Phase 1 Safety Management Plan (SMP)

California Association for Coordinated Transportation ITS4US Deployment Project

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Final Report – August 23, 2021
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COMPLETE TRIP
ITS4US

U.S. Department of Transportation

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16. Abstract

The CALACT ITS4US 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. This Safety Management Plan (SMP) for Phase 1 of the project encapsulates its consideration for the safety needs and risks in how travelers and others interact with the proposed system within California, Oregon, and Washington. The document lays out various safety scenarios detailing under what situations safety may be impacted, the severity of the risks related to those impacts, and what the project team plans to do to prevent and mitigate those impacts. While the "Concept of Operations" serves as the primary informative input for the Safety Management Plan, stakeholder engagement also informs how the project team assesses risk severity rankings and function as part of the feedback loop to ensure all safety concerns are addressed. The research and development that has gone into this project has been performed by a broad team of technology and transit experts in collaboration with stakeholders including transit operators and riders, and builds from the ongoing work of the community of rural and specialized transportation technology practitioners over the last decade. The SMP will be succeeded by additional plans which will further develop the proposal into a detailed system ready to be implemented.

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Revision History

Update the revision history table upon each update to the Safety Management Plan.

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Alex Kurzhanskiy, California PATH	23 July 2021	0.1	Initial Draft	Thomas Craig, CALACT
Weston Shippy, Trillium	26 July 2021	0.2	Draft Final	Thomas Craig, CALACT
Thomas Craig, CALACT	23 August 2021	1.0	Draft Final	Alex Kurzhanskiy, California PATH

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1. Introduction

The system this project proposes will fail if the safety concerns of all stakeholders impacted by the system (i.e., end users, developers, agencies, organizations, and other staff) are ignored and unplanned for. If the project's goal is to provide better access to transit for the target underserved populations, then the goal of the project must also be to ensure those populations can benefit from those changes without increased risk to safety. An unsafe component of a new system in fact creates a barrier to access, undermining the overall goal of the project. The Safety Management Plan encapsulates the project's consideration for the safety needs and risks in how travelers and others interact with the system. The document establishes strategies to minimize risks and respond to potential safety issues.

1.1. Document Overview

The purpose of the Safety Management Plan is to describe the impacts on safety this project may have to both users of the system and stakeholders adjacent to the system. The document lays out various safety scenarios detailing under what situations safety may be impacted, the severity of the risks related to those impacts, and what the project team plans to do to prevent and mitigate those impacts. While the "Concept of Operations" serves as the primary informative input for the Safety Management Plan, the stakeholder engagement through the interviews conducted as part of SMP development will also inform how the project team assesses risk severity rankings and function as part of the feedback loop to ensure all safety concerns are addressed.

The Safety Management Plan includes a description of project stakeholder engagement as it relates to safety (Section 2: Safety Overview and Relationships), scenarios based on the proposed system components and safety needs derived from those scenarios (Section 3: Safety Needs and Scenarios), safety risk assessment for the technologies deployed through the project (Section 4: Assessment of Safety Risk), and a proposed plan to reduce the likelihood and impact of the scenarios listed in Section 3 (Section 5: Safety Operational Concept). Lastly, this document outlines how the project team intends to manage safety concerns both once development is underway and beyond as the project enters the operation, evaluation and maintenance phase.

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. 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 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 OST, FHWA, and 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. 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 the 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. References

CALACT Phase 1 Concept of Operations (ConOps), FHWA-JPO- 21-858

2. Safety Overview and Relationships

2.1. Related Project Tasks

Readers can find each task document by visiting: https://its.dot.gov/its4us/htm/publications.htm

Task 1 – Project Management

Project management processes established in Task 1 will be used to coordinate the efforts surrounding Task 4 (Safety Management Plan, this document) and other project tasks (listed below). It is the responsibility of the SDL to steward those cross-team collaboration processes to ensure coordination.

Task 1B – User Needs Identification and Requirements Planning

Approaches laid out in Task 1B established important strategies that apply also to identifying safety needs.

Task 2 – Concept of Operations

Operational scenarios described in the "Concept of Operations" serve as an input to this task: Based on them, safety needs, scenarios and risks are investigated and discussed in this document. After the Safety Management Plan is finalized, additional user needs will be drafted to ensure that all safety needs are accounted for by the project.

Task 6 – Deployment System Requirements

Responses to safety risks that can be mitigated within the proposed system will generate the corresponding safety system requirements. After the development of additional user needs in the Concept of Operations based on the safety needs in this report, the System Requirements will define the manner in which those needs will be fulfilled by the system.

Task 7 – Enabling Technology Readiness Assessment

The safety system requirements must be reflected in the GTFS/GOFS specification, and the assessment of scheduling/CAD systems as well as trip planning software (see the proposed system diagram in Figure 1 of the "Concept of Operations) with respect to those requirements must be made.

Task 8 – Human Use Approval

The human use approval process will include testing of the responses to safety risks discussed in this document.

Task 9 – Participant Training and Stakeholder Education Plan

The training plan will include discussion on safety reporting and continuous safety planning described in this document.

Task 10 – Institutional, Partnership, and Financial Plan

The partnership plan will define the budget and scope of contracts as well as other agreements which will be necessary to implement the proposed system according to the deployment system requirements.

Task 13 – Integrated Complete Trip Deployment Plan

Deployment plan will address responses to safety risks and safety reporting described in this document.

Task 14 – Deployment Readiness Summary Briefing

Deployment readiness will address the extent, to which safety requirements can be fulfilled within the means of the proposed technology.

2.2. Safety Stakeholders

Safety stakeholders are listed in Table1 below. Additional safety stakeholders may be included as the project evolves, but based on the known safety risks of the project and supported by the safety risks identified in this report, the Safety Management plan needed thorough review by a small group of dedicated stakeholders representing diverse perspectives. For that reason, each of the project Stakeholder Committee Chairpersons (defined in CALACT ITS4US Project Management Plan), were included as reviewers of the safety risks and needs identified within this plan. Stakeholders such as DOT representatives/regulators, who do not participate in on-the-ground system deployment at transportation agencies, were not included, but transit agency stakeholders who interact with riders were. The CALACT System Development Lead was also included in the stakeholder review process to provide system context for how safety risks and needs identified by stakeholders would likely manifest during system operations.

As described in section 2.1, safety needs will be incorporated into the Task 6 report on system requirements, and be managed through the components of the proposed system based on the system requirements defined in the Task 6 report. As described in the Task 3 ConOps report, some system components will be governed by the individual state DOTs as opposed to the System Coordination Committee, and in this way the State DOTs will have a long-term relationship to safety management along with the CALACT ITS4US project management team. State DOTs will provide feedback on the manner in which safety needs are incorporated into system requirements.

Table 1. Safety Stakeholders List

Name	Organization	Expertise / Roles	Responsibilities
Hafsa Aden	Independent Consultant	Safe and Inviting transit	Committee chairperson
Darron Lewis	Independent Consultant	Low Income Riders	Committee chairperson
Kristen Joyner	KJ Backpack	Specialized transportation	Committee chairperson
Selena Kelly-Irvin	Independent Consultant	Rural and Tribal transit	Committee chairperson
Ron Brooks	Accessible Avenue	Disability and Access	Committee chairperson
Thomas Craig	CALACT	System Development Lead	Manages ITS4US project

2.3. Safety Risk Process and Approach

While the CALACT ITS4US project does not deal with vehicle deployment or infrastructure modification, it will affect user safety indirectly, as mistakes in trip planning may lead the user into uncomfortable or dangerous situations. We identify potential risks in accordance with operational scenarios listed in the “Concept of Operations” and categorize them by failure type:

- Equipment;

  Physical components/subcomponents of the system operated by an actor of the system, such as a bus or bus lift.

