Phase 1 Institutional, Partnership, and Financial Plan

UW ITS4US Deployment Project

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16. Abstract

This report presents the University of Washington (UW) ITS4US Deployment Program project's Institutional, Partnership, and Financial Plan for the project's Transportation Data Equity Initiative (TDEI.) The TDEI is developing tools to collect, validate, and disseminate transportation network infrastructure and transit service data so that they can be used in a wide variety of applications that will help people of all abilities plan and execute trips more easily. That same data can also be used to allow cities to more effectively plan and prioritization transportation infrastructure and service improvements that serve the needs of all travelers.

This report describes the stakeholder and partnership agreements and the institutional and financial arrangements necessary for the successful deployment and operation of the TDEI. The report includes descriptions of the current and planned agreements and institutional arrangements for the project. It also describes the vision for both how the system will be initially constructed and how the longer-term operation and expansion of the system will be supported.

The TDEI project is currently in Phase 1 (planning and systems engineering development). The plans discussed in this report may need to be altered in the future as Phase 2 (project engineering, concept development, testing and deployment) and Phase 3 (operation and evaluation) are performed. Alterations may also be required as the project partners gain experience with their business models for performing their designated tasks, as well as the outcomes and benefits they obtain from their participation in the use of the data.

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1 Introduction

This report presents the University of Washington (UW) ITS4US Deployment Program project's Institutional, Partnership, and Financial Plan for the project's Transportation Data Equity Initiative (TDEI). The TDEI is developing ways to collect, validate, and disseminate transportation network infrastructure and transit service data so that they can be used in a variety of applications that will help people of all abilities plan and execute trips more easily—particularly older adults, veterans and travelers with mobility disabilities. That same data can also be used to allow cities to more effectively plan and prioritization transportation infrastructure and service improvements that serve the needs of all travelers.

This report describes the stakeholder and partnership agreements and the institutional and financial arrangements necessary for the successful deployment and operation of the TDEI. The report includes descriptions of the current and planned agreements and institutional arrangements for the project. It also describes the vision for both how the system will be initially constructed and how the longer-term operation and expansion of the system will be supported.

The TDEI project is currently in Phase 1 (Concept Development). The plans discussed in this report may need to be altered in the future as Phase 2 (Design and Testing) and Phase 3 (Operation and Evaluation) are performed. Alterations may also be required as the many project partners gain experience with their own business models for performing their designated tasks, as well as the outcomes and benefits they obtain from their use of the data being generated and shared or from the beneficial travel outcomes those data support.

This report includes the current plans that support the operation and management of the TDEI for both Phase 3 and for a minimum of five years after the completion of Phase 3. This includes financing that operation without direct federal funding. (Note that transit operators may well use their own federal funding to generate updated schedule and service area data. These expenditures are considered outside the scope of this project.)

The report also describes the current status of all agreements, contracts, and subcontracts intended for use in this project. It also describes the ADA Transition Plans of public agencies partnering with this project.

1.1 Project Background

The UW ITS4US Deployment Project is one of five Phase 1 Complete Trip – ITS4US Deployment Program projects selected to showcase innovative business partnerships, technologies, and practices that promote independent mobility for all travelers regardless of location, income, or disability. It aims to create the foundational data tools necessary for both public and private entities to collect, share, manage, and use transportation data that provide equitable outcomes to all travelers. At its core, the project is about creating the foundational requirements for interoperable transportation data sharing that fulfills the informational needs of all travelers. This requires a specific focus on the unmet needs of people with mobility disabilities and other historically travel-disadvantaged communities that are the focus of this project. Without

implementing this type of project, the needs of these communities will continue to remain unmet or underserved, limiting the ability of people in these communities to access destinations, explore opportunities, and be aware of all services available to them.

The project consists of five major parts. The first part of the project includes working with existing standards committees to extend and update three existing, early-stage international data standards: OpenSidewalks, GTFS-Flex, and GTFS-Pathways. These three data standards enable the consistent collection and reporting of data that provide the underlying information needed by the currently underserved target populations—people with disabilities, older adults, and individuals with low income—to efficiently travel.

The second part of the project is the development of a series of tools that help agencies, jurisdictions, and other stakeholders collect the data that can be stored with these refined data standards. These tools are needed to lower the cost and improve the quality and consistency of those data collection efforts to increase the availability of the data.

The third portion of the project is the development of tools, policies, and procedures that allow sharing and governance of the collected data. The tasks performed will enable effective and efficient vetting, aggregation, management, and fusion of the data that participating agencies, jurisdictions, and other stakeholders collect. This portion of the project also includes tasks required to enable and manage the sharing of those data with application developers that write software to deliver requested travel information.

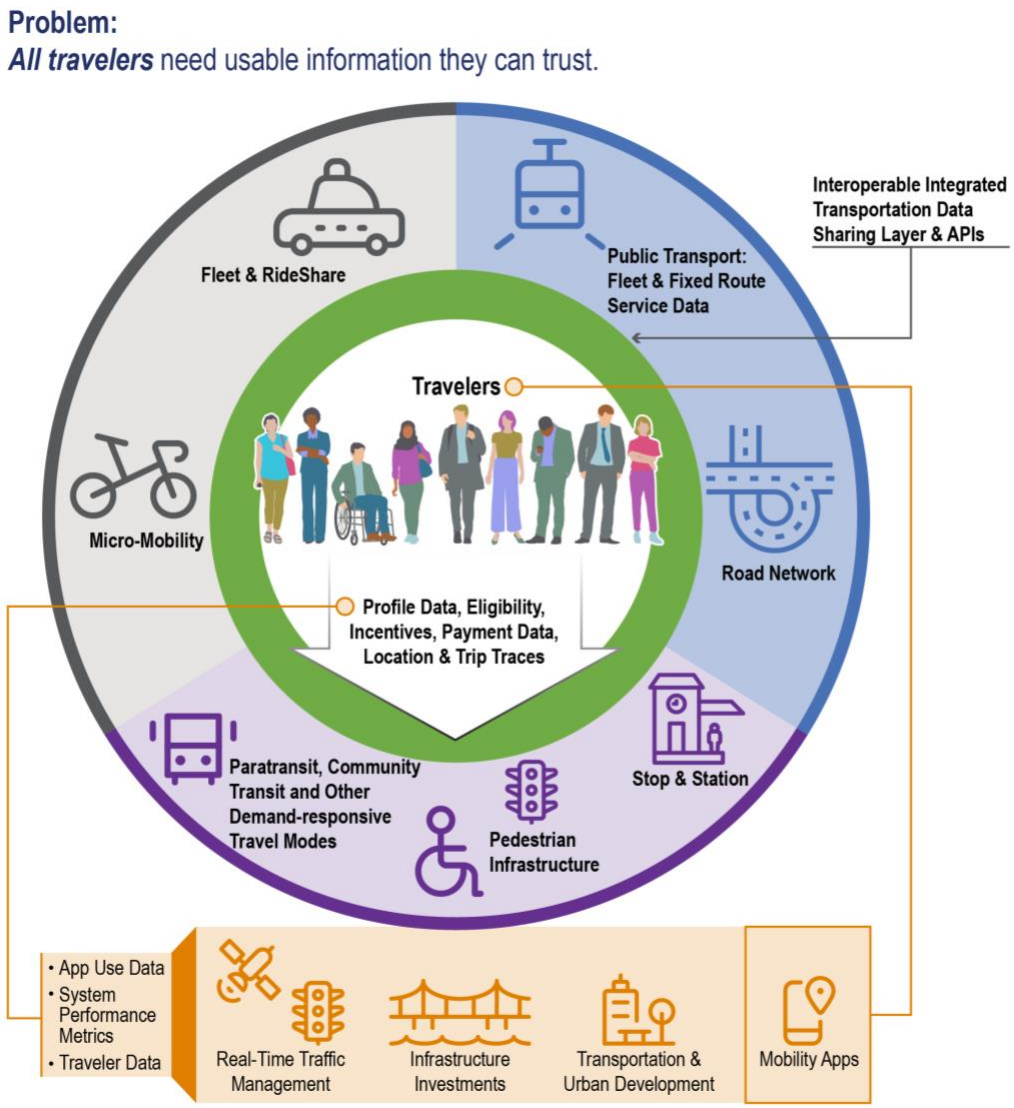
The fourth portion of this project is the development of a data repository to contain the data to be shared within the six counties that represent the geographic boundaries for this ITS4US project (King and Snohomish, in Washington, Multnomah and Columbia in Oregon, and Baltimore and Hartford in Maryland.) The data repository will be developed to illustrate how these data can be collected, stored, governed, updated, and maintained over time and then served upon request to application developers.

Finally, the fifth portion of this project is the development of three example applications that use the collected data. The three applications are intended to demonstrate three very different uses of the data that are collected, maintained, and made available to application developers as a result of the other four aspects of this project. Those data can be used to fulfill a variety of information needs, and those needs can be met through an almost infinite number of applications. The three applications deployed as part of this project are meant to show other application developers how the newly available data can be obtained and delivered.

Source: University of Washington.

Figure 1 illustrates the overall “new mobility” ecosystem to which the UW’s ITS4US project is contributing. The outer circle consists of the variety of public transportation services that exist. Many of these services already generate data that can be readily obtained by applications via internet connections – the act which results in the discovery of “new mobility” options. These include fixed route transit services, micro-mobility services, and taxi services. The UW ITS4US Deployment project will help add the data sources that are particularly important to people with mobility disabilities, shown in purple at the bottom of the image. These are data that describe pedestrian pathways, transit station infrastructure, on-demand paratransit and community transit services, and other on-demand shared ride modes. The UW ITS4US Deployment project is also building the interoperable integrated transportation data sharing layer and application

programming interfaces (APIs) shown in the green inner circle. This is the functionality needed to collect, fuse, and aggregate the data from disparate transportation services. Finally, the UW ITS4US project will demonstrate a small number of applications used by the travelers shown in the center of the diagram. The applications take requests for information from the travelers, extract the required data from the data sharing layer (green circle), perform any required tasks—such as computing navigation directions—and deliver information to users in formats (audio, text, tactile displays) designed to meet their needs.



Source: University of Washington.

Figure 1: Diagram. UW ITS4US Deployment Project's ecosystem.

