# MOD
## MOBILITY ON DEMAND

# MOD SANDBOX DEMONSTRATIONS INDEPENDENT EVALUATION

## PIERCE TRANSIT LIMITED ACCESS CONNECTIONS EVALUATION PLAN

Providing first and last mile service connections for transit users.

**PIERCE TRANSIT**

This is a pilot project to provide first and last mile connections to and from transit centers and bus stops. Lyft rides will be provided at no cost to the rider in specific areas (or "zones") within Pierce Transit's service area, on certain days and at specific times of the day.

**Have Questions?**
Learn More At piercetransit.org/Limited-Access-Connections

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## Notice

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**16. Abstract**

The Mobility on Demand (MOD) Sandbox Demonstration Program provides a venue through which integrated MOD concepts and solutions – supported through local partnerships – are demonstrated in real-world settings. For each of the 11 MOD Sandbox Demonstration projects, the MOD Sandbox Independent Evaluation includes an analysis of project impacts from performance measures provided by the project partners, as well as an assessment of the business models used.

This report constitutes the Evaluation Plan for the Pierce Transit (PT) Limited Access Connections Sandbox project. It includes the following chapters: project overview; evaluation approach and process; evaluation schedule and management; and data collection & analysis plan.

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# Chapter 1. Project Overview

This chapter gives a brief introduction to the Pierce Transit Limited Access Connections MOD Sandbox Project that will be evaluated through this Independent Evaluation.

## Introduction

Pierce Transit (PT) provides public transportation services in the urbanized area of Pierce County, Washington, Washington's second largest county. This area includes the City of Tacoma; and the communities of Edgewood, Fife, Fircrest, Gig Harbor, Lakewood, Milton, Puyallup, Ruston, Steilacoom, Tacoma, University Place; portions of Auburn and Pacific; and some unincorporated portions of Pierce County. The service area population is 557,069.

## Project Scope

PT is proposing a three-pronged approach to address the issues facing its community. The issues include park and ride lot congestion, fixed route service ending before night classes finish, and concentrated population living outside a walkable distance from fixed route bus service. Based on an average Lyft trip cost using various zones and times of day, PT calculated an average trip cost of $11 for their rideshare partners. All trips are subsidized and offered in the following ways:

- The first approach is a first/last mile solution, and refers to those riders needing transportation to or from transit because their start or end point lies beyond a half-mile from nearest transit access. Pierce Transit is collaborating with their rideshare partner to provide first/last mile service in and between select zones, and these trips are subsidized.
- The second approach is a guaranteed ride home, which refers to those riders travelling home after service has stopped for the night. These rides will be subsidized and covered by grant funds.
- The third approach will provide trips to and from park and ride lots and Sound Transit stations to reduce congestion. These services will increase throughput at stations served by parking-constrained park and ride lots, provide connections to existing bus routes, and provide rides home outside of regular service hours. These trips, like the others mentioned, are also subsidized.

Total funding for this project is $206,000 in U.S. Department of Transportation (USDOT) funds and $51,500 in local matching funds.

## Key Partners

Pierce Transit is partnering with Pierce College Puyallup, Sound Transit, and Lyft.

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# Project Timeline

The main milestones for the Pierce Transit program are captured in the timeline below. Please note that the evaluation timeline is provided in a later chapter of this report

1. **January 19, 2017 –** Agreement Execution Date with the USDOT.

2. **May 2018 –** Field Demonstration of Phase 1: Soft Launch in all zones without materials on board fixed route (to aim outreach at those who do not yet ride transit) Mailers to households in zones. Kickoff event at College.

3. **June 2018 –** Field Demonstration of Phase 2: Roll out materials on fixed route to alert current riders. Promote on local TV and with neighborhood councils.

4. **May 2019 –** Field Demonstration of Phase 1 & 2 Demonstrations are completed.

5. **June 2019 –** Final Project Report is submitted by the Pierce Transit team to the USDOT.

Pierce Transit will collect data relevant to this MOD Sandbox Demonstration (as outlined in this Evaluation Plan) between May 2018 and May 2019, and will share the data with the IE team for conducting the evaluation. More details on the data collection planning are provided in Chapters 3 and 4 of this report.

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# Chapter 2. Evaluation Approach and Process

For each of the 11 MOD Sandbox Projects, the IE team developed an evaluation framework in coordination with each project team – the framework is a project-specific logic model that contains the following entries:

1. **MOD Sandbox Project –** Denotes the specific MOD Sandbox project.