- Infrastructure;

  The physical, built environment with which and in which a user interacts with the system.

- Software application;

  Digital components/subcomponents of the system operated by an actor of the system, such as an API. Also applies to software a user operates to interact with the system, like a search engine.

- Other.

  Any component within the system that falls outside the previous categories.

Then, we rank those risks by **exposure** (how frequently they may occur), **severity** (how serious their impact could be) and **controllability** (to what extent could they be avoided or how effectively could they be mitigated). In this document, we list all major potential risks and separate those believed are unlikely to occur, have negligible impact, or cannot be helped. It is likely the project team and/or its stakeholders identify new risks later in the project lifecycle. Once these risks have undergone evaluation by the PMT, with input from the wider project team, the SDL will manage the addition of any risks to this document. Changes to existing risks, whether by removal or modification, will be managed the same way.

There will be no Safety Manager identified for the project at this time, although that decision is subject to review as circumstances change. Safety needs will be incorporated into the user needs listed in the Task 2 Concept of Operations, assigned to system requirements developed in Task 6, and then managed through the remainder of the project just like other requirements of the system. The Task 10 IPFP will detail the budget and scope of the agreements which will implement the proposed system fulfilling the system requirements.

Safety management in the CALACT ITS4US project will related only to the system being developed by the project, and not to other systems which interact with the project. As visualized in Figure 1 at the beginning of the next section, the proposed system impacts data standards which are used to exchange information between scheduling applications and rider applications through data and procurement guidelines, but neither of those applications publishing or consuming GTFS falls within the system. The project will have sponsored deployment sites, where agencies will pilot applications following the data and procurement guidelines, and to the degree that deployment agencies are directly engaged in promoting certain applications safety issues related

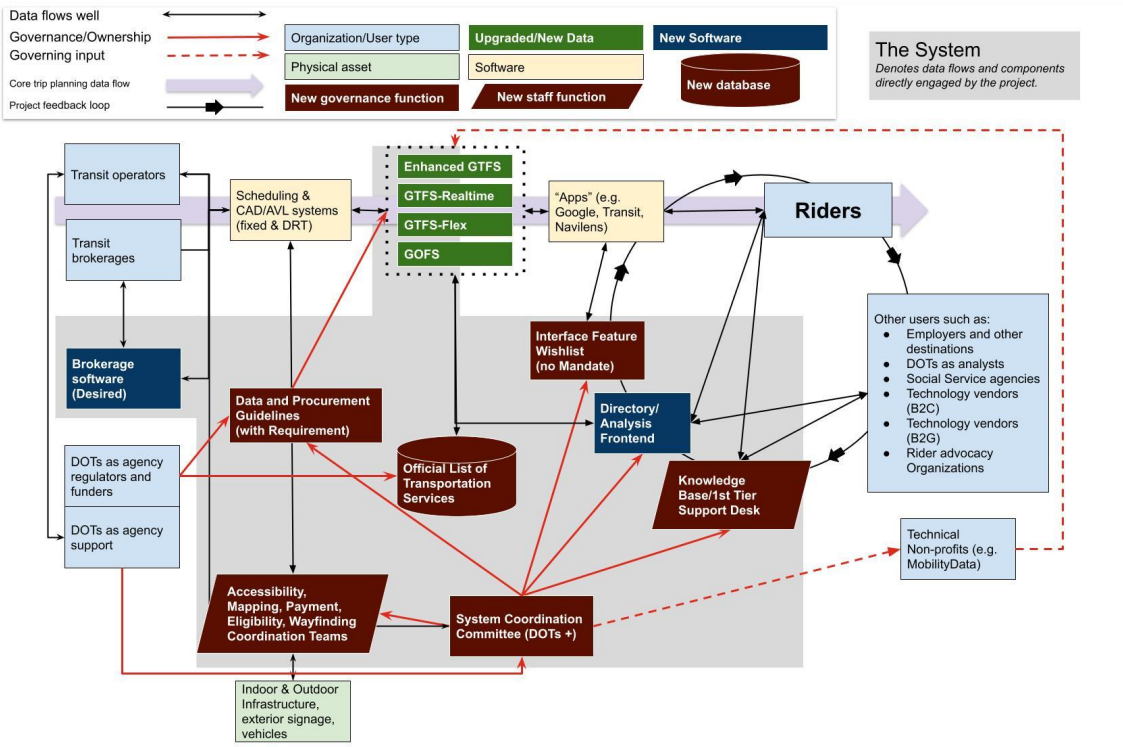
to apps may arise which require the consideration of the project team. However, this SMP will not exhaustively consider all potential safety impacts of these applications.

One particular type of potential safety interaction that will be considered explicitly out of scope of this analysis is any impact related to app users relying on apps to provide direction without actively managing their own personal safety. For example, the safety risk of walking into traffic or off a steep ledge because an app directed a user to walk forward will not be considered. This is because basic safety precautions are assumed to be external to this system, for example the practice of standard safety actions by all users such as looking and listening at intersections, using crosswalks, using a white cane, or the presence of ADA compliant infrastructure that supports safer user activities. This approach mirrors accepted practice within the industry; of three rider applications surveyed, none had any agreement with agencies taking on any degree of liability for user actions leading to physical harm, though one used a disclaimer on their app to specifically state that the user takes responsibility for their own safety precautions. The publication of a disclaimer for safe use of apps and a simple license defining allowed use of published data will be incorporated into the Task 6 system requirements in order to ensure that the relationship of data producers and consumers to safety needs incorporated into system requirements are defined.

3. Safety Needs and Scenarios

In this Section, we refer to Figure 1 (Proposed System Diagram) of the "Concept of Operations" when discussing the project components. A copy of the Proposed System Diagram is included here.

Figure 1: Proposed System Diagram



3.1. Safety Needs by Project Component

Safety needs were generated from the safety concerns identified during project stakeholder safety interviews. In these interviews, the project team provided high-level descriptions of each system component and gave stakeholders the opportunity to discuss any potential vulnerabilities pertaining to operator/user safety with each, whether related to physical or psychological safety.

Safety needs break down by system component as follows:

Data and Procurement Guidelines. Transportation service providers should deliver the following information about each vehicle:

- Status of vehicle accessibility features: This is especially important for people with mobility disabilities, as for them vehicles without such accessibility features may be inaccessible.

- Vehicle occupancy: Travelers should know if they would be able accommodated in a vehicle, together with their companions if necessary.

In both cases, being unable to begin the transit leg of one's journey at the planned time could result in a longer wait time, the need to quickly find a different transportation service, or foregoing the journey altogether. All these outcomes could expose a rider to danger.

Enhanced GTFS. Increased information regarding trip accessibility should be reported in a GTFS feed. An additional requirement is that travelers are provided with trip plan alternatives – "Plan B" should anything go wrong with their original trip – or be warned about the lack of alternatives.

- Exact stop locations, so that travelers could be confident that they are waiting at the right spot and can find their vehicles without ambiguity.

- Waiting conditions at the stop – open/covered and, if possible, safety amenities such as lighting or station attendance. Travelers should have a reasonable expectation about the environment where they board or make transfers.

- Transfer conditions at connection points – Travelers should be provided with information about accessibility and safety of pathways between stops at connection points and segments between the location the transit vehicle stops for pickup/drop-off and origin/destination points. This is especially important for people with mobility and vision disabilities.

3.2. Safety Scenarios by Project Component

Safety scenarios covering the needs by project component are listed below. These scenarios are considered probable and potentially frequent. The severity of their impact ranges from medium to high: from panic and distress to a severe injury or death for a traveler.

Data and Procurement Guidelines.