The project ConOps[1] describes a set of 62 user needs that drive the design of the system. The user needs statements were developed from extensive interaction with project stakeholders. Project stakeholders have been categorized on the basis of the following five groups:

- Data generators (e.g., municipal infrastructure owner/operators, private sector pedestrian-built-environment owner/operators, crowdsourced sidewalk reporters, elevation data providers),
- Transportation service providers (e.g., transit agencies and the companies that support the delivery of transit services operated by or for those transit agencies),
- Data service providers (e.g., mapping services, weather data providers),
- Application developers (e.g., AccessMap developers, Soundscape developers, third-party application developers), and
- Digital device end users (e.g., travelers with sidewalk preferences, blind, vision disabled, or deafblind travelers, sighted older adults, multilingual or multicultural travelers, low-income transit users, rural transit users).

The needs expressed by these groups describe the basic functionality of a successful system deployment. The needs are presented in detail in Chapter 4 of the ConOps.

The project is currently in Phase 1, which focuses on the planning elements of the systems engineering process, in which the initial project idea is decomposed into a structured concept that serves as the foundation for more detailed design, building, testing, and operation. The structured concept includes identifying specific performance measures, targets, and capabilities associated with performance monitoring and performance measurement. The next phase, Phase 2, will focus on the design, testing, and deployment of the proposed system, while in Phase 3, the system will be operational and evaluated for its effectiveness.

1.2 Intended Audience

This document is designed to provide key information that will assist individuals, agencies, and firms interested in accomplishing the following:

- Understanding that the plan for UW ITS4US project will be sustained during and after the ITS4US project,
- Gaining confidence that resources allocated to collect data, or produce applications that rely on those data, will return the benefits expected as a result of continued operation of the TDEI,

[1] Phase 1 Concept of Operations (ConOps)—University of Washington ITS4US Deployment Project, by the University of Washington and Cambridge Systematics, Inc., June 2021, Report Number FHWA-JPO-21-861. Available at: https://its.dot.gov/its4us/htm/publications.htm

- Participating in the project, and that wish to understand how their agency/firm can expect to interact with the UW ITS4US project, whether as part of the current project or as part of planned expansion of the TDEI at the end of the ITS4US project, and
- Understanding how broad public/private data sharing systems can be developed and supported.

The report is specifically intended to help the United States Department of Transportation (USDOT) understand, and gain confidence in, the long term financial, institutional, and operational plans for operating the TDEI.

1.3 Relevant Sources

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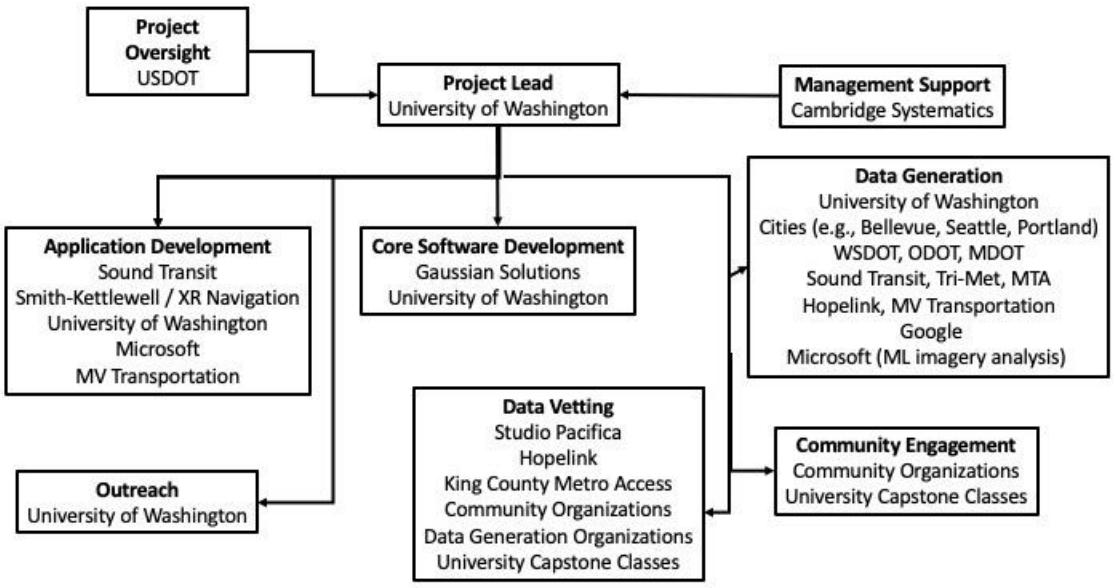
- GTFS-Flex document (ongoing), http://bit.ly/gtfs-flex-v2.
- GTFS-Flex GitHub site, https://github.com/MobilityData/gtfs-flex.

- GTFS-Pathways document (ongoing), http://bit.ly/gtfs-pathways.
- GTFS-Pathways GitHub site, https://github.com/google/transit/pulls?q=is%3Apr+pathways.
- (GTiO) Data Interoperability: A Practitioner's Guide to Joining Up Data in the Development Sector. https://www.data4sdgs.org/sites/default/files/services_files/Interoperability%20-%20A%20practitioner%E2%80%99s%20guide%20to%20joining-up%20data%20in%20the%20development%20sector.pdf, accessed 4/13/2021.
- (ISO) https://www.iso.org/home.html, accessed 3/15/21
- Needs expressed by MVTransit: How data science is driving digital transformation at MV Transportation. https://www.dxc.technology/workplace_and_mobility/insights/148131-how_data_science_is_driving_digital_transformation_at_mv_transportation

2 Project Team

The UW ITS4US Phase 1 project is being led by the University of Washington (UW), a public university, located in Seattle, Washington. Within the UW, the project is being led by Dr. Anat Caspi, Director of the Taskar Center for Accessible Technology, who is the concept lead and Principal Investigator. The Taskar Center is being supported by the Washington State Transportation Center (TRAC), whose Director, Mark Hallenbeck, is the project's Program Management Lead.

For Phases 2 and 3 of the UW ITS4US project, the UW will remain as the lead agency. The UW will directly receive funding from the USDOT and will execute subcontracts with supporting organizations. Figure 2 shows the planned functional organization of the Phase 2 UW team. This team is an expansion of the Phase 1 team, in addition to one change to that team. The change is that Unity Technology is no longer providing the Digital Twin simulation of the transit centers. The UW team has replaced the Unity demonstration with an application called Audiom that assists individuals who are blind in navigating multi-level, indoor transit centers. That effort is being led by the Smith-Kettlewell Eye Research Institute (SKERI) with the actual software application being written by XR Navigation. The UW will contract directly with XR Navigation, but SKERI will play a stakeholder role in the design and testing of that application.



Source: University of Washington, 2022.

Figure 2. UW Team Functional Organization

The expansion of the project beyond the Phase 1 team consists of the addition of a number of partners, both paid and unpaid. Those partners are contributing funding, data, data vetting, applications, or training. These new partners include Sound Transit, Gaussian Solutions, MV Transportation, XR Navigation and Hopelink. Sound Transit will be providing local cost-share and project partnership. Gaussian Solutions, MV Transportation and XR Navigation are subcontractors who will be providing software or application development. Both MV Transportation and XR Navigation are also providing local match.

In addition, the UW will work with a large number of organizations to collect, vet, and publish data. These organizations include cities, DOTs, and transit agencies, as well as community and advocacy groups. These unfunded partners use their own resources to participate because they see benefit to their organization in the generation and sharing of the data that are the heart of this project.

Funding and contractual relationships with project partners are shown in Figure 3. Note that the cities shown in Figure 3 are examples of many cities that exist in the six-county study area and who are likely to participate as unfunded partners in the project.

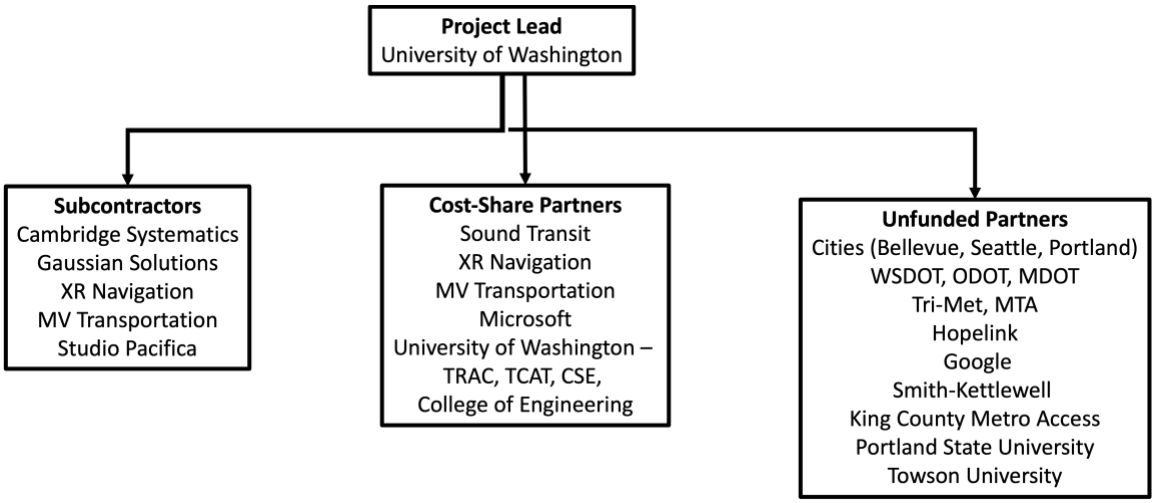


Figure 3: UW ITS4US Project Funding and Contractual Relationships

The three categories of partners in Figure 3 are as follows:

- Subcontractors, who will receive funding from the project,
- Cost-share partners who will provide cost-share to the project, and
- Unfunded partners.

For the subcontractors, budgets, scopes and letters of commitment have been obtained and formal contracts will be put in place once Phase 2 begins. Cost-share letters of commitment have been received for all cost-share partners. A large portion of the required project match is provided by Sound Transit. A Memorandum of Understanding (MOU) will likely be put in place for the work with Sound Transit. Sound Transit is not passing their funding through the UW. For the other cost-share partners, the cost-share letter of commitment is expected to be sufficient.

The unfunded partners are providing a variety of types of support. Many unfunded partners, such as the cities and the departments of transportations are providing data. Others are providing data

vetting and will be engaged as stakeholders. Portland State University and Towson University will potentially be teaching classes. For these partners, formal agreements will be put in place dependent on the level of engagement the partners have with the project.