2. **Project Goals –** Denotes each of the project goals for the specific MOD Sandbox project. The project goals capture what each MOD Sandbox project is trying to achieve.

3. **Evaluation Hypothesis –** Denotes each of the evaluation hypotheses for the specific MOD Sandbox project. The evaluation hypotheses flow from the project-specific goals.

4. **Performance Metric –** Denotes the performance metrics used to measure impact in line with the evaluation hypotheses for the specific MOD Sandbox project.

5. **Data Types, Elements, and Sources –** Denotes the Data Types, Elements, and the Data Sources used for the identified performance metrics.

6. **Method of Evaluation –** Denotes the quantitative and qualitative evaluation methods used.

This Chapter details the evaluation approach and process, as finalized in the evaluation logic model for the Pierce Transit MOD Sandbox project. This includes listing project goals, evaluation hypotheses, performance metrics, data types, elements and sources, and methods of evaluation.

## Project Goals

The project goals denote the objectives that Pierce Transit is aiming to achieve through the MOD Sandbox demonstration. These project goals include the following:

1. Increase the quality of transit service

2. Increase overall ridership on Pierce Transit

3. Increase ridership on Pierce Transit due to the new service

4. Increase access to Pierce Transit Bus Routes and Sound Transit stations

5. Provide access services more cost effectively

6. Provide paratransit services more cost effectively

7. Reduce parking lot use

8. Lower travel times

9. Lower wait times

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10. Users of wheelchairs report improved mobility

11. Reduce net vehicle miles traveled

12. Increase the quality of transit service for Pierce College Puyallup

13. Improve transit use through the guaranteed ride home

14. Improve transit use through the guaranteed ride home

15. Increase Student enrollment in the program

16. Increase transit use and rider satisfaction among those beyond the walk shed of the service corridor

17. Comply with ADA equivalent level of service requirements

18. Produce lessons learned through stakeholder interviews.

The project goals set the foundation for the Evaluation Hypotheses.

## Evaluation Hypotheses

The Evaluation Hypotheses flow from the project-specific goals, and denote what should happen if each Project Goal is met. These Evaluation Hypotheses include the following:

1. The perception of transit service quality (including the Pierce Transit brand) will improve among riders

2. The overall ridership on Pierce Transit increases

3. Users of the new service ride transit more because of the new service

4. The number of people accessing the Sound Transit stations and Pierce Transit bus lines increases

5. The cost effectiveness of the rideshare service provision will be better than previously demonstrated fixed route services

6. The cost effectiveness of the rideshare service will be better than previously demonstrated paratransit services

7. The program will reduce parking lot use

8. The overall travel times of users decrease

9. The overall wait times of users decrease

10. Passengers using wheelchairs will (on average) report improved mobility

11. By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction

12. The perception of transit service quality will increase for Pierce College Puyallup students

13. Riders that use the guaranteed ride home will report improved mobility and accessibility

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14. The guaranteed ride home enables increased transit use

15. Student enrollment may increase, especially those enrolled in night classes

16. The spatial spread of people using Pierce Transit and Sound Transit increases

17. The process of deploying the project will produce lessons learned and recommendations for future research and deployment

18. First and last mile service to passengers with disabilities is equivalent to that provided to passengers without disabilities.

The success of each Evaluation Hypothesis is measured by the Performance Metrics below.

# Performance Metrics

The performance metrics are used to measure impact in line with the evaluation hypotheses for the Pierce Transit Independent Evaluation. These performance metrics include the following:

- Reported perception of transit service quality by Pierce Transit riders.

- Reported sentiment on the impact of transportation choice for Pierce Transit Riders.

- Unlinked trips on supported bus and rail lines (per line for lines affected by the program)

- Reported impact on personal ridership by users of the service

- Number of riders accessing transit stations and bus lines before and after project (per line/station for lines/stations affected by the program)

- Dollars spent per rider accessing Sound Transit stations and Pierce Transit bus routes. This will be broken out by connections at Sound Transit stations.