1. **Lack of information about the vehicle's accessibility features**. Properly designed trip planners would not be able to build a trip that guarantees traveler satisfaction. Travelers would have to go on trips at their own risk of being stranded somewhere away from their homes. For example, a wheelchair user goes from her home to an appointment. Her trip has two legs and a connection point. The first part of the trip is successful: the user arrives at the connection point safely and on time. Then, however, the shuttle that is supposed to take her to the destination arrives but is not wheelchair accessible (has no ramp or lift). As a result, the traveler may be late for her appointment, or she may find herself stranded without means of going to the destination or returning home immediately. The severity of the impact grows in adverse weather for people with disabilities which require avoiding certain temperatures or in an environment lacking safety amenities such as lighting or station attendance. Additionally, the system may include transportation services which are not transit and are not required to meet the

compliance standards of the ADA, which could result in an inaccessible experience that does not meet rider expectations. Special consideration should be paid to ensuring that services which do not provide WAV vehicles are identified as such.

2. **Lack of vehicle occupancy information**. A traveler waiting at a bus stop may be passed by a bus at maximum capacity. This situation became common under COVID-19 restrictions. As a result, the traveler may be late to an appointment and suffer mental distress. The severity of the impact grows for an older adult or a person with a disability, and/or in an adverse weather for people with disabilities which require avoiding certain temperatures or in an environment lacking desired safety features or amenities.

Enhanced GTFS

3. **Lack of information about the exact stop locations**. When travelers do not know where to wait for their vehicle, they may get lost, miss their ride, and suffer distress. The severity of the impact grows for an older adult or a person with a disability, individuals with limited English, and/or in an adverse weather for people with disabilities whose which require avoiding certain temperatures or in an environment lacking desired safety features or amenities, as these populations may experience greater impacts from lost time due to reduced personal mobility.

4. **Lack of information about the waiting conditions at the stop – open/covered and presence of desired safety features or amenities**. Travelers might end up waiting for their ride in an unsafe environment. For example, users of power wheelchairs should not be in the open under a heavy rain, as this may result in a short-circuit of their equipment.

5. **Lack of information about the transfer conditions at connection points**. Without this information, the trip plan may have a connection point that includes an unsafe crossing for those with vision disabilities or a pathway inaccessible for travelers with a mobility disability. As a result, these travelers may miss their connection ride. In a worse case, this situation may result in severe injury.

6. **Lack of trip alternatives**. Travelers might need to interrupt their trip for various reasons, e.g., personal needs, a non-cooperative driver, or a force majeure en-route that prevents the ride to continue. Travelers must then look for replacement rides from a mid-point of the trip (anywhere along the route). In the absence of alternatives, travelers may end up stranded away from home. The severity of the impact grows for an older adult or a person with a disability, and/or in an adverse weather for people with disabilities which require avoiding certain temperatures or in an environment lacking desired safety features or amenities, as these populations may experience greater impacts from lost time due to reduced personal mobility .

4. Assessment of Safety Risks

This section describes and assesses safety risks. Each risk description references a safety scenario listed in Section 3.2 above and operational scenarios that can be found in Section 6 of the Concept of Operations or Appendix B of this document. Risk ranking is done by:

- **Exposure** is the relative expected frequency of the operational conditions in which a given risk becomes active. Exposure classification:
    - *Frequent*: there is an empirical evidence that travelers of certain categories are exposed to a given risk more than once a year.
    - *Probable*: there is an empirical evidence travelers of certain categories were exposed to a given risk at least once in the past three years.
    - *Occasional*: there exists an empirical evidence of a given risk exposure at several deployment area communities during the past year.
    - *Remote*: there exists an empirical evidence that someone was exposed to a given risk, but the cases of exposure were rare.
    - I*mprobable*: there is no empirical evidence that travelers were exposed to a given risk.
- **Severity** is the measure of an estimated risk impact in terms of potential trauma to the traveler. Severity classification:
    - *Catastrophic*: has a potential to cause severe or even life-threatening injuries.
    - *Serious*: has a potential to cause moderate or even severe injuries.
    - *Marginal*: has a potential to cause at most light injuries.
- **Controllability** is the relative likelihood that the system can help avoid a given risk or effectively reduce its impact. Controllability classification:
    - *Controllable*: a risk can be almost eliminated by providing necessary information to the traveler.
    - *Partially Controllable*: the impact of a risk can be reduced by providing necessary information to the traveler.
    - *Uncontrollable*: circumstances leading to a given risk cannot be foreseen, or the risk is unavoidable.

The safety risks was presented to each safety stakeholder individually, and each stakeholder provided their input on the Exposure, Severity, and Controllability of those risks respectively. Rankings were then updated based on feedback from stakeholders. The assessment at this stage was then brought to the project team who gave a final review of the appropriateness of the rankings.

4.1. Safety Risk Assessment

4.1.1. Risk #1: Vehicle Performing the Trip not Accessible to People with Mobility Disabilities

A vehicle not equipped with a ramp/lift and a restraint system cannot take a wheelchair user on board. This may result in travelers with a mobility disability being left without a ride. In these circumstances, the best case is when they cannot leave home to their destinations. The worst case is when a traveler with a mobility disability is stranded away from home in an unfriendly environment.

Exposure: Probable

Severity: Serious

Controllability: Controllable

Safety scenario:

- #1: Lack of information about the vehicle's accessibility features

Operational scenarios:

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

4.1.2. Risk #2: Equipment Failure in a Wheelchair Accessible Vehicle

Users with mobility disabilities rely on properly functioning ramps/lifts and restraining systems in WAV vehicles. Occasionally, pieces of this equipment fail. There is a range of impacts of such failures: a) A traveler may be unable to enter the vehicle; b) A traveler may be stuck inside a vehicle, unable to get out; c) A traveler may get injured and/or injure other passengers in the event of restraint system failure.

Exposure: Occasional

Severity: Serious

Controllability: Partially Controllable

Safety scenarios:

- #1: Lack of information about the vehicle's accessibility features

Operational scenarios:

- #2*:* Person who uses a wheelchair planning a trip to work using fixed-route service near their home

4.1.3. Risk #3: A Vehicle is Full and Cannot Take Anymore Passengers

A passenger and/or their companion cannot be accommodated in a vehicle because the vehicle is full. Just as in Risk #1, the best case is when they cannot leave home to their destinations. The worst case is when a traveler with a mobility disability is stranded away from home in an unfriendly environment.

Exposure: Probable

Severity: Serious

Controllability: Controllable

Safety scenarios:

- #2: Lack of vehicle occupancy information

Operational scenarios:

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

4.1.4. Risk #4: A Traveler Cannot Find the Stop

Travelers may experience difficulties in finding their stops. This problem is especially acute for people with a vision disability and older adults, as well as people with limited

English proficiency. As a result, travelers may get lost and miss their ride. Adverse weather or an environment lacking desired safety features or amenities. The impact ranges from mild distress to severe injuries.

Exposure: Probable

Severity: Serious

Controllability: Partially Controllable

Safety scenarios:

- #3: Lack of information about the exact stop locations

Operational scenarios:

- #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.

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

4.1.5. Risk #5: A Traveler Cannot Find the Vehicle

A traveler may have a difficulty in identifying and navigating to their vehicle. This can happen at a transit hub or at a busy street. This can result in a missed ride or a wrong destination. The traveler may end up in an unfamiliar neighborhood, having to make a new trip plan. This is particularly of concern for riders with vision disabilities.

Exposure: Probable

Severity: Serious

Controllability: Partially Controllable

Safety scenarios:

- #3: Lack of information about the exact stop locations

Operational scenarios:

- #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.

4.1.6. Risk #6: Unsafe Waiting Location

Waiting for a ride may be dangerous due to weather conditions. For example, users of power wheelchairs should not stay in the open under the rain, as this may result in a short-circuit of their equipment and cause severe injuries. The other danger, to which all travelers are vulnerable, may come from waiting in areas lacking desired safety features or amenities or from being in a location without lighting at night or from being unprotected by the sun on a hot day.