The UW team expects that once data become available through the TDEI, a second set of organizations will become unfunded partners in the project. These unfunded partners will write third-party applications for end users that will provide additional benefits resulting from the ability of those unfunded partners to take advantage of the data generated and made public as a result of this project. TriMet also uses this model. TriMet publishes transit data, including General Transit Feed Specification (GTFS) data on its Trimet Developer Resources web site.[2] Third-party application developers are encouraged to write applications using that data. The TriMet web site lists third-party apps that have been developed using their data; as of the date of this report, there are 49 apps that have been developed with the TriMet data[3].

The Baltimore Metropolitan Council is also working with Toole Design to build applications that use routable sidewalk data. They currently wish to perform better active transportation planning and mobility planning for individuals with disabilities but lack sidewalk data. They are working with the UW team to determine the best path for obtaining those data so that consultants they have under contract can build such tools for them. Another example is the Southeast Michigan Council of Governments, who recently completed a sidewalk data collection effort, to build tools[4] they could use for planning purposes. The City NCHRP Synthesis 558[5] was recently published indicating the current interest in these data, lack of currently collected data, lack of uniformity in the data being collected, and the need for tools to take advantage of those data.

The additional applications that take advantage of the TDEI will cover a very wide range of services. For example, they might assist with asset management of pedestrian infrastructure, the planning/prioritization of services or infrastructure that would benefit cities and counties looking to expand the mobility of their communities, additional navigation services, or location exploration applications. Similarly, applications developed for transit agencies might identify where changes in service areas could more effectively meet the needs of the people with disabilities that they serve.

2.1 Partnership Status Summary

Table 1 describes the current and expected organizational partners to the UW's ITS4US project. This table describes the role each agency or organization is performing and the status of both formal contractual agreements and informal relationships.

[2] https://developer.trimet.org

[3] https://trimet.org/apps/index.htm

[4] https://semcog.org/blog/tools-to-plan-for-walking-and-biking

[5] https://www.trb.org/Main/Blurbs/181481.aspx

Table 1. Partnership Status Summary

Organization	Role	Phase 1 Status	Phase 2 & 3 Status
Institutional Partnerships			
University of Washington (UW)	Project lead, concept design lead, software development for the core system and Multi-Modal AccessMap application, data generation, design of data vetting, production of data vetting tools, project management, lead for project outreach.	Phase 1 contract with USDOT signed	NOFO response for Phases 2 and 3 submitted March 11.
USDOT	Sponsoring agency	Phase 1 Contract with UW signed.	Cooperative agreement required for Phases 2 and 3.
Sound Transit (ST)	ST operates a number of transit centers for which GTFS-Pathways data are currently being generated and will be provided to the project team. In addition, ST is actively developing software applications that use the GTFS-Pathways and OpenSidewalks (OSW) data standards to deliver navigation and routing information to travelers of all abilities. Cooperative development of software applications that use GTFS-Pathways and OSW data standards.	Stakeholder participant	Letter of commitment with match provided signed for Phase 2. Letter of intent with match signed for Phase 3. Letter of commitment for Phase 3 requires budget authority which will not come until the next ST budget cycle.
King County Metro (KCM)	KCM operates, through contractors, para-transit and on-demand accessible transit services in King County. It is working with its contractors to supply data in both OSW and GTFS-Flex data formats, as well as supporting interns working on the development of those data.	Stakeholder participant	Letter of commitment, with match provided signed for Phase 2 and Phase 3.
Washington State Department of Transportation (WSDOT)	WSDOT supports a variety of on-demand and flexible route transit service providers (e.g., small rural agencies). WSDOT is actively helping those agencies develop, maintain, and share GTFS-Flex data sets, which are being provided to this project.	Stakeholder participant, & letter of support for entire project	Stakeholder participant, & letter of support for entire project.
Oregon Department of Transportation (ODOT)	ODOT supports a variety of on-demand and flexible route transit service providers (e.g., small rural agencies). ODOT is actively helping those agencies develop, maintain, and share GTFS-Flex data sets, which are being provided to this project.	Stakeholder participant, & letter of support for entire project	Stakeholder participant, & letter of support for entire project.

Organization	Role	Phase 1 Status	Phase 2 & 3 Status
Maryland Department of Transportation (MDOT)	MDOT and the Maryland Transit Administration (MTA) support a variety of on-demand and flexible route transit service providers (e.g., small rural agencies). MTA helps those agencies develop, maintain, and share GTFS-Flex data sets, which are being provided to this project. MTA also operates a number of transit centers for which GTFS-Pathways data can be generated and provided to the project team	Stakeholder participant, & letter of support for entire project	Stakeholder participant, & letter of support for entire project.
TriMet (Portland, Oregon)	TriMet operates a number of transit centers for which GTFS-Pathways data can be generated and provided to the project team. TriMet also supports Open Trip Planner and other open-source data sharing and application development efforts which are being coordinated with this project	Stakeholder participant	Stakeholder participant Publicly available data shared. Possible data MOU.
City of Seattle	Data provider for pedestrian pathways and test location for planning applications and navigation applications that use those data.	Stakeholder participant Publicly available data shared	Stakeholder participant. Publicly available data shared. Possible data MOU.
City of Bellevue	Data provider for pedestrian pathways and test location for planning applications and navigation applications that use those data.	Stakeholder participant Publicly available data shared	Stakeholder participant. Publicly available data shared. Possible data MOU. May become a paid member of the project deployment team (to be decided in Phase 2).
City of Redmond	Data provider for pedestrian pathways and test location for planning applications and navigation applications that use those data.	Stakeholder participant Publicly available data shared	Stakeholder participant. Publicly available data shared. Possible data MOU.
Other cities in Wash., Ore., and Md.	Data providers for pedestrian pathways and test location for planning applications and navigation applications that use those data.	Stakeholder participant	Exploratory phase. Publicly available data shared, Phases 2 and 3 Possible data MOU with some cities

Organization	Role	Phase 1 Status	Phase 2 & 3 Status
Baltimore Metropolitan Council	Data provider for pedestrian pathways and test location for planning applications that use those data.	Stakeholder participant	Exploratory phase. Publicly available data shared, Phases 2 and 3 Possible data MOU with the Council
County governments in Wash., Ore., and Md.	Data providers for pedestrian pathways and test location for planning applications that use those data.	Stakeholder participant	Exploratory phase. Publicly available data shared, Phases 2 and 3 Possible data MOU with some counties.
Portland State University (PSU)	PSU has an excellent Urban Planning Program, with a very strong program in Active Transportation. The UW team is exploring teaming with PSU to offer a capstone class or design charette that builds and applies planning application tools using the OSW network being constructed for the Portland, Oregon metro area.	Stakeholder participant	Exploratory phase. Formal agreement to be signed if PSU offers a class, expected late Phase 2
Towson University (TU)	TU has an excellent Urban Planning Program, with a very strong program in Active Transportation. The UW team is exploring teaming with TU to offer a capstone class or design charette that builds and applies planning application tools using the OSW network being constructed for the Baltimore metro area		Exploratory phase. Formal agreement to be signed if TU offers a class, expected late Phase 2
Business Partnerships			
Cambridge Systematics, Inc. (CS)	Subcontractor assisting with project planning and execution, and supporting the documentation of the ConOps, System Requirements, and System Engineering Plans	Subcontract with UW signed	Letter of commitment, scope of work, and budget for Phase 2 and 3 received.
Studio Pacifica	Subcontractor assisting with stakeholder engagement, along with development and vetting of GTFS-Pathways data sets	Subcontract with UW signed	Letter of commitment, scope of work, and budget for Phase 2 and 3 received.
Gaussian Solutions	Subcontractor assisting with the development and coding of the central data system.		Letter of commitment, scope of work, and budget for Phase 2 and 3 received.

Organization	Role	Phase 1 Status	Phase 2 & 3 Status
Microsoft	Supporting development of AI techniques and collection of sidewalk data through both direct funding of UW activities and support of the G3ict[6] program which is also producing OpenSidewalks data and storing that data in public data repositories.	Stakeholder participant, & letter of support for entire project	Stakeholder participant. Matching funds received at UW as gifts. Letter of commitment for phases 2 and 3 received.
Google	Google is actively collaborating on data available for inclusion in Google Maps and techniques for delivering routing and navigation using that information. The tasks for which it is providing support are 1) support for AI data collection, 2) providing access to Google's "local guides" for data vetting, and 3) leading hack-a-thons to demonstrate multiple uses of the data being developed and published as part of this project.	Stakeholder participant, & letter of support for entire project	Stakeholder participant.
Smith-Kettlewell Eye Research Institute	Supporting development and delivery of applications that help individuals with low-vision or who are blind navigate and explore their environments.		Stakeholder participant. Letter of support for Phase 2 and Phase 3 received.
XR Navigation	Supporting development and delivery of applications that help low-vision and blind individuals navigate and explore their environments.		Letter of commitment, scope of work, budget, and match provided for Phase 2 and 3 received.
MV Transportation	Supporting development and use of private OSW repositories and their interaction with the public, shared OSW, provision of GTFS-Flex data.	Stakeholder participant	Letter of commitment, scope of work, budget, and match provided for Phase 2 and 3 received.
Moovit	Developing a third-party application that absorbs the OSW, GTFS-Pathways, and GTFS-Flex data and provides routing and navigation using those data.		Exploratory phase. Data terms and services to be signed if they become a 3rd party developer
Local Partnerships			

[6] G3ict: the Global Initiative for Inclusive Information and Communication Technologies https://g3ict.org/

Organization	Role	Phase 1 Status	Phase 2 & 3 Status
Hopelink	An on-demand transit service provider in Washington state that is working as a stakeholder with the UW team on the GTFS-Flex and OSW data standards and will be providing data to the team.	Stakeholder participant	Letter of support for Phase 2 and 3 received.
On-demand transit service providers	Transit service providers willing to generate and provide GTFS-Flex data standards to the team.		Exploratory phase (typically identified by state DOTs), expected late Phase 2 and early 3.
Disability Rights Washington	Advocacy group interested in partnering with the UW team for collecting, vetting, and publishing data required by its constituency to travel freely.		Exploratory phase, participation desired in Phase 2 and early Phase 3.
Lighthouse for the Blind	Advocacy group interested in partnering with the UW team for collecting, vetting, and publishing data required by its constituency to travel freely.		Exploratory phase, participation desired in Phase 2 and early Phase 3.
Move Washington	Advocacy group interested in partnering with the UW team for collecting, vetting, and publishing data required by its constituency to travel freely.		Exploratory phase, participation desired in Phase 2 and early Phase 3.
Boy Scouts of America	Working with local community groups (e.g., troop level) interested in partnering with the UW team for collecting, vetting, and publishing data about their community.		Exploratory phase, participation desired in Phase 2 and early Phase 3.
Girl Scouts of the USA	Working with local community groups (e.g., troop level) interested in partnering with the UW team for collecting, vetting, and publishing data about their community.		Exploratory phase, participation desired in Phase 2 and early Phase 3.
Other community organizations interested in either disability mobility or active transportation	Community groups interested in partnering with the UW team for collecting, vetting, and publishing data about their community.		Exploratory phase, participation desired in Phase 2 and early Phase 3.
Other Supporting Partnerships			
UW Internal Review Board (IRB)	Review and approval of UW team human subjects application.	Phase 1 IRB application approved	Phase 2 application is currently under review

Organization	Role	Phase 1 Status	Phase 2 & 3 Status
CALACT ITS4US team	The CALACT team shares a vision of a refined GTFS-Flex data standard and the generation and publication of GTFS-Flex data. The two teams are working on the standard together and will share GTFS-Flex data generated in the states of Oregon and Washington.	Stakeholder participant Active collaboration on GTFS-Flex	Stakeholder participant Active collaboration on GTFS-Flex in Phase 2 and Phase 3.
Facebook / Mapillary	The UW team has worked closely with the Facebook/Mapillary RapID team as part of working with updates to OpenStreetmap	Stakeholder participant	Stakeholder participant

2.2 Deployment Partnership Coordination Activities

This section provides a description of the roles of the different project partners with respect to the operation of the system being developed and deployed as part of the UW ITS4US project.