- Dollars spent per rider relative to dollars spent per paratransit rider

- Park and ride utilization according to parking lot counts that track percentage of parking spaces full

- Reported travel time of users for the most recent trip, and for the average trip when using the service. Compared with the travel times of the same trip prior to the project

- Reported overall wait time of travelers

- Reported travel times, wait times, mobility, and accessibility by ADA travelers

- Estimated before and after VMT of service users

- Reported perception of transit service quality by Pierce College Puyallup students

- Change in mobility and accessibility satisfaction by users of guaranteed ride home

- Change in reported transit ridership due to guaranteed ride home

- Student enrollment in night classes that end after fixed route service ends

- Increase in area of spatial distribution of transit riders across all forms of service

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- Average wait time (or planning time) of general population and persons with disabilities making similar trips
- Average travel time of general population and persons with disabilities making similar trips
- Average travel distance of general population and persons with disabilities making similar trips
- Average fare of general population and persons with disabilities making similar trips
- Hours and days of service for the general population and persons with disabilities making similar trips
- Wheelchair Accessible Vehicle (WAV) trip requests, measured by number of trips
- Trips provided with WAV.

The performance metrics will draw from a set of data sources that are specific to the project.

# Data Types, Elements, and Sources

The following data types, elements, and sources are used for the performance metrics that are defined for the Pierce Transit Independent Evaluation:

***Data Types and Elements:***

1. Traveler Survey Data:
   - User demographics
   - ADA status and wheelchair use
   - Pierce College Puyallup student status
   - Transit usage before and after the project
   - Mode shift to transit
   - Vehicle ownership
   - Travel behavior changes
   - Perception of transit service quality
   - Travel times
   - Wait times
   - Sentiment towards traditional transit
   - Awareness of the project
   - Changes in perception of transit service and mobility as a result of the project
   - Accessibility by ADA travelers
2. Ridership and Activity Data:
   - Ridership data from Pierce Transit (daily counts, by route)

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- Ridership data from Sound Transit (daily counts, by station)
- Pierce Transit data on Rides subsidized through TNCs
- Total unique users
- Heatmap of monthly trip pickups and drop-offs
- Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations
- Sound Transit license plate data - addresses of car owners are mapped
- Any before data on approximate distribution or home location of those accessing transit lines
- Parking at transit stations and park & ride lots (vehicle counts over time by station)
- Ridership on feeder lines prior to implementation
- Paratransit ridership
- Paratransit activity data

3. Cost/Economic Data:
   - Spending on TNC trips
   - Cost of previous demonstrations
   - Cost to Pierce Transit for paratransit service provision
   - Monthly reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost

4. Student Enrollment Data:
   - Number of full-time and part-time students enrolled at Puyallup College in night classes, broken out by student type and year

5. Expert Interviews:
   - Qualitative documentation from stakeholder interviews

***Data Sources:***

1. Traveler Survey Data Sources:
   - Survey of Pierce Transit Riders
   - Survey of Lyft users (Pierce Transit Service Area)
   - Survey of Pierce Transit Riders and Lyft users (of subsidized trips)
   - Survey of Pierce Transit Riders and Lyft service users who are ADA eligible
   - Survey of users who are Pierce College Puyallup students
   - Survey of users who use the guaranteed ride home

2. Ridership and Activity Data Sources:

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- Pierce Transit:
    - Ridership Data
    - Paratransit Data
    - TNC-Subsidized Trip Data
    - Parking Data
- Sound Transit:
    - Ridership Data
    - Aggregated User Data
- Lyft:
    - Monthly Usage Data (pick-up/drop-off)
- Cost Data Sources:
    - Pierce Transit:
        - TNC Subsidy Data
        - Demonstration Costs
        - Paratransit Costs
    - Lyft:
        - Monthly Billing Data
3. Student Enrollment Data Sources:
- Pierce College Puyallup enrollment
4. Qualitative Data Sources:
- Surveys described in (1)
- Stakeholder Interviews

# Data Sources Mapping

The following diagram shows the mapping of data sources, data sets, and performance measures that will be used in the independent evaluation of the Pierce Transit Limited Access Connections MOD Sandbox Project. As shown, the datasets include both quantitative and qualitative data, and will be submitted to the USDOT Public Data Hub.