Exposure: Probable

Severity: Serious

Controllability: Partially Controllable

Safety scenarios:

- #4: Lack of information about the waiting conditions at the stop – open/covered presence of safety features or amenities

Operational scenarios:

- #2: Person who uses a wheelchair planning a trip to work using fixed-route service near their home
- #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.
- #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.
- #8: A rider with limited English proficiency is navigating to the correct bus stop in a transit mall.
- #9: A rider in a rural area without consistent internet needs to book a trip into the closest urban area for a shopping trip.
- #10: A rider who is a victim of stalking is planning a trip home from work at night using transit and their bike.

4.1.7. Risk #7: Unsafe Transfer Conditions

When a trip consists of multiple legs, connections may require travelers to walk a certain distance to their next ride. This may involve a pathway inaccessible for wheelchairs or a crossing without appropriate warnings for people with a vision disability. Such unsafe passages pose a risk of severe injuries.

Exposure: Frequent

Severity: Serious

Controllability: Partially Controllable

Safety scenarios:

- #5: Lack of information about the transfer conditions at connection points

Operational scenarios:

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

4.1.8. Risk #8: Lack of a Replacement Ride

All risks listed in this document, as well as personal circumstances, may lead travelers to adjust their trip plans from a midpoint anywhere along an itinerary. In case there is no alternative ride, travelers may end up stranded away from home and possibly in an unfriendly environment.

Exposure: Occasional

Severity: Serious

Controllability: Partially Controllable

Safety scenarios:

- #6: Lack of trip alternatives

Operational scenarios:

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

4.1.9. Risk #9: Unexpected Route Change during the Trip

Unexpected events of various kinds may lead to an abrupt route change or ride cancellation in the middle of a trip. This may lead to a traveler being left stranded in an unfamiliar and possibly unfriendly environment. This problem is especially acute for

people with a disability and older adults, as well as for non-residents and those with Limited English Proficiency. Agencies likely have local policies which may support maintaining safety of riders, but those operational policies are likely outside the scope of this project.

Exposure: Occasional

Severity: Serious

Controllability: Uncontrollable

Safety scenarios:

- #6: Lack of trip alternatives

Operational scenarios:

- #2: Person who uses a wheelchair planning a trip to work using fixed-route service near their home
- #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.
- #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.
- #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.
- #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.
- #8: A rider with limited English proficiency is navigating to the correct bus stop in a transit mall.
- #9: A rider in a rural area without consistent internet needs to book a trip into the closest urban area for a shopping trip.
- #10: A rider who is a victim of stalking is planning a trip home from work at night using transit and their bike.

5. Safety Operational Concept

This section itemizes the risk mitigation approaches which will be used with regard to each risk assessed in Section 4.

5.1. Safety Design Elements

The safety risks assessed in the previous section can be mitigated by ensuring that information about vehicle equipment (i.e., WAV vehicle status), passenger counts, exact vehicle locations and infrastructure characteristics (i.e., stops and pathways) is obtained and passed to the trip planning apps through a GTFS feed – see the Proposed System Diagram in Section 3 of this document. The system components that should account for safety risks are:

- **Data and Procurement Guidelines**. These guidelines must emphasize that data obtained from transportation providers contain:

    a) WAV vehicle status and additional accessibility features of their vehicles;

    b) Real time passenger counts.

    c) Be accurate, complete, and up-to-date

- **Accessibility, Payment, Eligibility, Wayfinding Coordination Teams**. These teams should focus on obtaining complete and maintaining up-to-date information about stop and transfer pathway infrastructure as well as disambiguation of stop locations and identifying hotspots that present infrastructure-related safety risks from the list in Section 4.

- **Enhanced GTFS**. It is necessary that the enhanced information about vehicles' accessibility status and features, passenger counts and infrastructure characteristics is adequately represented in the GTFS feed.

5.2. Safety Operational Processes

Because of the indirect nature of the relationship between user safety and this project, there are no operational processes specifically and exclusively identified as safety operational processes for this project. Safety needs developed from this SMP will be integrated into the ConOps as user needs, and developed during the project based on the system requirements traced to those user needs in the SyRS.

The implementation of the safety design elements listed above will be specifically managed through the recommendations to trip planner app providers defined in the Proposed System Diagram (Figure 1) as the Interface Feature Wishlist, in order to encourage their support for providing risk-mitigating information to the end users. These recommendations should refer to the

safety risks described in Section 4 and indicate which information would be necessary to address the corresponding risk. Additionally, the recommendations may suggest features that would aid the end users in finding resolutions to risk scenarios when such materialize. Such feature suggestions could include a link to a phone number for a customer service system that could point the rider to alternate transportation services not represented in the trip planning application or a real-time function that provides estimates for when the next vehicle with ADA capacity is available.

5.3. Mitigations and Fail-Safes

It is the responsibility of the system to provide mitigations to every safety risk it generates. The following are mitigations proposed by the project that are intended to control the severity of impact if/when safety impacts occur. Mitigations are listed by risk.

- **Risks #1 and #2.** The data about a vehicles' accessibility informs the traveler if a particular vehicle is currently wheelchair accessible. If these data are not available from the transportation provider, it is recommended that the trip planning app states so explicitly to warn the traveler so that the rider can be made aware of the possibility that the vehicle in use may not suit their needs and then make the safety determination themself.

- **Risk #3.** Real-time passenger counts are needed to warn the traveler about a possibility to be passed by their vehicle because the vehicle has already reached passenger capacity. This information may also indicate how many wheelchair seats are currently unoccupied. In the case of on-demand ride requests, specific seats on those rides should be reserved. If real-time data about vehicle occupancy are not available, historic passenger counts for a given day of week, time of day and location can be used to give the rider a baseline approximation of seat availability so they can make better informed travel decisions.

- **Risk #4.** Information about precise stop location should be provided to the traveler. The stops themselves should be made clearly identifiable (i.e. a rider must be confident that the location they are waiting at is associated with the stop. This could be fulfilled by physical signage, an audio notification spurred by their GPS signal, or a scannable code on physical infrastructure that points the rider to the stop's digital fingerprint) for everyone including people with vision disabilities as well as for non-residents and those with Limited English Proficiency. Providing real-time status of key infrastructure at train stations, transit centers, and subways–for example elevator outages–critical to trip completion is another potential mitigation.

- **Risk #5.** Information about precise vehicle location should be provided to the traveler (i.e. a rider should have a clear understanding of where the vehicle is along the route in relation to their stop at least every 20 seconds). The vehicles should be made clearly identifiable for everyone including people with vision disabilities as well as for non-residents and those with Limited English Proficiency.

- **Risks #6 and #7.** Data about infrastructure characteristics – open vs. covered area; pavement condition, curbs, intersection crossings, stairs – shall be provided to the traveler. This information gives the traveler an approximate understanding about what to

expect at a particular waiting spot or transfer location. This information helps travelers to decide if a particular element of the proposed trip is safe and comfortable enough for them.

- **Risk #8.** For travelers, especially those most vulnerable, it is important to know that in case their trip is interrupted for any reason, they can resume it from a mid-point or return home. Therefore, having potential ride alternatives may be vital. Should there be no alternative rides–whether from the same or different service–available, the trip planning app must include an explicit warning to the traveler alongside any results after submitting a search query for available transportation.

- **Risk #9.** In the case of an abrupt route change or a ride cancellation, the travelers' first step would be to schedule a new trip from their current location. If that is not possible, and travelers are stranded away from home, an emergency contact representing the transportation provider should exist to address the situation and provide the rider with an alternative solution.

Ultimately, it is trip planning apps that must enable such mitigations. The mitigations listed here will therefore be included in the recommendations for app providers.