2.2.1 Concept of Operations (ConOps)

The project's Concept of Operations is described in the report *Phase 1 Concept of Operations, University of Washington ITS4US Deployment Project*, report number FHWA-JPO-21-861, June 28, 2021.

The organizations listed in subsection 2.1 have supported the UW ITS4US project in multiple ways. In particular, staff from these agencies have participated in a number of stakeholder and co-design meetings for the project dealing with data standards, data collection, vetting and feedback, data sharing and data publication. They also participated in, and provided feedback to the team during, the project's ConOps webinar and Systems Requirements walkthrough.

2.2.2 Performance Measures and Targets

The performance measures and targets for the UW ITS4Us project are described in the report *Performance Measurement and Evaluation Support Plan, University of Washington ITS4US Deployment Project,* report number FHWA-JPO-21-879, November 15, 2021.

The organizations listed in subsection 2.1 have supported the development of the performance measures and targets adopted for the UW ITS4US project in ways similar to those described for the Concept of Operations. Staff from these agencies have participated in a number of stakeholder and co-design meetings for the project dealing with data standards, data collection, vetting and feedback, data publication and system performance. The performance measures and targets were developed using the information obtained from those meetings. Stakeholders from these agencies also participated in, and provided feedback to the team during, the project's Performance Measurement webinar.

2.2.3 Operational Changes

The operational requirements for the TDEI were discussed in multiple stakeholder co-design meetings. The requirements are described in the report *Phase 1 System Requirements Specification (SyRS), University of Washington ITS4US Deployment Project,* report number FHWA-JPO-21-884, October 25, 2021.

Based on the outcomes of the SyRS plan as discussed and agreed to by stakeholders during the System Requirements Walkthrough, UW team has responsibility for determining the operational procedures of the TDEI. Input on any required refinements to those procedures will be provided by Gaussian Solutions, the project's primary software subcontractor as it responds to testing results on the software it produces. Similarly, the UW team will interact with third-party application developers as part of the Agile software development process being used to ensure that the software developed interacts correctly with that of those firms. If issues are identified during the Agile development process, then the feedback from those stakeholders will contribute to any required changes in the operational process.

Similarly, the TDEI will rely on ongoing interaction with a number of partners through a continuation of the stakeholder and co-design meetings that were held in Phase 1. In Phase 2, the UW team will work directly with the jurisdictions and agencies that provide data to the system including the following:

- Transit agencies that operate on-demand services,
- State DOTs that support many of the smaller transit agencies that provide those on-demand services,
- Transit agencies that supply GTFS-Pathways data,
- Jurisdictions that maintain data on sidewalks, pathways, and street crossings, and
- Local community organizations and advocacy groups that help vet data and supply missing sidewalk and pathway feature details.

All of these organizations are identified in Table 1.

During Phase 2, the procedures for the TDEI to interact with these various groups will be refined, tested, and implemented. The intent is to have strong two-way communication between the TDEI and each of the organizations/agencies/jurisdictions that will generate or vet data being published by the TDEI. As these two-way communication links are tested, feedback from these groups will be expected. That feedback will be used to refine both the procedures used for communicating data and data refinements, and the software used to facilitate the transfer of data between the participants. Feedback will be provided in written form as part of the regular stakeholder co-design meetings for the project. Feedback will be provided as shared mark-ups of those shared documents by the stakeholders participating in those meetings.

2.2.4 Governance Framework and Processes

There are two major governance aspects to this project. The first is associated with the three data standards. The second is associated with the governance and operation of the TDEI.

The data standards update process follows existing international data standards governance procedures. For example, the GTFS standards revision process can be found here:

https://gtfs.org/reference/realtime/changes/#specification-amendment-process and can be summarized as consisting of the following steps.

- Create a git branch with an update of all relevant parts of the protocol definition, specification, and documentation files (except for translations).
- Create a pull request on https://github.com/google/transit. The pull request must contain an extended description of the patch. The creator of the pull request becomes the advocate.
- The proposed change must be announced by its advocate in the GTFS Realtime mailing list.
- The discussion of the proposal follows. Pull request comments should be used as the sole discussion forum. The discussion lasts for as long as the advocate feels necessary but must be at least seven calendar days.
- The advocate can call for a vote on a version of the proposal at any point in time following the initial seven-day interval required for discussion.
- The vote lasts the minimum period sufficient to cover seven full calendar days and five full Swiss business days.
- The proposal is accepted if there is a unanimous consensus vote of “yes” with at least three votes.

Note that if a feature proposal that the TDEI believes is necessary is not approved, the standards rules allow the TDEI to implement the feature as a custom extension instead of part of the official specification.

Governance of the TDEI itself during the ITS4US project, and the five years of operation that follow the conclusion of the federal funding for the project, will be straightforward. For the entire ITS4US project, the University of Washington has responsibility for operation and governance of the TDEI. However, the UW team’s approach to the entire project centers on the co-design process, where stakeholders are heavily involved in the design process, and their input is thus sought out by the team prior to decisions being made. This model has been readily accepted in all project co-design meetings as well as the public webinars and system walkthroughs.

As part of phases 2 and 3 of the project, the UW team will investigate business models that provide stable, long-term funding for operation, maintenance, and expansion of the data services developed and implemented in this project. These alternative business models are described in Section 5. A number of different business models are being explored, and the post-ITS4US project governance structure will change with the business model adopted.

2.2.5 Data Sharing Agreements

Data sharing is a major ingredient of this project. For partners who share data with TDEI, the need for a formal data sharing agreement will be evaluated based on several conditions. One item the team will evaluate is if the data sharing is ‘substantive’ (e.g., ongoing data sharing) or ‘non-substantive’ (e.g., data is downloaded from the partner’s web site).

For the purpose of this document, we define ‘non-substantiative’ data sharing as the case where data is downloaded from the partner’s web site or API or where the UW Team makes a one-time request to a partner for data for purposes of exploring and evaluating that data. When the UW Team downloads data from a partner’s web site or API, it is expected that the web site will have

terms and conditions for the use of that data that must be accepted before the data is downloaded. The UW Team will review those terms and conditions to ensure that TDEI's planned use of that data is consistent with the terms and conditions. In this case, the acceptance of the terms and conditions will constitute the agreement between the UW TDEI Team and the partner. For a one-time data request for exploratory purposes, no formal agreement will be signed.

Data sharing is considered 'substantiative,' if data transfer occurs more than as a one-time exploratory data request, or as a data download from the partner's web site. If data sharing is substantive, the need for a formal data sharing agreement will be evaluated with the partner. Note that the data the project needs from these partners is public sector data that the agencies typically provide upon request. Further, much of the data may be available via web feeds, especially from the transit agencies, which limits the need for formal agreements with these agencies.

To date, no participating agency or jurisdiction has requested a data sharing agreement for the publicly available sidewalk, signal control, or crossing data obtained from a jurisdiction or organization. The project team has reviewed and agreed to terms and conditions of web sites when downloading data.

For sidewalk data, the UW is publishing publicly observable data. The jurisdictions do not need to agree to make it public. It is readily observable. The fact that it is easier to obtain it from those jurisdictions is a benefit to the project. Encouraging its use by the jurisdiction has benefits to that jurisdiction, but they do not need to agree to the data being made public. Similarly, transit service data are already published publicly – at a minimum, on paper. Thus, the transit agencies do not need to agree to make the data public. They already are public. They are just now electronically available.

In one instance to date, sidewalk data being generated by a private company at the behest of a public agency within the UW ITS4US project area did not come with the rights to be shared publicly. The agency purchasing these data was therefore not able to share the data with the TDEI. When an agency purchases data from a private company, it is responsible for obtaining the rights to publish those data, and if those rights are not obtained, those data cannot be shared with the TDEI. When existing data cannot be shared, the TDEI will explore other options for obtaining similar data. For example, in the case of privately generated sidewalk data, the TDEI will use its own software, imagery, and data vetting procedures to generate sidewalk data that can be shared freely with the public.

All TDEI data will be shared under Open-Source licenses. Those licenses will stipulate that, while the data are publicly available, those data come with no express or implied warranties. Users of the data, including application developers, will be made aware that they use those data at their own risk and that errors may be present in the data.

2.2.6 Financial Agreements

The funds for the operation of the TDEI during the three phases of the ITS4US project that are partially funded by USDOT are defined in the project's Integrated Complete Trip Deployment Plan. A summary of planned expenditures for both federal and local shares for Phase 2 is shown in

Table 2. Table 3 shows federal and local funding shares for Phase 3. Phase 1 funding of $1,800,000 was entirely provided by USDOT.

A thorough discussion of the Phase 2 and 3 financial plan is presented in Section 3.1.2 below.