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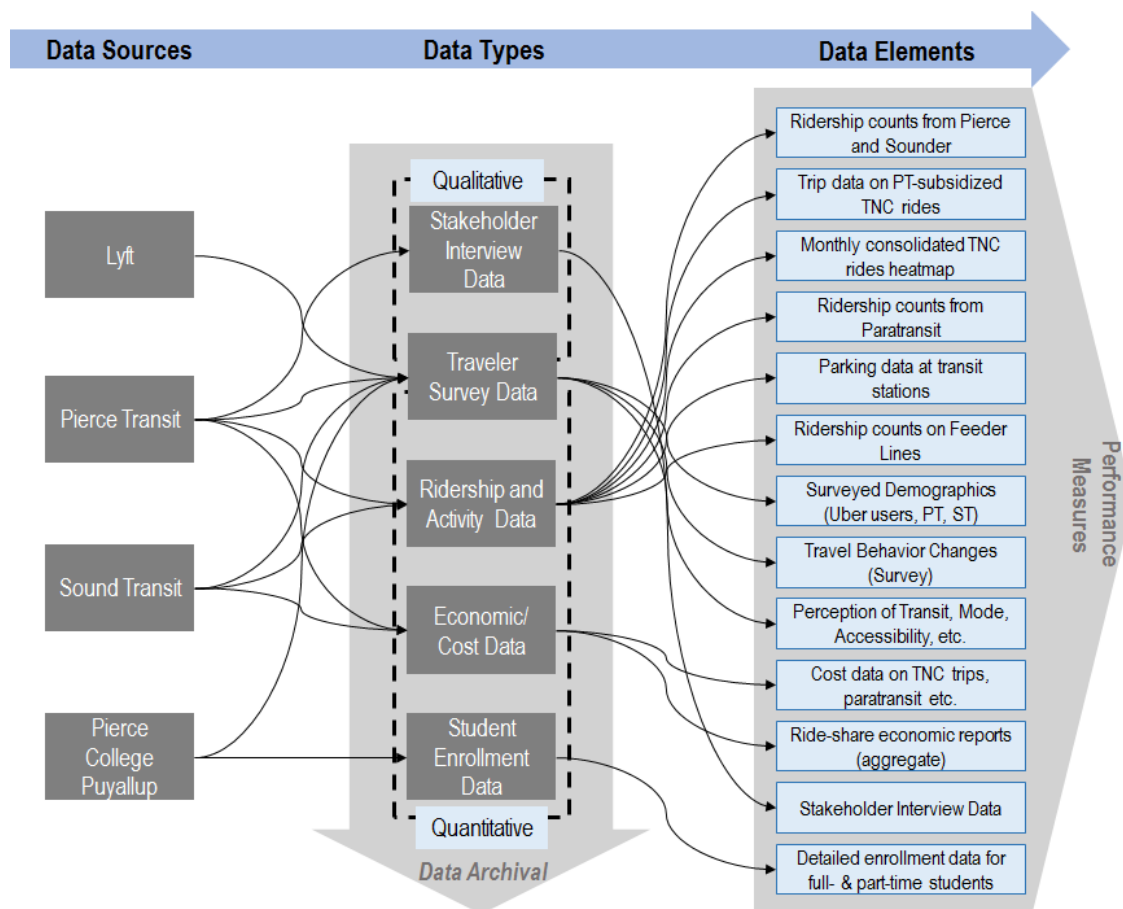
**Figure 1. Map of Data Sources, Data Sets, and Performance Measures**

# Methods of Evaluation

The quantitative and qualitative evaluation methods used in the Pierce Transit IE include the following:

- Survey Analysis

- Time series analysis of ridership data on effected bus and rail lines

- Time series analysis of access data

- Time series and cross-sectional analysis

- Activity data analysis before and after program implementation

- Spatial analysis of riders and activity data before and after the program implementation

- Summary of expert interviews.

Further details about the analysis methods by Evaluation Hypothesis are provided in Chapter 4.

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# Evaluation Logic Model

Table 1 below represents an extract from the final Pierce Transit evaluation logic model. Building on the project goals, the logic model lists evaluation hypotheses, performance metrics, and data elements and sources for the Pierce Transit project.

**Table 1. Evaluation Hypotheses, Performance Metrics, and Data Elements and Sources for the Pierce Transit Sandbox Project**