5.4. Safety Responses

If an individual's trip is interrupted due to any of the above-mentioned risks (or other risk not listed here but related to their travel), the individual should follow these steps:

1. Schedule a new trip from their current location. If that results in failure, proceed to step 2.

2. If a traveler is at home, proceed to step 3. Otherwise, it is recommended that the trip planning app provides an emergency widget allowing the traveler to communicate their circumstances to a human customer service specialist representing the transit agency and call for help.

3. Report the safety incident, either to the agency or to the 1st Tier Support Desk defined within the Proposed System Diagram. If reported to the agency, the safety concern will be outside the system and agency safety response processes will be actualized. In the case that there is a report of a safety incident to the 1st Tier Support Desk, it will be managed along with other user comments into the Support Desk, and developed into system requirements which maintain user safety if appropriate.

5.5. Safety Reporting.

Safety incidents should be reported through the **Knowledge Base / 1st Tier Support Desk** entity that is governed by the **System Coordination Committee** – see the Proposed System Diagram in Section 3 of this document. The report will be evaluated against known risks, and the cause of failure will be identified. The response to a reported incident will also be assessed. The responsible parties must be notified, along with the System Coordination Committee and the USDOT as appropriate during the course of the project.

The Knowledge Base of incidents should be reviewed by the manager of the 1st Tier Support Desk system component on a regular basis (e.g., quarterly). As a result, new risks may be identified in addition to those listed in Section 4. Also, new responses to existing risks may be called for. These risks will be identified as system requirements traced to new or existing user needs, and developed within the core operational processes of the system. Ongoing development of the system through an agile process will re-evaluate user needs and system requirements as development proceeds and testing is performed by system users. Those new system requirements will be addressed through continuing development, and some system requirements may be added at a high priority level which will ensure that they are addressed quickly, as is likely to be the case with any newly discovered safety risks.

6. Safety Management Summary

6.1. Safety Risk Summary

Safety risks, their assessment, operational strategies for risk mitigation, factors to monitor, and the overall status are included in Table 2. The factors to be monitored refer to the information about vehicle equipment, passenger counts, and infrastructure that has to pass through a GTFS/GOFS feed to make into the trip planning apps that serve the end user. Monitoring should consist of data specifications, guidelines, and quality reviews that ensure presence of information to be monitored. The overall status is defined as:

- I = Important. The project must address this safety risk.
- D = Desirable. The project should address this safety risk.
- O = Out of scope of this project. The project will not address this safety risk, though the transit agency may.

Table 2. Safety Risk Management Summary

ID	Safety Risk	Safety Assessment	Safety Operational Concept Strategies	Factors to Monitor	Overall Status
1	Vehicle Performing the Trip not Accessible to People with Disabilities	Probable, Serious, Controllable	Obtain vehicle's accessibility status; Publish this status in GTFS/GOFS; Encourage trip planner providers to use this info	Equipment; GTFS/GOFS; Trip planner features	I
2	Equipment Failure in a Wheelchair Accessible Vehicle	Occasional, Serious, Partially Controllable	Obtain vehicle's accessibility status; Publish this status in GTFS/GOFS; Encourage trip planner providers to use this info	Equipment; GTFS/GOFS; Trip planner features	D
3	A Vehicle is Full and Cannot Take Anymore Passengers	Probable, Serious, Controllable	Obtain vehicle's occupancy status; Publish this status in GTFS/GOFS; Encourage trip planner providers to use this info	Real-time passenger counts; GTFS/GOFS; Trip planner features	I
4	A Traveler Cannot Find the Stop	Probable, Serious, Partially Controllable	Obtain precise stop location; Publish this info in GTFS/GOFS; Encourage trip planner providers to display this info and utilize digital signage	Infrastructure; GTFS/GOFS; Trip planner features	I

ID	Safety Risk	Safety Assessment	Safety Operational Concept Strategies	Factors to Monitor	Overall Status
5	A Traveler with a Vision Disability Cannot Find the Vehicle	Probable, Serious, Partially Controllable	Obtain precise vehicle location; Publish this info in GTFS/GOFS; Encourage trip planner providers to display informational signage	Equipment; GTFS/GOFS; Trip planner features	I
6	Unsafe Waiting Location	Probable, Serious, Partially Controllable	Obtain data about infrastructure; Publish this info in GTFS/GOFS; Encourage trip planner providers to display this info	Infrastructure; GTFS/GOFS; Trip planner features	D
7	Unsafe Transfer Conditions	Frequent, Serious, Partially Controllable	Obtain data about infrastructure; Publish this info in GTFS/GOFS; Encourage trip planner providers to display this info	Infrastructure; GTFS/GOFS; Trip planner features	I
8	Lack of a Replacement Ride	Occasional, Serious, Partially Controllable	Encourage trip planner providers to inform users about possible alternatives or warn them about the lack of alternatives	GTFS/GOFS; Trip planner features	D
9	Unexpected Route Change during the Trip	Occasional, Serious, Uncontrollable	Encourage trip planner providers to inform users about emergency contacts	Trip planner features	O

6.2. Continuing Safety Planning

Knowledge Base / 1st Tier Support Desk entity that is governed by the **System Coordination Committee** (see the Proposed System Diagram in Section 3 of this document) is expected to become a primary source of information about:

- The exposure and severity of existing risks;
- New risks, not listed in this document;
- Sources of failures and parties responsible for mitigating or preventing future failures;
- Types of incident responses and their effectiveness.

This information will be used to update the list of risks and the corresponding mitigations. It may also be used for recommendations to transportation providers, cities (about infrastructure) and trip planning app providers.

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.

GOFS – General On-demand Feed Specification: https://mobilitydata.org/why-on-demand-transportation-needs-to-be-standardized

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

WAV - Wheelchair Accessible Vehicle

WBS - Work Breakdown Structure

WSDOT - Washington State Department of Transportation

WSTA - Washington State Transportation Association

Appendix B. Operational Scenarios

Below are operational scenarios that demonstrate the proposed system in action. Each follows a particular user along with supporting users as they plan a trip or use the system for another purpose.

Table 8. 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.
Geographic Scope	This user could be travelling anywhere within the tri-state region that has a demand-response service which meets their accessibility needs.
Actors	● Transit agency ● Rider with mobility disability ● Trip planning application
Preconditions	1. Data about the demand response service must be up to date and publicly available. 2. The data standard modeling these services must be accepted and used by both producers and consumers for them to appear in trip planning queries.

Main Flow	1. Trip planning apps ingest and model non-fixed-route services from datasets provided by an agency, DOT, non-profit, or vendor acting on behalf of one of these. 2. The data the app consumes and publishes includes information on who the service is for (ie eligibility restrictions). 3. The individual accesses the trip planning app, to which they have provided user profile information (use and type of mobility device). 4. The user searches for a trip between the start and end points. 5. The app accesses ingested datasets and checks user profile and trip parameters against them. The app returns a possible trip that matches the user's needs, as well as information about the agency providing the trip, such as name and contact information. 6. The app identifies and presents a demand response service trip that could serve the rider's needs. The user is also presented with a "book now" button, which deep links to a booking application or webpage. 7. The user clicks on the book now button to proceed with the booking process through an agency-maintained application. 8. The user is served by the demand response service following the parameters of the trip they booked with the agency originally discovered through the trip planning application.
Alternate Flow(s)	6a. The app could also provide live vehicle/trip availability through an API transmitting real-time vehicle or dispatch data from the agency. 8a. When the vehicle has not arrived at the expected time, the rider texts, calls, or checks the mobile/web application to learn that the vehicle is still on route but delayed.
Post-conditions	1. The user discovers a transit service tailored to their specific needs and is able to plan trips with that service using a booking process that is linked with the application they used.