Table 2. Phase 2 planned expenditures and funding by source

Organization	Federal Share	Local Share
University of Washington	$4,550,200	$200,000
Cambridge Systematics	506,000	
Gaussian Solutions	2,304,000	
XR Navigation	98,800	65,650
MV Transportation	100,000	71,030
Studio Pacifica	100,000	
Sound Transit		1,500,000
Microsoft		100,000
King County Metro		63,320
Total	**$7,659,000**	**$2,000,000**

Table 3. Phase 3 planned expenditures and funding by source

Organization	Federal Share	Local Share
University of Washington	**$1,749,255**	$300,000
Cambridge Systematics	**74,345**	
Gaussian Solutions	**176,400**	
Studio Pacifica		
Sound Transit		200,000
Total	**$2,000,000**	**$500,000**

For Phase 2 and Phase 3 of the project, the University of Washington will enter into a cooperative agreement with USDOT, will continue to lead the UW ITS4US project, and will be responsible for signing contracts with other agencies and firms participating in the project using either UW funds or USDOT funds. The UW will then execute subcontracts with Cambridge Systematics, Gaussian Solutions, XR Navigation, MV Transportation, and Studio Pacifica.

In Phase 1, the UW has subcontracts with Cambridge Systematics and Studio Pacifica. Cambridge Systematics has provided considerable support in developing key documents for the project. Studio Pacifica has provided significant support in helping lead stakeholder group meetings.

The UW will also be responsible for funding the operation of the TDEI for the five years immediately following the conclusion of the ITS4US project. Long-term funding and operation of the system will be dependent on work to be performed in phases 2 and 3, which includes the development of a business model acceptable to the organization that operates the TDEI. While the UW is a possible long-term operator of the system, a number of other options are possible. The leading options are briefly discussed in Section 5 of this document.

3 Phase 1 Partnerships and Agreements Details

This chapter describes the UW ITS4US team's Phase 1 partnerships and agreements. It does not address how those agreements are expected to change for Phase 2, Phase 3, or for operation of the TDEI after the end of the Phase 3.

3.1 USDOT Phase 1 Contract

3.1.1 Documentation

The UW ITS4US Phase 1 contract is a fixed price contract between the University of Washington and the USDOT, issued through the Federal Highway Administration's Office of Acquisition and Grants Management. The contract was originally signed on January 6, 2021, with a period of performance from January 15, 2021 to January 14, 2022. The contract has been modified three times at the request of USDOT, so that the end date is now June 15, 2022.

The Contracting Officer's Representative is Kate Hartman.

3.1.2 Financial Agreements

The Phase 1 fixed price contract consists entirely of federal funds. There is no formal local match. The contract has a value of $1,800,000. Payments are provided by USDOT to the UW upon the successful completion of 14 tasks. A summary of planned expenditures for both federal and local shares for Phase 2 is shown above in Table 2 in Section 2.2.6. Table 3 in that same section shows federal and local funding shares for Phase 3.

As shown in Tables 2 and 3 above, Phases 2 and 3 are being funded by a combination of USDOT funds and local funds, including internal funds from the University of Washington, and funds supplied by Microsoft, Sound Transit, King County Metro, MV Transportation, and XR Navigation. Additional funding sources may also be incorporated into the work being performed in Phase 3. Letters committing the match funding have been received from all partners. Match from MV Transportation and XR Navigation is in-kind. King County Metro will be hiring and supervising interns that generate and vet data for the project. The University of Washington and Microsoft match funding is cash.

A major source of local match for the project will come from Sound Transit. Sound Transit has committed to spend $1,500,000 for local match during Phase 2. Sound Transit will control these funds but will spend them on data generation and vetting, and the creation, testing, and deployment of applications which use the TDEI as primary data inputs. Sound Transit has also submitted a letter of intent to provide an additional $200,000 in match for Phase 3 but cannot formally commit to those funds until their next budget cycle. This commitment will be obtained during Phase 2 and prior to the Go/No Go point for Phase 3. Sound Transit will not be passing these funds through the UW, but will be directly contracting with their selected suppliers.

For Phase 2 and Phase 3 of the project, the University of Washington will enter into a cooperative agreement with USDOT, will continue to lead the UW ITS4US project, and will be responsible for signing contracts with other agencies and firms participating in the project and using either UW funds or USDOT funds. The UW will then execute subcontracts with Cambridge Systematics, Gaussian Solutions, XR Navigation, MV Transportation, and Studio Pacifica.

In Phase 1, the UW has subcontracts with Cambridge Systematics and Studio Pacifica. Cambridge Systematics has provided considerable support in developing key documents for the project. Studio Pacifica has provided significant support in helping lead stakeholder group meetings.

The UW will also be responsible for funding the operation of the TDEI for the five years immediately following the conclusion of the ITS4US project. Long-term funding and operation of the system will be dependent on work to be performed in phases 2 and 3, which includes the development of a business model acceptable to the organization that operates the TDEI. While the UW is a possible long-term operator of the system, a number of other options are possible. The leading options are briefly discussed in Chapter 5 of this document.

In addition to the software development work, the UW and its partners (both funded and unfunded) will provide assistance to some agencies for the development and publication of data. In most cases, this will involve the UW team and its participating agencies using a combination of federal and local funds to generate data sets that are then shared with the agencies and the public. One example of this is that participating state departments of transportation (e.g., WSDOT and ODOT) are paying to develop GTFS-Flex data sets for small transit agencies in their states. The funds being used by ODOT and WSDOT are not coming from this project and are not being used as match for this project. These data sets will be shared with both the CALACT and UW ITS4US teams, illustrating the overall level of cooperation and support from both the state DOTs and the CALACT team with the UW team. The UW ITS4US project will not sign formal financial agreements for these data generation activities.

In a second work area of Phase 2, project-related funds will be spent to develop, test, refine, and deploy software and systems that greatly lower the cost of generating data that meet the requirements of the three data standards contained in the TDEI (GTFS-Flex, GTFS-Pathways, and OpenSidewalks). An example of this is the use of AI software developed by the UW with funding from Microsoft's AI for Accessibility project within the G3ict[7] program to develop baseline, routable sidewalk network data for use within the TDEI.

In Phase 2, the UW will not provide funds to, or sign specific financial agreements with, cities and other jurisdictions but will instead generate data for those cities and jurisdictions and merge those data with other data (e.g., the location and details of traffic control devices) supplied at no cost and by those cities. These data will become the routable pathway data published in the TDEI, needed by pedestrians, and delivered to end users in Phase 3 of the project. As noted earlier, the

[7] G3ict: the Global Initiative for Inclusive Information and Communication Technologies https://g3ict.org/

data will be available under an open-source license. No additional financial agreements are expected in Phase 3.

After the conclusion of the ITS4US project, additional financial agreements may be signed to provide ongoing financial support of the TDEI. These agreements would be part of the adopted business model for long-term sustainability of the TDEI. The need for, and design of, these agreements will be discussed with USDOT as part of the development and adoption of the business model. This work will be performed as part of phases 2 and 3.

3.2 Institutional Partnerships

Table 4 provides a list of the current set of institutional partners for the UW ITS4US project. With the exceptions of Sound Transit and the two universities, the role of all institutional partners is to help supply accurate data in the adopted standard formats that can be published via the TDEI, so that the users of participating transit agencies, and travelers within participating jurisdictions have both improved discoverability of travel options and better navigation while using those options.

Table 4. List of Institutional Partners

Institutional Partner	Nature of Support	Deployment Phase
University of Washington (UW)	Project Lead, Providing Match Funding	1, 2, 3, Post
USDOT	Project Sponsor	1, 2, 3, Post
Sound Transit (ST)	Data Generation, Application Development, Test Location, Deployment Site, Providing Match Funding	2, 3, Post
King County Metro (KCM)	Data Generation, Application Development Support. Providing Match Funding	2, 3, Post
Washington State Dept. of Transportation (WSDOT)	Data Generation	2, 3, Post
Oregon Dept. of Transportation (ODOT)	Data Generation	2, 3, Post
Maryland Dept. of Transportation (MDOT)	Data Generation	2, 3, Post
TriMet (Portland, OR)	Data Generation, Deployment Site	2, 3, Post
Portland State University (PSU)	Data Vetting, Training, Third-Party Application Development	2, 3, Post
Towson University (TU)	Data Vetting, Training, Third-Party Application Development	2, 3, Post
City of Seattle	Data Provider	1, 2, 3, Post
City of Bellevue	Data Provider	1, 2, 3, Post
City of Redmond	Data Provider	1, 2, 3, Post
Other cities in Wash., Ore., and Md.	Data Provider	2, 3, Post
Baltimore Metropolitan Council	Data Provider	2, 3, Post
County governments in Wash., Ore., and Md.	Data Provider	2, 3, Post

Sound Transit is an exception in that it is actively coordinating its development of new data sources and applications to deliver those data with this project. In addition, its cooperation allows the use of its facilities as the initial test location for end user applications being developed as part of this project. Initial testing will be done in the downtown Seattle Link stations, but then deployed across the Sound Transit system when data are available.

The two university partners (Portland State and Towson University) are currently being recruited to participate in the project. Their role, if they accept it, will include training students in the techniques being developed, helping vet data in the geographic areas near them, and developing new techniques for using those data to help identify and prioritize infrastructure and transit service improvements as part of capstone and professional development opportunities for their students.

At this time, the smaller, on-demand transit agencies that will provide GTFS-Flex data are not being treated as “institutional partners.” In some cases, these are privately owned service providers that operate under contract to public agencies. In other cases, these small agencies will provide data through contracts supported by the state DOTs. These details will be determined in Phase 2, as the UW project team works with those state DOTs.

Work performed in Phase 1 of the project has shown that there are very different governmental structures in the three participating states. For example, 60 independent cities are found in the two Washington counties included in the project. In contrast, there are only 15 independent cities in the two Oregon counties, and only two cities and one town in the two Maryland counties. At this time, the local governmental agencies and jurisdictions that have been contacted have all simply cooperated with the project team because of the potential benefits they can gain from participating in the project. No formal agreements have been signed with these organizations. During Phase 2, as two-directional feedback mechanisms are developed to help maintain the quality of the data stored in the TDEI, formal agreements with local jurisdictions and agencies may become appropriate. Formal agreements will then be negotiated and signed at that time.

3.2.1 Documentation

Formal agreements, especially data sharing agreements are valuable because they can help clarify the parameters of data sharing and prevent misunderstandings and miscommunications about how the shared data will be used. Such agreements can help ensure that the TDEI’s data usage is in line with the expectations of partners who share data with TDEI.