| Evaluation Hypothesis | Performance Metrics | Data Elements | Data Sources |
|---|---|---|---|
| 1. The perception of transit service quality (including the Pierce Transit brand) will improve among riders | Reported perception of transit service quality by Pierce Transit riders. Reported sentiment on the impact on transportation choice | Quantitative perception indicators from the survey on transit service quality, and mobility | Survey of Pierce Transit Riders and Lyft users (Pierce Transit Service Area) |
| 2. The overall ridership on Pierce Transit increases | Unlinked trips on supported bus and rail lines | Ridership data from Pierce Transit (daily counts, by route) Ridership data from Sound Transit (daily counts, by station) Pierce Transit data on Rides subsidized through TNCs Heatmap of monthly trip pickups and drop-offs | Ridership and Activity Data: <br>• Pierce Transit <br>• Lyft <br>• Sound Transit |
| 3. Users of the new service ride transit more because of the new service | Reported impact on personal ridership by users of the service | Total unique users | Survey of Pierce Transit Riders and Lyft users (of subsidized trips) |
| 4. The number of people accessing the Sound Transit stations and Pierce Transit bus lines increases | Number of riders accessing transit stations and bus lines before and after project | Ridership data on feeder lines prior to implementation of project Parking at transit stations and park & ride lots (average occupancy if possible) | Ridership and Activity Data: <br>• Pierce Transit <br>• Sound Transit |
| 5. The cost effectiveness of the rideshare service provision will be better than previously demonstrated fixed route services | Dollars spent per rider accessing Sound Transit stations and Pierce Transit bus routes. This will be broken out by connections at Sound Transit stations. | TNC ridership data during project Spending on TNC trips in conjunction with Pierce Transit Historical cost of running Paratransit | Cost Data Sources: <br>• Pierce Transit. <br>• Monthly Cost Data from Lyft. |

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| Evaluation Hypothesis | Performance Metrics | Data Elements | Data Sources |
|---|---|---|---|
| 6. The cost effectiveness of the rideshare service will be better than previously demonstrated paratransit services | Dollars spent per rider relative to dollars spent per paratransit rider | Paratransit ridership and cost (to study increase or decline) | Cost Data Sources:<br>● Pierce Transit.<br><br>Ridership and Activity Data:<br>● Pierce Transit |
| 7. The program will reduce parking lot use | Park and ride utilization | Parking at transit stations and park & ride lots (average occupancy if possible) | Ridership and Activity Data:<br>● Pierce Transit |
| 8. The overall travel times of users decrease | Reported travel time of users for the most recent trip, and for the average trip when using the service. Compared with the travel times of the same trip prior to the project | Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations<br><br>Heatmap of monthly trip pickups and drop-offs | Ridership and Activity Data:<br>● Pierce Transit<br>● Lyft<br>● Sound Transit<br>Survey of Pierce Transit Riders and Lyft users (of subsidized trips) |
| 9. The overall wait times of users decrease | Reported overall wait time of travelers | Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations | Ridership and Activity Data:<br>● Pierce Transit<br>● Lyft<br>Survey of Pierce Transit Riders and Lyft users (of subsidized trips) |

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| Evaluation Hypothesis | Performance Metrics | Data Elements | Data Sources |
|---|---|---|---|
| 10. Passengers using wheelchairs will (on average) report improved mobility | Reported travel times, wait times, mobility, and accessibility by passengers using wheelchairs | Qualitative Data on perception and awareness of passengers using wheelchairs<br>Travel times and wait times of wheelchair users based on paratransit activity data | Survey questions by Customer service agents<br>Ridership and Activity Data:<br>• Pierce Transit (Paratransit Activity Data) |
| 11. By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction | Estimated before and after VMT of service users | Before and after VMT of service users | Ridership and Activity Data:<br>• Lyft<br>Survey of Pierce Transit Riders and Lyft users (Pierce Transit Service Area) |
| 12. The perception of transit service quality will increase for Pierce College Puyallup students | Reported perception of transit service quality by Pierce College Puyallup students | Perceived quality of transit indicators from survey | Survey of Users who are Pierce College Puyallup students |
| 13. Riders that use the guaranteed ride home will report improved mobility and accessibility | Change in mobility and accessibility satisfaction by users of guaranteed ride home | Perceived quality of transit service | Survey of users who use the guaranteed ride home |
| 14. The guaranteed ride home enables increased transit use | Change in reported transit ridership due to guaranteed ride home. | Perceived quality of transit service | Survey of users who use the guaranteed ride home |
| 15. Student enrollment may increase, especially those enrolled in night classes | Student enrollment in night classes that end after fixed route service ends | Student Enrollment in night classes by program, by year | Pierce College Puyallup |