Information Requirements	• Trip planning app must display
	  ○ Demand-responsive service
	  ○ Eligibility requirements
	  ○ Booking requirements
	  ○ Capacity for vehicle and service to accommodate the mobility device the rider uses
	  ○ Service hours
	  ○ Booking link
	  ○ Contact information for questions
	• Trip planning app needs user information on
	  ○ Pick up/drop off location
	  ○ Trip time
	  ○ Mobility device needs
	  ○ Eligibility information

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

Table 9. 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.
Geographic Scope	The information the user needs for this case is limited to their path of travel. In this scenario the user will be traveling from an urban residential area to a denser urban commercial area. They will need information about the path between their home and the bus stop, the bus stop itself, the vehicle, the bus stop they will arrive at, and the path from the bus stop to their work. This will likely include information about sidewalks and curb cuts, streets, crosswalks, and any other barriers.
Actors	● Transit Agency ● Underserved Population User/Traveler ● Bus operator ● Manager of built environment, i.e. sidewalks, curbs, crosswalks, and signage, and data representing that infrastructure ● Customer-facing trip planning tool/application
Preconditions	1. The transit agency has a website with an embedded trip planner that is able to consume and display the required information. 2. The entity creating the data has access to the information required such as the vehicle's accessibility features and information about the surrounding bus stops and pathways.

	3. The company providing the mobile application has data regarding the street grid in close proximity to the bus stops in question, including accessibility features such as sidewalks, curb cuts, crosswalks, and barriers that may impact the navigation of pedestrian routes.
Main Flow	1. User accesses the transit website's trip planner to look up their possible trip 2. Transit website's trip planner directs user to a third party site that includes all necessary information about the bus route, arrival times, and information regarding the accessibility features of the stop 3. User uses the provided information to confirm that they will be able to travel from their home to the bus stop along a route that is accessible to them 4. User is able to confirm that once the bus arrives, they will be able to board. 5. User is able to confirm they have a safe space for their mobility equipment. 6. User is able to confirm that they will be able to travel from the bus stop to their work along a route that is accessible to them 7. User is able to confirm that there is an available return trip meeting these requirements at the end of their work day so that they know they will be able to get home successfully. 8. As the user begins the trip, they refer back to the application to receive a real-time update on the expected departure time of their vehicle.
Alternate Flow(s)	2. Agency's trip planner contains information with a similar user flow as the third party app, but no referral to external software is necessary. 7. User is able to confirm that while the route they are using for their initial trip will not be running at the time of their return trip, that there is an alternate accessible route they will be able to take.
Post-conditions	1. User is able to plan a complete trip that is accessible to them and completes the trip 2. User is able to determine that the route is not going to be accessible to them, so they do not take the trip and look for other options
Information Requirements	● Trip planning app/third party site must display ○ Stop location and vehicle arrival times ○ Specific lat/lon positions of potential barriers to a mobility device with description of those barriers ○ Description of vehicle accessibility capabilities including ▪ boarding/alighting ▪ specifications around aisle width ▪ current availability and size of wheelchair spaces and turnaround space ▪ availability of driver to assist ● Trip planning app needs user information on ○ Pick up/drop off location

	○ Trip time ○ Mobility device needs
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

Table 10. 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.
Geographic Scope	This use case takes place in a suburban area where the user lives a few blocks from a train stop.
Actors	● Transit Agency ● Rider with a vision disability
Preconditions	1. The agency must have a website with the information the rider is seeking presented in a way that is accessible to people using screen readers.
Main Flow	1. User accesses the agency website 2. User is able to use their screen reader program to understand information on the homepage of the website and navigate to the correct page for arrival times 3. User finds the specific stop they want to find the arrival times for. 4. User signs up for notifications regarding alerts for the service they plan to ride 5. Before reaching the train station, the user receives a text notification which explains that the train has been delayed significantly 6. The rider visits a coffee kiosk near the train station and waits for the train while enjoying a delicious beverage.
Alternate Flow(s)	4. Instead of requesting a notification,user, the user plans to check back on the website later; 5. The user looks again at the website and finds on the same page that the arrival time has been updated and a new alert is posted, stating that there has been a significant delay. 1. Instead of the agency's website and text, the user perform steps 1 through 5 using a smartphone application.
Post-conditions	1. The user is able to find the information they need in an effective and efficient way. Because an alert was posted in a way that was accessible through their user interface, they adjusted travel plans and maintained their personal comfort at the train station.
Information Requirements	● Transit website information for user: ○ Screen reader accessible without additional unnecessary information cluttering the site ○ Stop locations ○ Arrival times ○ Alert posted on arrival times page easily identified through page hierarchy ● User information:

	○ Chooses correct stop
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

Table 11. 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.

Geographic Scope	This scenario takes place on a busy urban street where many vehicles are parked and either pulling in or pulling out.
Actors	● Transit operator ● Rider with vision disability ● Driver
Preconditions	1. The vehicle operating the demand responsive service has a code or beacon that allows communication with the mobile application. 2. The rider must have a smart phone with a working camera and internet access through either cell or wifi. 3. The vehicle must be encoded with a digital code or beacon that can direct a user to the proper vehicle.
Main Flow	1. The rider with a vision disability has booked a trip through a mobile application for a demand-responsive service, with an origin location on a busy urban street. 2. The mobile application confirms the vehicle is en route to the pickup location and provides a push notification to the rider's mobile phone identifying the expected time until pickup. 3. The vehicle arrives, and parks along a sidewalk with other vehicles both in front of and behind that vehicle. 4. The rider receives a notification that the vehicle has arrived and raises their phone to see the line of cars. 5. The phone identifies through its camera the digital code placed near the front of the vehicle, and directs the rider towards the vehicle through audio indications of direction 6. The rider announces to the driver that they are ready for their ride.
Alternate Flow(s)	
Post-conditions	1. The rider finds the vehicle and proceeds on their demand responsive trip.
Information Requirements	● The smart phone application must be aware of the codes placed on physical vehicles, and be able to connect that code to vehicle information provided in real-time by the demand responsive scheduling application ● The smart phone application must be aware of the sidewalk and curb position, and potential barriers between the rider and the boarding location.
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

Table 12. 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.
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
Geographic Scope	This scenario takes place in an urban area with reliable internet and phone connections. The distance between the rider's home and their destination is under 3 miles and is within the urban area.
Actors	● Transit Agency ● Underserved Population User/Traveler ● Bus operator ● Customer-facing trip planning tool/application
Preconditions	1. The transit agency has adequate information about their paratransit services online that the rider is able to find the information they need to understand eligibility requirements and be approved. 2. The transit agency has an online booking option for paratransit services. 3. The rider has an internet connection and device to access the internet

Main Flow	1. User searches for paratransit services near them in a directory interface and finds the correct local transit service. 2. User locates information about the paratransit service including eligibility requirements, how to apply, and how to book a trip. Information is presented in a clear and straightforward way through text-to-speech so that the user is able to understand the materials. 3. User is able to submit the required documentation with the help of a caregiver and get approved in a timely manner to use paratransit. 4. User is able to then book a ride, confirming their pick up and drop off points and request a notification to be sent to their sister upon both pick up and drop off. 5. User receives a notification alerting them to the vehicle approaching their location 6. User is picked up within a minimal time window and dropped off in time for work. 7. A notification is sent automatically to the rider's sister to let her know the rider arrived safely.
Alternate flow	3. Instead of submitting documentation, the eligibility verification process includes entering a small amount of personally identifiably information (PII) into a web interface, which leads to the automated verification of the rider's eligibility.
Post-conditions	1. The user arrives safely and on time for work and their sister is notified.