For partners who share data with TDEI, the need for a formal data sharing agreement will be evaluated based on several conditions. As noted earlier, one item the team will use in that evaluation is if the data sharing is ‘substantive’ (e.g. ongoing data sharing) or ‘non-substantive’ (e.g. data is downloaded from the partner’s web site).

For the purpose of this document, we define ‘non-substantive’ data sharing as the case where data is downloaded from the partner’s web site or API or where the UW Team makes a one-time request to a partner for data for purposes of exploring and evaluating that data. When the UW Team downloads data from a partner’s web site or API, it is expected that the web site will have terms and conditions for the use of that data that must be accepted before the data is downloaded. The UW Team will review those terms and conditions to ensure that TDEI’s planned use of that data is consistent with the terms and conditions. In this case, the acceptance of the

terms and conditions will constitute the agreement between the UW TDEI Team and the partner. For a one-time data request for exploratory purposes, no formal agreement will be signed.

For other partners for which data sharing is deemed to be 'substantive', the UW Team will evaluate the need for formal agreements. For the purpose of this document, 'substantive' data sharing is all data sharing that does not meet the 'non-substantive' description above. Examples of substantive data sharing include a regular ongoing, possibly automated, data transfers, transfers of data to be ingested into the TDEI system and published via the TDEI API (that is data transfers for more than exploratory purposes). Data sharing with these substantive partners will begin with a discussion – either phone, zoom or in person, and will address the following topics: the time period for the data sharing, the intended use of the data, any constraints on use of the data, confidentially of data, data security and methods of data sharing. It is important that TDEI clearly articulate their planned use of the data so that the partner understands how their data will be used. It is expected that most data that TDEI ingests will be public data that is not confidential, so confidentiality and security are not expected to be topics of importance. Once this discussion has been had, the partner and TDEI team will determine if a formal data sharing agreement is appropriate, and it may be in many cases. Any data sharing agreements will address the topics listed above. Information for this paragraph has been adapted from: https://ura.uchicago.edu/page/data-sharing-agreements

For partners who use TDEI data in their applications via the TDEI APIs, those partners they will receive that data via the TDEI's APIs, the TDEI will require that partners agree to terms and conditions for the use of that data and will ensure that partners understand that the data is available 'as is' and that the TDEI disclaims liability for data errors. A sample terms and conditions document is found on the TriMet transit agency's web site[8].

3.2.2 Financial Agreements

In response to the Phase 2 Notice of Funding Opportunity (NOFO), letters of commitment have been provided by all partners providing local match. Sound Transit has committed to spend $1,500,000 for local match during Phase 2. Sound Transit has also submitted a letter of intent to provide an additional $200,000 in match for Phase 3 but cannot formally commit to those funds until their next budget cycle. This commitment will be obtained during Phase 2 and prior to the Go/No Go point for Phase 3.

King County Metro has committed $63,320 in match. Formal agreements will be signed as appropriate once the Phase 2 cooperative agreement has been signed between USDOT and the UW.

XR Navigation has committed $65,650 in in-kind match as part of the upgrade of their Audiom software.

[8] developer.trimet.org

MV Transportation has committed $71,030 in match as part of their set up, operation, and cloud costs of a Private OpenStreetMap (POSM) instance.

Microsoft provided a $100,000 gift to the Taskar Center, which will be used as match for this project.

The UW has committed $500,000 in match to the project, with $200,000 committed for Phase 2 and $300,000 committed for Phase 3.

3.3 Local Partnerships

The UW team is currently working to identify advocacy organizations and community groups that are interested and willing to support the data collection and data vetting tasks required to provide complete, accurate data sets within their communities. The private partners listed in Table 5 are those currently in discussion with the project team. Additional community organizations and advocacy groups are likely to be identified as part of Phase 2 and Phase 3.

Table 5. Local Partners

Local Partner	Nature of Support	Deployment Phase
Hopelink	Data Provider	2, 3, Post
On-demand transit service providers	Data Provider	2, 3, Post
Disability Rights Washington	Data Vetting	2, 3, Post
Lighthouse for the Blind	Data Vetting	2, 3, Post
Move Washington	Data Vetting	2, 3, Post
Boys Scouts of America	Data Vetting	2, 3, Post
Girl Scouts of the USA	Data Vetting	2, 3, Post
Other community organizations interested in either disability mobility or active transportation	Data Vetting	2, 3, Post

Other than a letter of support and cooperation with Hopelink, no formal agreements have been signed with these organizations. Formal agreements will be negotiated and signed with these groups as appropriate as part of phases 2 and 3 of the project. The UW team has experience with identifying and recruiting local data partners as a result of their work on multiple G3ict OpenSidewalks data generation projects. One result of that earlier work is that the team is confident that it will be able to find local partners, as multiple advocacy and community groups are interested in better sidewalk and transit data.

3.3.1 Documentation

At this stage of the project, no formal agreements have been signed between the UW and community groups or advocacy organizations. Formal agreements will be negotiated and signed with these groups as appropriate as part of phases 2 and 3 of the project.

3.3.2 Financial Agreements

At this stage of the project, no formal financial arrangements have been signed between the UW and local agencies, jurisdictions, community groups, or advocacy organizations. Formal agreements will be negotiated and signed with these groups as appropriate as part of phases 2 and 3 of the project. While this carries modest risk, the UW team has been able to find local partners in cities all over the world when developing OpenSidewalks networks as part of the G3ict effort, so we are confident that we will find local data partners for this project.

3.4 Business Partnerships

Table 6 lists the businesses currently expected to participate in the project. The table lists firms that will be placed under contract as part of Phase 2 to write software as part of the ITS4US project. It also lists firms that have a potential business interest in the TDEI, either because they wish to write applications that take advantage of the data the TDEI will contain or because they see a business opportunity in operating such a data system.

Table 6. Business Partnerships

Business Partner	Nature of Support	Deployment Phase
Cambridge Systematics, Inc. (CS)	Project Management and Documentation	1, 2, 3
Studio Pacifica	Stakeholder Engagement, ADA Infrastructure Reviews	1, 2, 3
Gaussian Solutions	Software Development	2, 3
Microsoft	Financial Support, Application Development, Business Model Input	1, 2, 3
Google	Financial Support, Business Model Input	1, 2, 3
Smith-Kettlewell Eye Research Institute	Application Development	2, 3, Post
XR Navigation	Application Development	2, 3
MV Transportation	Application Development, Data Provider	2, 3, Post

3.4.1 Technical Services

In Phase 1, only Cambridge Systematics, Inc. and Studio Pacifica were under contract to the UW as part of the ITS4US project. These contracts will be renewed should funding be obtained for phases 2 and 3 of the UW's ITS4US project.

If and when Phase 2 is awarded, the UW will sign contracts with Gaussian Systems, XR Navigation (working through Smith-Kettlewell Eye Research Institute), and MV Transportation. Gaussian Systems will write software for the core of the TDEI operations under the direction of the UW. XR Navigation will update its Audiom application so that it can absorb GTFS-Pathways data and provide routing and navigation for blind individuals through transit centers. MV Transit will work with the UW team to allow use of its current OpenPaths software as a private OpenStreetmap data repository.

3.4.1.1 Documentation

At this point in Phase 1 of the ITS4US project, only Cambridge Systematics and Studio Pacific are under contract to the UW. These agreements will be updated when the Phase 2 interagency agreement is signed between the UW and USDOT.

3.4.1.2 Financial Agreements

Microsoft has provided a $100,000 cash gift to the Taskar Center to be used as match for this project. A letter agreement has been submitted to the UW.

3.4.2 Vendor Procurement

The UW does not expect to require vendor procurements as part of the ITS4US project.

3.5 Other Supporting Partnerships

One of the efforts undertaken within phases 2 and 3 will be the development and adoption of a business model for future operation of the TDEI. The selection of the final business model will be dependent on business decisions yet to be made by a number of large technology firms. It is possible that once demonstrated as part of this project, the TDEI will be viewed as a positive business opportunity by one of several firms. It is also possible that the TDEI could be operated as a non-profit, perhaps as part of the OpenStreetMap. A number of other alternative business models are being explored to support post project operation of the TDEI. The outcome of the business model exploration may result in additional supporting partnerships to the UW ITS4US project during phases 2 and 3.

Finally, the UW ITS4US team has an ongoing relationship with the UW's IRB. The UW Internal Review Board (IRB) reviews all research involving human subjects that occurs at the UW or is led by UW Principal Investigators.

4 Risk Assessment

This chapter provide a list and brief description of institutional-, financial-, and partnership-related issues and risks currently identified by UW project team, along with the UW team's plan for mitigating and managing those risks.

As part of the project's risk management effort, new risks will be described at each of the routine project meetings with USDOT, and a Risk Register will be maintained as part of the Project Management Plan (PMP) in order track and manage those risks.

4.1 Organizational Risks

The UW team's initial list of risks relevant to organization and partnerships includes the following:

- Inability to agree on standards releases
- Inability to address privacy concerns at this stage of standard releases
- Inability to get standards adopted by service providers
- Adopted standard releases prove unable to meet the needs of the traveling public
- Lack of a successful business model to build, operate, and maintain the system of data and mobility applications
- Partial or complete loss of key staff or lack of available time for key staff due to accident or unexpected demand for those individuals from other projects.

The co-design and multi-technique approaches that are mentioned above and that are more fully discussed in the ConOps are key to mitigation of these risks. The co-design approach, which started in Phase 1, brings together the stakeholders involved in the larger eco-system in which we are working. This means that groups that control transportation services, application developers, and travelers with lived experience are all part of early review of the ongoing design of the system. By working with these groups directly, continuously, and from an early stage in the process, we are likely to identify specific risks early and to be able to plan for and address those risks. Finally, working with this wide range of stakeholders will allow the UW team to identify contingency plans if our preferred alternative is not feasible.

4.2 Schedule Risks

A key schedule risk for this project is the difficulty of estimating software development times. Software development tasks are known to be difficult to estimate accurately. This project is addressing this risk by, first, using the Agile software development methodology. That methodology is specifically intended to help mitigate the risks inherent in software development by breaking that development into small pieces that can be independently implemented and tested. In this way, any major estimation errors or issues can be discovered early and mitigated. Second, the team has recruited individuals and subcontractors with significant experience in

software development who have the capability to manage and deliver on software implementation projects.

4.3 Cost Risks

There are three major cost risks associated with this project. These risks are the cost of software development, the loss of local funding, and the potential for operations and maintenance costs being far larger than anticipated. These are related to the institutional, partnership, and financial plan in that funding is required to build, operate, and maintain the system. These and other, smaller risks are shown and briefly discussed in Table 7 on the next page.