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| Evaluation Hypothesis | Performance Metrics | Data Elements | Data Sources |
|---|---|---|---|
| 16. The spatial spread of people using Pierce Transit and Sound Transit increases | Increase in area of spatial distribution of riders | Perception and Rider satisfaction. Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations Sound Transit license plate data - addresses of car owners are mapped Any before data on approximate distribution or home location of those accessing transit lines | Survey of Pierce Transit Riders and Lyft users (of subsidized trips) Ridership and Activity Data: • Pierce Transit • Lyft |
| 17. The process of deploying the project will produce lessons learned and recommendations for future research and deployment | N/A | N/A | Stakeholder interviews |
| 18. First and last mile service to passengers with disabilities is equivalent to that provided to passengers without disabilities | • Average wait time (or planning time) of general population and persons with disabilities making similar trips<br>• Average travel time of general population and persons with disabilities making similar trips<br>• Average travel distance of general population and persons with disabilities making similar trips<br>• Average fare of general population and persons with disabilities making similar trips<br>• Hours and days of service for the general population and persons with disabilities making similar trips | Reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost for ADA travelers | Ridership, Activity, and Cost Data: • Pierce Transit • Lyft |

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# Documentation and Reporting

The IE team will develop an evaluation report for this MOD Sandbox demonstration project. The report will include a summary of major findings of the project in an Executive Summary section, followed by multiple sections providing details of the demonstration, evaluation hypotheses, data collected, analysis performed, findings, and results. The results will be reported through a mix of exhibits including tables, graphs, and charts.

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# Chapter 3. Evaluation Schedule and Management

This chapter provides details on the evaluation project schedule and other details on the management of the evaluation project.

## Evaluation Schedule

Figure 2 shows the IE schedule from the beginning of the quantitative and qualitative data collection that spans throughout the demonstration period and leads to the analysis, whose results are included in the site-specific evaluation report. Note that interim data spot checks and sample analyses will be performed throughout the demonstration period to proactively mitigate data-related risks.



*Source: Booz Allen Hamilton, May 2018*
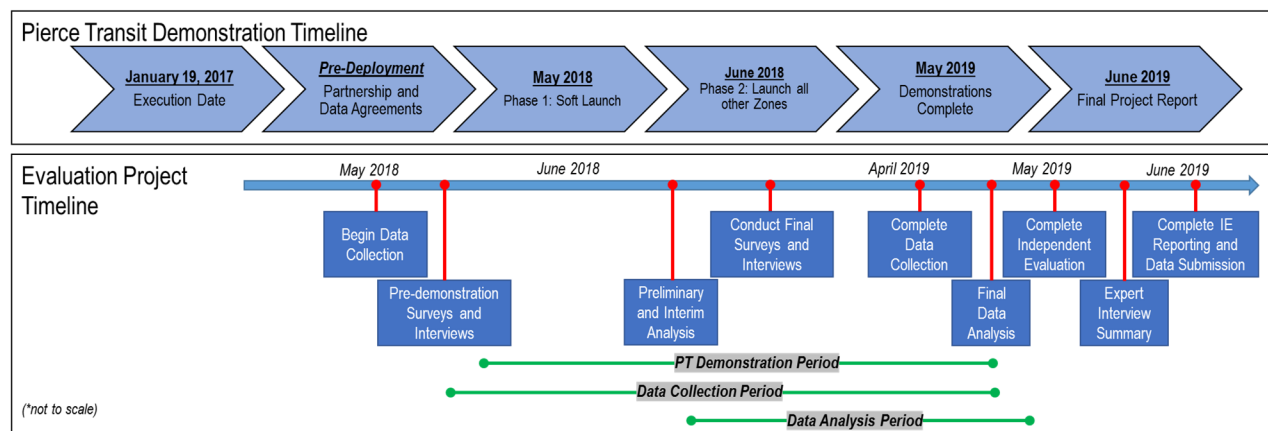
**Figure 2. MOD Sandbox Evaluation and Demonstration Schedule**

Data relevant to the program will be collected between May 2018 and May 2019. This data will be shared with the IE team for evaluation purposes. More details on the data types, elements, and collection timeframes are provided in Chapter 4.

## Roles and Responsibilities

The three main entities involved in the evaluation and their corresponding high-level roles are as follows:

- **The site team** coordinates the collection of the requested evaluation data from the various project partners throughout the demonstration period, and transfers the data to the IE team

- **The IE team** supports the site team in the definition of the requested data elements, and performs the analysis using the data provided by the site team

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- **The USDOT team** supervises the work and provides support for topics that encompass more than one site (e.g., coordination with TNCs who are partnering with several Sandbox sites).

## Data Transfer and Storage

Various types of qualitative and quantitative data sources are involved in the evaluation, as specified in Chapter 4. Figure 3 below shows the overall data collection framework, including the steps and parties involved in data design, collection, transfer and storage.