Information Requirements	• Paratransit service information online needs to include:
	  ○ Eligibility requirements
	  ○ How to apply and timeline
	  ○ Booking ability
	  ○ Ability to request arrival notifications
	• Paratransit service needs information on:
	  ○ Eligibility
	  ○ Pick up/drop off location
	  ○ Trip time and latest allowed arrival time
	  ○ Arrival notification request

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

Table 13. 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
Geographic Scope	This scenario takes place in either a rural or an urban area with good internet and phone connections.
Actors	● Transit Agency ● Veteran rider on a low income ● Transit operator

	● Customer-facing trip planning tool/application
Preconditions	1. The transit agency has adequate information about their veteran services, fares, and vehicle accessibility/storage published through appropriate data specifications 2. The transit agency has services and/or fares specifically for veterans 3. The rider has an internet connection and device to access the internet
Main Flow	1. The user uses a public mobile application to search transit services in her area. 2. The user is able to find the multiple services that meet her needs, including an intercity route and, in the local area around the hospital, both a fixed-route service that requires a fare and a veteran-specific demand-responsive service that is free but has limited capacity which doesn't suit her immediate needs. 3. The user selects the service that meets their trip requirements and is able to find the price of that service, available discounts, and information on storage availability on the vehicle. 4. The user is able to confirm that payment is accepted in at least one way that is accessible to her. 5. The user finds that space is available onboard the vehicle for her cart and begins planning for the time of her trip.
Alternate Flow(s)	The rider identifies that a free demand-response service will work for future shopping trips if she plans them in advance, and gets in touch with the agency to begin scheduling rides for that service.
Post-conditions	1. The user is able to find at least one trip option that works for their pick up and drop off points and budget and will accommodate a cart.
Information Requirements	● Transit service information online needs to include: ○ Availability of veteran services ○ Eligibility requirements ○ How to apply and timeline ○ Storage availability on vehicles ○ Booking ability ○ Fares information ○ Ability to accept fares in multiple ways ● Transit service needs information on: ○ Payment preferences ○ Eligibility ○ Pick up/drop off location ○ Trip time
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

Table 14. 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
Geographic Scope	This scenario takes place in a small urban area along a bus route. There are a variety of businesses nearby.
Actors	● Transit Agency ● Older rider with a hearing disability

	● Bus operator
Preconditions	1. Information about locations, upcoming stops, and nearby restrooms/business is available and presented to riders in a non-audio format
Main Flow	1. User determines that they need to deboard earlier than planned to find a restroom. 2. User is able to access information visually about where they are along the route, upcoming stops, and where restrooms are available, through the use of a mobile application which shows that information along the bus route. 3. The users identifies that if they alight from the bus, there will not be another bus on their route for a long time, but identifies another service that will let them finish their trip within a reasonable time. 4. User indicates that they wish to alight at the appropriate stop by signaling to the bus driver through the vehicle stop request tool. 5. User alights and is able to find their way to the nearest restroom using their mobile device. 6. The rider uses the mobile app to navigate to the stop for the service to finish their ride, and successfully boards.
Alternate Flow(s)	6. Instead of a fixed-route service, the ride being used to finish the trip is a microtransit service. The rider books a trip which arrives, and when the driver asks them a question, the rider communicates via a text message with the driver that they have a hearing disability and if they driver has information for them they should communicate in text.
Post-conditions	1. The rider was able to find the information they needed, alight, and find a restroom.

Information Requirements	● Transit service information on the vehicle needs to include visual information depicting:
	  ○ Where the vehicle is along the route
	  ○ What is nearby/restroom locations
	● Mobile application needs information on:
	  ○ Which stop the rider wants to alight at

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

Table 15. 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.
Geographic Scope	This scenario takes place in a small urban transit mall with multiple stops in an area for different routes in different directions, not all of which are visible from all other parts of the transit mall.
Actors	● Transit Agency ● Rider with limited English proficiency ● Wayfinding signs vendor ● Transit operator
Preconditions	1. The rider was able to prepare for their trip by researching the stop location beforehand and accessing information on wayfinding signs so they know what to look for now that they are at the transit mall. 2. Information about wayfinding signs was available through mobile applications for the rider to find and reference during navigation 3. Wayfinding signs present information in a way that does not require a high level of English proficiency

	4. The website, maps, and mobile apps are available in multiple languages/can be translated into any language 5. Transit operators are trained to communicate clearly and patiently with folks with limited English proficiency
Main Flow	1. User researches their trip online and is able to find in their preferred language the information they need about the stop location and how to find their stop with wayfinding and vehicle signs 2. Once at the transit mall, the user is able to recognize the necessary symbols and information on wayfinding signs to navigate to the correct stop 3. When the vehicle arrives, the user is able to confirm that it is the correct vehicle before boarding based on signs on the outside of the vehicle. 4. The user is able to confirm directly with the driver that they are on the right vehicle if the user wants that confirmation.
Alternate Flow(s)	
Post-conditions	1. The rider was able to board the correct vehicle and communicate with the driver if desired.
Information Requirements	● Transit website or mobile application information for user: ○ All information on the site could be translated to any language ○ Stop locations ○ Arrival times ○ Wayfinding sign formats and meanings ● At the transit mall ○ Wayfinding signs in formats that do not require a high level of English proficiency ● On vehicle ○ Confirmation of the vehicle route and direction ● User information: ○ Pick up and destination locations ○ Preferred language
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

Table 16. 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.
Geographic Scope	This user is traveling from a low-income rural neighborhood to a small urban neighborhood several miles away.
Actors	● Transit Agency ● Rural low-income rider ● Commercial app (possibly)
Preconditions	1. The transit agency needs to have an app or other interface that does not require constant internet connection and an ability to book trips, distribute necessary information, and answer questions by alternate means such as phone or text message. 2. The transit agency needs to be able to send alerts about delays or changes by means that do not require internet access
Main Flow	1. The user accesses the internet from their home computer to get basic information about their trip (service area and times timing) and is able to access this in a format that does not require fast or consistent internet. 2. The user is able to call or text the agency with questions and successfully complete a trip booking through these communication channels and does not have to rely on an online chat or email function. 3. There is a delay or disruption to the user's trip and the user receives a text message letting them know. The user is then able to either wait through the delay or book a different trip that meets their needs.

	4. Using this information, the user is able to navigate to their pickup location at the correct time and board the vehicle.
Alternate Flow(s)	1. The user accesses a mobile trip planner that can plan their trip without a present data connection. 2. The user is able to book the trip using the trip planner app. 3. The user begins and tracks the progress of their trip offline along the planned itinerary which includes transfers and walking using a GPS enabled mobile phone. 4. The user receives a text message letting them know that there is a delay or disruption to the itinerary. 5. The user is then able to modify their itinerary for a trip that meets their needs.
Post-conditions	1. The user is able to successfully complete their trip.
Information Requirements	● Transit service information: ○ Online trip information that doesn't require a fast internet connection to load ○ Contact information for transit agency ○ Trip reservations and answer to questions by phone ○ Trip updates and alerts by phone or text message ● Transit service needs information on: ○ Rider contact information (for alerts) ○ Rider location and trip needs
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

Table 17. 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.
Geographic Scope	In this scenario the user is traveling from an urban commercial area to a suburban residential area at night.
Actors	● Transit Agency ● Rider with safety concerns and a bicycle ● Vehicle operator ● Commercial app (possibly)
Preconditions	1. Information is available online regarding multimodal trip planning and bike accommodations 2. Information is available about safety information such as amenities near stops and information on likely number of people near stops
Main Flow	1. User researches trip options online and it able to find either the agency's website or a third party trip planning application 2. User is able to discover multiple trip options using a combination of biking and riding transit