The biggest cost risk is that the effort required to build the core software system has been significantly under-estimated. Software costs are known to be difficult to estimate accurately, which produces a risk for this project. The team is aware of this risk, and the software cost risk is being addressed and mitigated by using Agile software development as described in the Systems Engineering Management Plan (SEMP). Agile is a software development methodology in which tasks and estimates are created in short increments (e.g., two-week sprints), and progress on those tasks is closely monitored and regularly evaluated (e.g., every two weeks). By breaking tasks into small increments and regularly evaluating the progress of tasks and project progress, versus larger goals specified as releases and epics, software progress can be closely monitored, and any unexpected software cost issues can be identified early and addressed so the project can achieve its goals. In addition, we will document our processes and work so that if we should need to replace key software developers during the project, that documentation will make it easier to integrate a new person into the project with limited lost time or cost.

The second major risk is the loss of local funding. Phase 3 funding is somewhat at risk in that most of our funding partners do not budget three years out. They are therefore reluctant to commit funds three and four years out. To mitigate this risk, the team is working during both Phase 1 and Phase 2 to line up additional local match partners so that match exceeds the minimum 20 percent value.

The final major cost risk is that operational costs for the system may far exceed expected values. To mitigate this risk, the architecture is being designed specifically such that the system can be maintained both on the Cloud and locally. The Cloud has considerable operational advantages but carries more risk. If Cloud services prove too expensive, then the team will consider moving some or all of the services to university-provided systems where costs can be better controlled. The team will also explore operating agreements with technology firms that could reduce the operational costs of the system. These decisions will be made on the basis of early operational experiences provided through the Agile development process.

Table 7 summarizes the risks currently being tracked and planned for as the TDEI is developed and deployed.

Table 7. Example of Risk Assessment and Mitigation Matrix

Risk Title	Description	Mitigation
Standards acceptance	Inability to gain standards acceptance or new standards releases	Use custom extension option.
Privacy concerns	Inability to address privacy concerns within data standards	Use custom extension option.
Unmet needs	The data in the standards do not meet the needs of the users	Update standards through our co-design process, using local assistance to collect the additional data.
Poor business model	Lack of a successful business model	Adopt a lower cost, less efficient data storage model (e.g., store sidewalk data in OpenStreetMap, with state DOTs supporting a unified, small agency transit GTFS-Flex feed and large agencies supporting their own GTFS-Pathways feed.
Staff loss	Loss of key staff cause the project to run behind schedule.	Maintain contingency plans for replacing software development staff with software development partners, also cross-train and good documentation to mitigate staff loss and onboard new staff quickly.
Slow software development	Software development takes considerably longer than expected	Use Agile development process to better control time and cost of software development, and identify issues earlier, allowing for earlier identification of solutions, and thus better project management. Also: select software developers with experience in the types of software tools and systems being created.
Under-estimated costs	Software development costs are easily under-estimated	Use of Agile development process to better control time and cost of software development.
Loss of local funding	Participating partners do not control budgets three years out, making some local funding at risk	Line up additional funding participants for Phase 3 and post-deployment.
Operational costs are too high	Operational costs for the system far exceed expected values	Design software to run either in the Cloud (better performance) or on UW servers (better cost control).

5 Operations and Management Concept

For the ITS4US project, including the five-year period after the end of USDOT funding, operations and management of the TDEI will be the responsibility of the University of Washington. The UW will maintain all formal governance decisions over the TDEI but will make those decisions only after consultation with our stakeholders.

During Phase 2 and Phase 3, the UW ITS4US team will work with our stakeholders to determine the best business model for continued operation of the TDEI. A number of possible alternatives exist for that post-project business model, and the model selected will drive the post-deployment operations and management of the system.

5.1 Post-Deployment Operations and Management

The financial model for the TDEI relies on a combination of funding sources. This is true for phases 2 and 3, as well as for the five-year period after Phase 3 ends and on into the future. During all phases, funds for system operation and maintenance will come from multiple private and public sources. It is expected that the actual amounts and even the specific companies and public agencies involved in supporting the TDEI will change over time. The TDEI is a shared data system expected to grow and change over time, and consequently the costs and responsibilities will change as data users, uses, and priorities change.

Note that funds for data generation/collection/vetting will be different for each of the three different data types (pedestrian, on-demand, and transit center), and the funding of the ongoing operation of the data aggregation/storage/publication system are likely to be separate from the data generation/vetting process.

In all cases, the business model for the system needs to make sense to the organizations performing the required tasks. For public agencies, this means the data must be routinely used in order to compete for scarce agency resources. The use of the data must continue to meet important agency outcomes and policies. Similarly with private sector funds—whether as a business activity or as a foundation activity—the value of the outcomes from use of the data must exceed the cost of the financial contribution. In the case of a business, this is best measured by a positive revenue to cost relationship, but it can also result from meeting important corporate policy goals.

For phases 1 through 3 of the UW ITS4US project, the team is using federal funds to lower the local costs associated with the development, set-up, and testing of the system. However, local resources will be needed into the future to operate and maintain the system. The lower the cost of these activities, the more likely that funds will be available to perform them; therefore, a portion of the UW ITS4US project is developing tools that will lower the cost of ongoing activities such as data collection and data vetting. The UW ITS4US team is also encouraging third-party applications to use the data being generated because when public agencies/jurisdictions and

private companies experience those benefits, competing for available funds and thus generating sufficient revenue to maintain and grow the system will become easier.

To generate future support for the system during Phase 2, the UW ITS team will actively market the data, the services that can be created with those data, and the analytical transportation performance measures (e.g., equity measure of access) that become possible by using the data. The UW team has identified sufficient University of Washington resources to maintain the system for five years after the end of Phase 3, but new resources will be needed to further expand the system and operate it beyond the ITS4US program. Identification of those funds will be a key task during phases 2 and 3.

Financial plans—both those expected to occur and alternatives that are under consideration for post-Phase 3—are described below. In all scenarios, financial participation in the cost of operating the TDEI will be expected from both public and private entities.

5.1.1 Data Collection and Vetting

The source of funds for data collection and vetting is expected to vary with the type of data being generated, collected, and vetted.

5.1.1.1 GTFS Pathways

The transit agencies that own and operate transit centers are expected to pay for the expansion, vetting, and maintenance of GTFS-Pathways data. The ITS4US project has an objective of driving down the cost of that effort, but we expect that once those costs have been lowered, agencies will generate these data as part of making their systems accessible. Similarly, transit agencies will vet and maintain these feeds, just as they do their existing GTFS feeds.

5.1.1.2 GTFS Flex

For GTFS-Flex, larger, more sophisticated transit service providers are expected to generate, vet, and maintain GTFS-Flex data feeds and APIs. However, smaller, on-demand service providers will be unlikely to have the resources or technical ability to perform these tasks. The model the UW team expects is currently seen on the West Coast, where state DOTs traditionally provide funding and technical support for small, rural transit agencies; similarly, they are expected to provide financial support for the development and maintenance of GTFS-Flex at smaller agencies. In the case of on-demand medical or veterans' transportation services, funding is likely to come from the medical services sector (e.g., hospitals and insurance companies) that financially support these services and veterans' agencies. Again, the easier the ITS4US project can make the generation of GTFS-Flex data streams and the more beneficial the services that use those data, the more likely this support will be made available.

5.1.1.3 Sidewalk and Path Data

Unlike the two GTFS data systems, there is not a clear connection between a specific agency and sidewalk data. For example, in many cases, cities regulate but do not own sidewalks.[9] The result is that many cities do not have good sidewalk data, and the cost of collecting those data can be intimidating. However, routable sidewalk data have enormous potential for improving the quality and completeness of planning analyses related to equitable access to services and users' ability to safely achieve active transportation.

Already several private firms offer to provide basic routable sidewalk data. Therefore, where public interest in accessibility—especially equitable ADA access—is high, public funding for data collection will be possible. However, there are strong private sector motivations for collecting these data in many locations. For example, the same data needed to route a wheelchair are needed to route a freight delivery robot. Therefore, a market for these data exists, not just in the pedestrian navigation space and the public transportation and equity space, but also in a number of emerging private sector business markets. The UW ITS4US team expects that expansion of the TDEI routable sidewalk network beyond this project will be dependent on a combination of public and private sector activities, and the decision to generate these data will be made differently in different parts of the country.

However, once the data exist, maintenance and continued vetting of the data will depend on a combination of community involvement and self-interest from both public agencies that wish to use the data for planning purposes and private companies that need high quality data. Again, the exact mix of these funds will vary from region to region.

5.1.2 Operations and Maintenance Costs

The other major expense for the TDEI will be the ongoing operation and maintenance of the system. During the ITS4US project, these funds are being provided by a combination of federal project funds and local matching funds. Local funds will be used to operate and maintain the system for the five-year period at the end of the project.

The financial framework for operation and maintenance of the TDEI has not been finalized at this time. There are three potential business models, as well as a fourth model that is a combination of those three. The UW ITS4US team will explore each of these models as part of phases 2 and 3, working with interested and involved public and private sector partners. The four possible financial models are Public Operation, Private Operation, Non-profit Operation, and a Combination Model. Each of these is briefly outlined below.

[9] For example, in Seattle, RCW 35.69. 020(2)-(3) states that while the city generally has a right of way easement on sidewalks for public access, sidewalks in front of homes are not generally located on city property. Sidewalks are typically owned by the adjoining property owner, subject to the city's easement rights.

5.1.2.1 Public Operation

In the public operation model, one or more regional, state, or local entities will operate the TDEI (or a regional version of the TDEI). For example, in the Puget Sound region, the value of the combined transit and sidewalk data might be so high to the public sector that the Seattle metropolitan planning organization (MPO) would fund the continued operation of the system. Because the initial costs have already been paid for by the project, the MPO would be responsible only for operating and maintaining the system. This could be done by MPO staff or under contract. This business model exists in many parts of the country for regional traffic operations centers, which public agencies pay private contractors to staff and operate.

Under this model, it would also be possible for multiple regions or states to jointly fund the TDEI, or a regional/state-level TDEI. This model exists on the East Coast in the form of the I-95 Corridor Coalition, which allows states to jointly fund a program that helps operate much of the freeway system on the Eastern Seaboard.

The key to this model is that the public agencies that provide the funding to operate the system see sufficient benefit from the system to allocate scarce public funds. These benefits would be a combination of improved mobility for residents with disabilities, improved planning for active transportation modes, and a more competitive economic environment that derives from providing better access to the built environment for all users.

