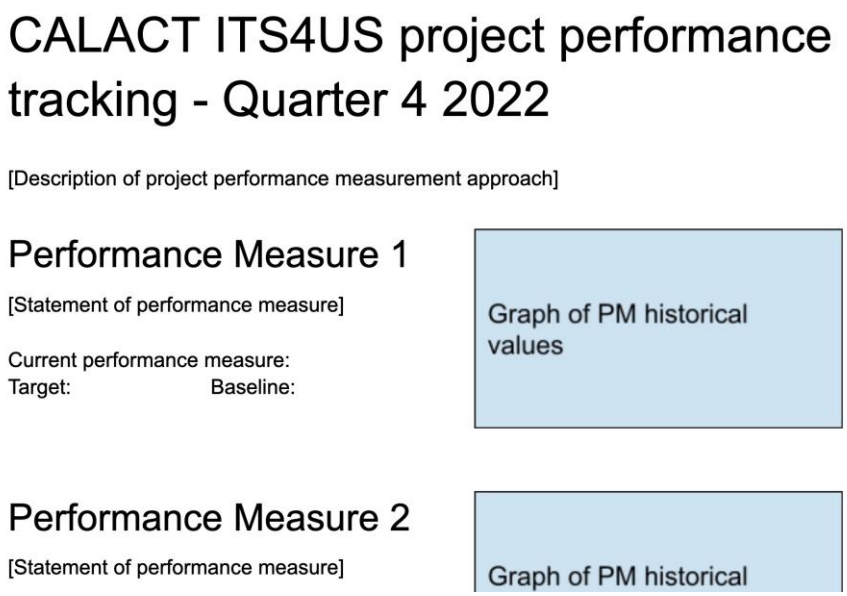
- Drafts of surveys or other materials intended for public distribution will be presented and reviewed by System Coordination Committee and stakeholders before deployment: some of the specific forms of data management and performance tracking have not been detailed in this report because they cannot yet be defined with certainty. These materials will be defined and reviewed by project leadership prior to finalization, including feedback from stakeholders as appropriate.

- All surveys, drafts, and gathered information will be available to all project partners within a shared drive. This will facilitate process transparency and allow project partners the ability to view documents and provide ongoing feedback.

- The project team will participate in IE activities and provide data to the IE as requested.

- Performance tracking reports will be published quarterly beginning in the fourth quarter of Phase 2 and include reporting information on all identified performance measures in each report. These reports will be released on the CALACT or another partners' website, in addition to through publication by USDOT. An example reporting format has been visualized below in Figure 1, but this format will be reviewed based on the final design of performance reporting approach defined during the first half of Phase 2.

Figure 1. Example Reporting Format for Project Leadership Committee Meetings



9. Performance Measurement and Evaluation Support Schedule

This section includes important dates related to the performance measurement plan.

Table 29. Timeline of Deliverables

Deliverable	Due date
Draft of public webinar on performance measurements	11/8/2021
Public webinar on performance measurements	11/15/2021
Draft of baseline rider survey	06/2022
Information derived from Directory/Analysis Frontend for baselining PMs 1.1 and 1.2	09/2022-12/2022
Information gathered from agencies and vendors for baselines on PMs 3.1 and 3.2	12/2022
Baseline data analysis period	07/2022-12/2022
First performance report published	12/2022
Baseline rider survey distribution and response collection period	01/2023-03/2024
Project deployment period	2022-2023, ongoing reporting and tracking per frequencies defined above
Draft of post-deployment rider survey(s)	12/2023
Project operations period	2024-2025, ongoing reporting and tracking per frequencies defined above

10. References

CALACT, Phase 1 Concept of Operations (ConOps)

CALACT, Phase 1 Data Management Plan (DMP)

Appendix A. Acronyms and Glossary

Accessibility – Accessibility is used in this document to indicate the ability all riders—especially people with disabilities, Limited English Proficiency, or who faces other barriers to access transit—to use transit and transit technologies in a way that best supports those users' individual experiences with transit. A service or technology may be "accessible" as defined by the ADA, but may also present "accessibility barriers" which this project seeks to help riders manage, in order to make the service or technology "more accessible".

ADA - Americans with Disabilities Act

API - Application Programming Interface

B2C - Business to consumer

B2G - Business to government

BAA - Broad Agency Announcement

CA - State of California

CA PATH - California Partners for Advanced Transit and Highways

CAD/AVL – Computer-Aided Dispatch/Automatic Vehicle Location

CALACT - California Association for Coordinated Transportation

Caltrans - California Department of Transportation

CCPA - California Consumer Protection Act

CDL - Concept Development Lead

ConOps - Concept of Operations

Deep link – a deep link is a link within a mobile application which directs the user to another mobile application, rather than to a website.

Demand-responsive transit – Transit services which provide trips at a location and/or time that is requested by a rider. Generally, any transit service that is not Fixed-route is considered a type of Demand-responsive transit for the purposes of this document, including general public DAR, ADA paratransit, and other transit models.

DOT - Department of Transportation

Fixed-route transit – Transit services that provide service to the general public through vehicles which stop at designated locations (stops and stations) at designated times.

GPS – Global Positioning System

GTFS - General Transit Feed Specification

IEEE - Institute of Electrical and Electronics Engineers

IRB - Institutional Review Board

NEMT – Non-Emergency Medical Transportation

NIST 800-53 - National Institute of Standards and Technology

PII – Personally Identifiable Information

PLC - Project Leadership Committee

PML - Project Management Lead

PMO - Project Management Organization

PMP - Project Management Plan

PMT - Project Management Team

ODOT - Oregon Department of Transportation

OR - State of Oregon

OS - Operating System

SCC - System Coordination Committee

SDL - System Development Lead

SEMP - Systems Engineering Management Plan

SyRS - System Requirements Specification Document

TBD - To Be Determined

TTS – Text-to-Speech

TNC - Transportation Network Company

UI - User Interface

WA - State of Washington

WBS - Work Breakdown Structure

WSDOT - Washington State Department of Transportation

WSTA - Washington State Transportation Association

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