**Data Needs**

Identified by the IE team with support from the Pierce Transit team in the project-specific **Evaluation Logic Model**

**Data Collection Details**

Identified by the IE team with support from the Pierce Transit team in this project-specific **Evaluation Plan** (Data Collection & Analysis Section)

**Baseline and Demonstration Data**

Collected by the Pierce Transit team with support from the IE team in line with the Data Collection Plan; then transferred to the **IE Data Repository**

**Data Analysis**

Performed by the IE team using the data collected by the site team and transferred to the **IE Data Repository**

**Data Submission to the RDE**

Sanitized data prepared for submission to the USDOT's **Public Data Hub** by the IE team

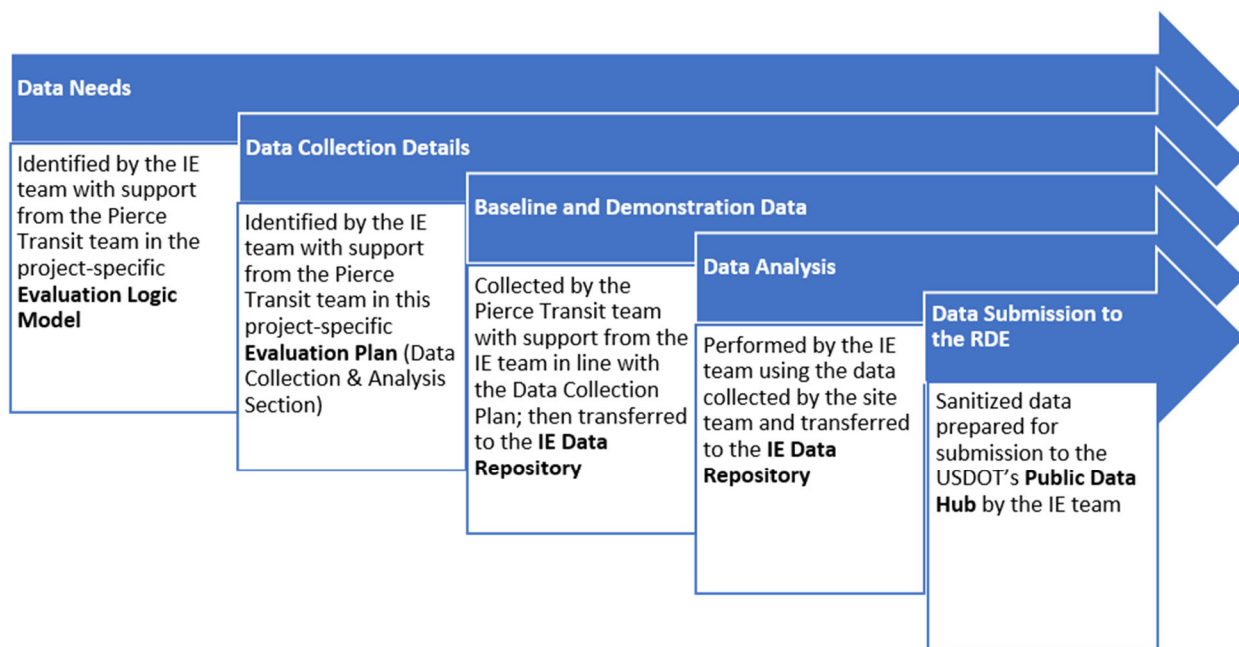**Figure 3. Pierce Transit Data Collection Framework**

## Data Collection Responsibilities

Table 2 denotes the data collection responsibilities for the various data types required for the evaluation.

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**Table 2. Data Type and Data Collection Responsibilities for Pierce Transit Sandbox Evaluation**

| Data Type | Data Collection Responsibilities |
|---|---|
| Traveler Survey Data | • Survey questions are developed by the IE team in collaboration with the Pierce Transit team<br>• Surveys are administered by the Pierce Transit team<br>• Survey responses are transferred by the Pierce Transit team to the IE team (Alternatively, access to the data can be given to the IE team, as appropriate) |
| Ridership and Activity Data | • Collected by the Pierce Transit team from Pierce Transit, Sound Transit and Lyft, and transferred to the IE team (Alternatively, access to the data can be given to the IE team, as appropriate) |
| Cost/Economic Data | • Collected by the Pierce Transit team from Pierce Transit, Sound Transit and Lyft, and transferred to the IE team (Alternatively, access to the data can be given to the IE team, as appropriate) |
| Student Enrollment Data | • Collected by the Pierce Transit team from Pierce College Puyallup and transferred to the IE team (Alternatively, access to the data can be given to the IE team, as appropriate). |
| Expert Interviews | • Interviewees are identified by the IE team in collaboration with the Pierce Transit team<br>• The IE team is connected to the interviewees by the Pierce Transit team<br>• The IE team conducts the expert interviews via phone or in person |

# Risk Management

The IE team will continually monitor risk in an ongoing process throughout the demonstration period and identify the best resources within the team to address each risk.