5.1.2.2 Private Operation

A second model is private sector operation. In this model, one or more technology firms would take over operation of the TDEI. That firm would then generate sufficient revenue from the use of those data to pay for the operation and maintenance of the system. An excellent example of this model is Google Maps. Google supplies a large amount of data through Google Maps. It generates funds from advertising on the maps and from fees paid by users of the data. (For Google, limited use of the data is free, but large data requests require payment.) The exact business model would be up to the private firm. Any firm operating the TDEI would then work with the groups collecting and vetting data to continue to expand and improve the base data. An excellent example of this type of business model is the operation of WAZE, which often signs data sharing agreements with public agencies.

5.1.2.3 Non-Profit Operation

A third model is for a non-profit organization to operate the TDEI. This could be the OpenStreetMap Foundation or another non-profit with a specific interest in either active transportation or disability mobility. As with the private firms, a foundation might generate revenue from the sale of access to the data when the use of those data was for commercial purposes. Note that one or more non-profits might choose to operate the TDEI, or even competing versions of the TDEI, as the data are publicly available and open-source licensed, so any non-profit can operate such a system if they have the financial ability and interest.

5.1.2.4 Combination Operation

Finally, these three models could be used in combination. That is, the public sector could work with a major technology firm to collect and vet data in return for reduced or no cost data access. It might work with a non-profit in much the same way.

It is also possible that the business model will change over time, as occurred with the evolution of the business models that support traveler information services. Early in the intelligent transportation systems (ITS) era, the public sector dominated traveler information. Now, while almost all public agencies maintain a basic level of traveler information delivery, much information delivery to travelers occurs via private sector companies, which both collect their own data and absorb the public data feeds. They then provide that combined information to travelers as part of their business model. It is entirely possible that such a combination model could eventually support the functions of the TDEI.

5.2 Post-Deployment Governance Structure

The post-deployment governance structure cannot be determined at this point in time. The governance structure must account for the business model that supports the system, and which of the alternative business models discussed above will be selected is not known.

5.3 Post-Deployment Partnerships

Similar to the governance structure, the post-deployment partnerships cannot be identified with confidence at this time. However, it is expected that the overall partnership structure from the UW ITS4US project will remain in place. That is, transit agencies will be responsible for generating GTFS-Pathways and GTFS-Flex data about their facilities and services. These data will be transferred to the operator of the TDEI, who will be responsible for aggregating these data and publishing them.

Sidewalk data will be generated from a variety of sources, ranging from private companies (potentially including the operator of the TDEI) to city and county governments. These data will be vetted by a combination of public resources and various advocacy and community groups. The operator of the TDEI will need relationships with each of these groups, although the exact nature of those relationships will be up to the operator of the TDEI.

Finally, the TDEI will need relationships with third-party application developers/providers who access the TDEI data and publish it via their applications to end users. Again, the exact nature of the relationships between the TDEI and the application developers/providers will be a function of the TDEI operator, and the business model being used by that operator.

6 Americans with Disabilities Act (ADA) Transition Plans

This section describes the status of the ADA transition plans for all project partners focusing on those partners who are covered by Title II of the ADA. Table 8 shows the status of ADA transition plans and self-evaluations for all project partners covered by Title II. The University of Washington has a formal Americans with Disabilities Act (ADA) transition plan. Neither the UW nor any of our deployment partners currently has an open legal action related to ADA transition planning. Three project partners have entered settlements or consent decrees: The Oregon Department of Transportation (ODOT), the Seattle Department of Transportation (SDOT) and the Portland Bureau of Transportation (PBOT).

Table 8 Status of ADA Transition Plan for Project Partners

Organization	Subject to ADA Title II Regulations (Yes/No)	Self-Evaluation Conducted (Yes/No)	ADA Transition Plan (TP) or Other Plan Developed (ADA TP, Other Plan, No Plan)	Date of Current Plan or Most Recent Update (with link)
University of Washington	Yes	Yes	ADA TP	10/2020 UW ADA Summary Seattle Campus ADA Plan
King County, WA	Yes	Yes	ADA TP	04/2021 King County ADA TP
Baltimore Metropolitan Council (BMC)	Yes	Yes	ADA TP	2016 BMC ADA TP
City of Bellevue	Yes	Yes	ADA TP	01/2019 Bellevue ADA TP
City of Seattle / Seattle Department of Transportation (SDOT)	Yes	Yes	ADA TP	12/2020 SDOT ADA TP
City of Portland / Portland Bureau of Transportation (PBOT)	Yes	Yes	ADA TP	07/2021 PBOT ADA TP
City of Redmond	Yes	Yes	ADA TP	02/2021 Not available online

Organization	Subject to ADA Title II Regulations (Yes/No)	Self-Evaluation Conducted (Yes/No)	ADA Transition Plan (TP) or Other Plan Developed (ADA TP, Other Plan, No Plan)	Date of Current Plan or Most Recent Update (with link)
Washington State Department of Transportation	Yes	Yes	ADA TP	04/2018 WSDOT ADA TP
Oregon Department of Transportation (ODOT)	Yes	Yes	ADA TP	04/2017 ODOT ADA TP
Maryland Department of Transportation (MDOT)	Yes	Yes	ADA TP	12/2009 MDOT ADA TP
Portland State University (PSU)	Yes	Unsure	Unsure; exploratory phase; has been contacted	PSU Accessibility Plans
Towson University (TU)	Yes	Unsure	Unsure; exploratory phase; has been contacted	TU Accessibility Plans
Sound Transit	No	N/A	Other Plan	Sound Transit Accessibility Plans
TriMet	No	N/A	Other Plan	TriMet ADA Plans
Maryland Transit Association (MTA)	Yes	Yes	ADA TP	Draft 01/2022 MTA ADA TP
Cambridge Systematics	No	N/A	N/A	N/A
Studio Pacifica	No	N/A	N/A	N/A
Gaussian Solutions	No	N/A	N/A	N/A
Microsoft	No	N/A	N/A	N/A
Google	No	N/A	N/A	N/A

Organization	Subject to ADA Title II Regulations (Yes/No)	Self-Evaluation Conducted (Yes/No)	ADA Transition Plan (TP) or Other Plan Developed (ADA TP, Other Plan, No Plan)	Date of Current Plan or Most Recent Update (with link)
Smith-Kettlewell Eye Institute	No	N/A	N/A	N/A
XR Navigation	No	N/A	N/A	N/A
MV Transportation	No	N/A	N/A	N/A
Hopelink	No	N/A	N/A	N/A
Facebook	No	N/A	N/A	N/A

In March 2017, the courts approved a Settlement Agreement that the Oregon Department of Transportation (ODOT) will be operating under until 2032. Details of this agreement, appendices, and related annual reports can be found on the ODOT Making Transportation Accessible web site[10]. The City of Portland entered into a consent decree[11] in September 2018. The City of Seattle (Seattle Department of Transportation) entered into a consent decree[12] in July 2017.

As part of this project, the UW team has been contacting partners' ADA Coordinators and reviewing partners' ADA transition plans in part because use of the data generated and published as part of the TDEI can help partners better meet both the spirit and letter of the law. Part of the work being explored in cooperation with the TDEI's implementation is to take our data and work with interested parties (e.g., university researchers, students, and advocacy groups) to develop tools and techniques to identify and prioritize improvements that will help jurisdictions both meet their legal requirements and reach their broader accessibility goals. The TDEI team will consider

[10] https://www.oregon.gov/odot/About/Pages/ADA.aspx

[11] https://www.portland.gov/sites/default/files/2020-06/consent-decree-judgment.pdf

[12] https://www.documentcloud.org/documents/3896496-Curb-Ramp-Settlement.html

the (Proposed) Public Rights-of-Way Accessibility Guidelines (PROWAG)[13] and Complete Streets Building Guidelines[14] in this work.

Portland State University (PSU) and Towson University (TU) are included in this table as they were explicitly mentioned as project partners in prior tables and are subject to Title II requirements. Partnerships with both PSU and TU are in the exploratory phase, and we have contacted both PSU and TU about their ADA transition plans but have not heard back from them. The table will be updated as these partnerships evolve.

[13] https://www.access-board.gov/prowag/

[14] https://highways.dot.gov/complete-streets

Appendix A. Acronyms and Glossary

This appendix includes a list of acronyms and a glossary of key terms used in the document.

Acronym	Definition
ADA	Americans with Disabilities Act
API	Application program interface
BMC	Baltimore Metropolitan Council
ConOps	Concept of Operations
CS	Cambridge Systematics Inc.
DOT	Department of transportation
FHWA	Federal Highway Administration
G3ict	Global Initiative for Inclusive Information and Communication Technologies
GTFS	General Transit Feed Specification
GTFS-Flex	The Flex route extension to the General Transit Feed Specification, designed to describe demand-responsive or paratransit service
GTFS-Pathways	The Pathways extension to the General Transit Feed Specification which defines pathways linking together locations within stations
IRB	Internal Review Board
IT	Information technology
ITS	Intelligent transportation system
ITS JPO	Intelligent Transportation Systems Joint Programs Office
ITS4US	The name of a USDOT program to enable communities to showcase innovative business partnerships, technologies, and practices that promote independent mobility for all that is led by the Intelligent Transportation Systems Joint Program Office with support from the Office of the Secretary of Transportation, Federal Transit Administration, and Federal Highway Administration.
KCM	King County Metro
MDOT	Maryland Department of Transportation
MPO	Metropolitan planning organization
MTA	Maryland Transit Administration
ODOT	Oregon Department of Transportation
OSW	OpenSidewalks
PBOT	Portland Bureau of Transportation
PMP	Project Management Plan
POSM	Private OpenStreetMap data repository
PROW	Public right of way
PSU	Portland State University
RFP	Request for proposal

Acronym	Definition
RRFB	Rectangular Rapid Flashing Beacon
SDOT	Seattle Department of Transportation
SEMP	Systems Engineering Management Plan
ST	Sound Transit
Taskar Center or TCAT	Taskar Center for Accessible Technology at the University of Washington
TDEI	Transportation Data Equity Initiative
TRAC	Washington State Transportation Center at the University of Washington
TriMet	Tri-County Metropolitan Transportation District of Oregon
TU	Towson University
U.S.	United States
USDOT	United State Department of Transportation
UW	University of Washington
WSDOT	Washington State Department of Transportation

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