	3. User is able to see information on safety accommodations such as lighting at boarding, transfer, and alighting stops in each potential trip, as well as whether there is space for bikes on board vehicles 4. User picks an option based on their specific safety needs and bike needs 5. User is able to safely complete their chosen trip.
Alternate Flow(s)	
Post-conditions	1. The user safely completes the trip of their choice.
Information Requirements	● Transit service information: ○ Data on bike storage and accommodations ○ Data on safety amenities ○ Ability to trip plan multimodal trips using transit and a bike ● Transit service needs information on: ○ Rider location ○ That the rider is bringing a bike
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

Table 18. 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
Geographic Scope	This scenario involves a geographic area surrounding a social service agency which may include rural, suburban, and urban areas.
Actors	● DOT analyst ● Social services agency ● Transit agencies ● Third party commercial transit apps
Preconditions	1. Information about available services and eligibility requirements are available online in a complete and accurate way
Main Flow	1. Analyst accesses the DOT's directory of transit agencies in the area 2. Analyst is then able to use this list to identify available services and find more information on each service 3. Analyst has questions regarding details of agency's services, and is able to look up the administrative contact information for the agency in order to get those questions answered. 4. Analyst compiles information on each available service, booking requirements, fares, and applicable eligibility requirements
Alternate Flow(s)	
Post-conditions	Analyst is able to provide the Social Services agency with a complete report on transit options in their area.
Information Requirements	● DOT-maintained directory of transit agencies in the area ● Data on booking requirements, eligibility, and fares

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

Table 19. 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.
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.
Geographic Scope	This use case takes place in a rural or small urban setting, but research and communication happens online and is not location dependent.
Actors	● Small rural transit operator ● B2G software vendor ● State DOT acting as agency support
Constraints	1. The transit operator serves diverse riders through multiple services and must be able to accommodate multiple use cases within software, such as deviated-fixed and eligibility-restricted demand-response. 2. The operator also needs to exchange some trips with a local taxi company which has an overlapping service area.

Preconditions	1. Procurement guidelines have been placed within the funding agreement between the transit operator and the State DOT, necessitating that the transit operator participate in a state data program or purchase a scheduling system capable of producing the appropriate standardized data formats.
Main Flow	1. Transit operator reviews state guidelines indicating the requirements of the scheduling software they want to purchased. 2. Transit operator contacts state DOT for technical assistance and receives a proposed scope of work to include in an RFP, as well as a list of vendors that are known to meet the guidelines. 3. Transit operator publishes an RFP including the proposed scope of work and receives multiple responses within budget. 4. Software vendor and DOT supports the transit operator through implementation, and helps the operator integrate the published data from their system into the state data system. 5. Software vendor and DOT are both able to use their standard data quality assurance processes to confirm that the agency is successfully publishing GTFS data as required.
Alternate Flow(s)	State DOT could use a group purchase arrangement allowing the operator to forgo an RFP and purchase directly from a list of vendors at pre-negotiated prices.
Post-conditions	1. The transit operator implements new scheduling software which complies with the data guidelines, and integrates that data into the directory/analysis front end as well as into mobile applications such as Google Maps, while still accepting phone reservations and other desired customer endpoints and internal processes.
Information Requirements	● Transit operator must provide local operation constraints, and information such as size of fleet and staff in order to allow appropriate pricing by vendor.
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

Table 20. 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.
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.
Geographic Scope	The geographic scope of this use case is primarily within a large region including some urban, suburban, and rural areas, but also refers to areas outside the region for comparison.
Actors	● Rider Advocacy group ● Specialized transportation operator
Preconditions	1. All transportation services within the three-state project region have been incorporated into the directory/analysis frontend, so that any comparable areas can be referred to in the analysis.

Main Flow	1. Rider advocacy group identifies area of analysis, in collaboration with specialized transportation operator, as well as areas for comparison 2. Rider advocacy group downloads needed data from the directory analysis front end, such as number of services and vehicles available and frequency and stop locations of fixed route services 3. Rider advocacy group downloads comparison data from other areas 4. Rider advocacy group performs analysis defining level of service in area of concern compared to other areas in the state 5. Rider advocacy group and specialized transportation operator prepare and present analysis to state DOT demonstrating unmet needs and level of funding needed to bring the service up to a level equitable with other regions.
Alternate Flow(s)	
Post-conditions	1. The advocacy group and operator demonstrate the level of funding needed to the state DOT to provide adequate services in the region.
Information Requirements	● All transportation services must be available through the directory/analysis front end. ● The rider advocacy group must have access to mapping data allowing them to analyze the transportation services in light of infrastructure information.
Related User Needs	REG-02 - Anonymized DR trips REG-05 - Vehicle location auditing MUL-07 - Map data

Table 21. 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.
Geographic Scope	The geographic scope of this use case is the entire three state region of Washington, Oregon, and California.
Actors	● B2G software vendor
Preconditions	1. All transportation services within the region have been incorporated into the directory/analysis frontend.
Main Flow	1. Vendor queries the directory/analysis frontend for the number of agencies, vehicles, and or bus stops within the region depending on the exact technology being planned for. 2. Vendor performs worst case/base case/best case analysis on an expansion plan for their product sales, and compares expected revenue and expenses to planned investment.
Alternate Flow(s)	3. As an additional step, because there is an interest by the state DOT in the planned investment, the vendor applies for a project and receives a grant to fund part of the development, in exchange for the funded portions being open source technology.
Post-conditions	1. The vendor can demonstrate the return on investment expected by investing in a new technology and selling it to agencies in the three state region.
Information Requirements	● All transportation services must be available through the directory/analysis front end.
Related User Needs	B2G-01 - Identify customers MUL-06 - Alignment on needs

Table 22. Scenario 15: A state DOT is trying to add additional depth of information on mobility devices to the GTFS specification

	Scenario 15: A state DOT is trying to add additional depth of information on mobility devices to the GTFS specification
Short Description	In this use case, the state DOT sees the need to represent a new mobility device-related piece of information to travelers and needs an extension of GTFS to relay this additional piece of information.
Goal	The goal of this use case is to illustrate how DOTs or other parties interested in further standardization can leverage the data standardization process to meet traveler needs.
Constraints	This use case will be constrained by the fact that the standard is governance is dependent on consensus of stakeholders reaching beyond the three state area. The use case will also be constrained by the readiness of agencies and vendors to adopt new specification extensions.
Geographic Scope	The geographic scope of this use case is the entire three state region of Washington, Oregon, and California.
Actors	• State DOT • System Coordination Committee • Technical non-profit • Rider App Developer
Preconditions	The state DOT will need to have a GTFS producing agency and GTFS consuming app ready to implement their addition to the GTFS specification.
Main Flow	1. State DOT collects needs from riders. 2. State DOT brings their needs to the System Coordination Committee. 3. The State DOT/Committee confirms the interest the of GTFS producing agency and GTFS consuming app, and reviews the compliance of agencies and vendors to the current spec, to gauge feasibility of further extensions to accommodate required use cases. 4. State DOT/Committee approaches Technical non-profit with needs. Technical non-profit helps the DOT/Committee understand any overlap with other standardization efforts. 5. Technical non-profit suggests Spec Extension as a standardization solution. 6. The State DOT, Producer, Consumer as well as the greater GTFS community review solution and come to agreement. 7. The Producer and Consumer implement the spec. 8. The Spec Extension is voted on by the community. 9. The Spec Extension is added to the Directory/Analysis Frontend and added into the data adoption tools, Procurement guidelines.

Alternate Flow(s)	8. Some members of the global GTFS community provide the feedback that the information being added is specific to the US context, and the vote for inclusion within the spec does not pass. However, the State DOT, SCC, and Technical non-profit agree that there is sufficient need to warrant an unofficial spec extension.
Post-conditions	The State DOT can show that riders are now able to access the additional piece of information to ease their travel.
Information Requirements	• Stakeholders must understand GTFS and its governance process.
Related User Needs	REG-01 - Assess compliance MUL-02 - Clear governance

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