Some of the main risks involved in the evaluation are included below.

**Schedule:**

The IE team will maintain a demonstration tracking schedule to track and contact the demonstration teams for data and documentation. The team will keep an up-to-date integrated schedule that reflects updates from the site teams on a constant basis. Components of the evaluation reports will be created throughout the demonstration period, as the data and documentation for the project becomes available. The site team should inform the IE team of any changes in schedule that could affect the overall evaluation schedule (e.g., delays in the demonstration schedule).

**Data Quality Assurance**:

The IE team will perform spot checks on the data as it is being collected throughout the demonstration period to proactively manage risks related to data quality. This will allow the following:

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- Avoiding insufficient data on performance of MOD demonstration to reliably estimate impacts and/or benefits.

- Addressing challenges in empirical data including lack of consistency, biases, and incompleteness.

- Identifying and controlling sources of error.

- Consideration of quality and quantity issues in data collection.

- Ensuring data privacy and proprietary protections in line with human subjects' protections.

- Consideration of confounding factors.

Table 3 below includes risk mitigation strategies that will be employed in order to ensure the availability of the requested Data Types for the evaluation.

**Table 3. Data Type and Risk Mitigation Strategies for Pierce Transit Sandbox Evaluation**

| Data Type | Risk Mitigation Strategies |
|---|---|
| Traveler Survey Data | <ul><li>The Pierce Transit team will ensure that participants in the pilot are willing to take the surveys</li><li>The Pierce Transit team acknowledges the need to survey people with disabilities and recruit these individuals to take the surveys</li><li>The Pierce Transit team will ensure the adequate number of willing survey participants in each category is assessed</li><li>The Pierce Transit team will ensure the survey is accessible and 508-compliant</li></ul> |
| Ridership and Activity Data | <ul><li>The Pierce Transit team will include the data needs/requirements in the agreement with Lyft and Sound Transit.</li><li>The Pierce Transit team will ensure that the needed data is collected from Lyft and Sound Transit and transferred to the IE team</li></ul> |
| Cost and Economic Data | <ul><li>The Pierce Transit team has access to the requested data and can provide these to the IE team</li></ul> |
| Student Enrollment Data | <ul><li>The Pierce Transit team will receive historic and current enrollment data from Pierce College Puyallup.</li></ul> |
| Expert Interviews | <ul><li>The Pierce Transit team will facilitate the connection between the IE team and expert interviewees, and will help in getting their commitment to participate in the interviews</li></ul> |

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# Chapter 4. Data Collection & Analysis Plan

This chapter describes the plan for data collection and analysis for the Pierce Transit MOD Sandbox project evaluation. It summarizes the data that needs to be collected, and how that data should be processed and delivered to the IE team. Where possible, the IE team will help the Sandbox project team with processing the data in order to get the requested data format to conduct the calculations necessary for the evaluation. Any personally identifiable information will need to be removed when present in the data.

The data collection plan follows the evaluation logic model, with each data field discussed in association with a hypothesis and performance metrics. Certain types of data collected address multiple hypotheses. In cases where the data structure is the same for more than one hypothesis, the plan refers to the data structure for a hypothesis already described.

Most demonstration data should be provided from the beginning of the pilot demonstration period. The IE team also requests that data about general Pierce Transit activity be provided back to 2015 if possible. This request for longer time series of activity that existed before and after the pilot demonstration is made to help discern background trends that may have been present before the project and continued through it. Naturally, any data collected as a result of the pilot demonstration itself, can only be produced from the beginning of the data collection period. All hypotheses will be evaluated at the Pierce Transit level, when data permits. An aggregate analysis will be performed on system-wide impacts as well.

Table 4 below summarizes the data types, data elements, collection periods, collection responsibility and mechanisms, and hypothesis alignment for the Pierce Transit Sandbox project evaluation. The table is followed by a more detailed data collection and analysis plan for each evaluation hypothesis.

**Table 4. Data Type, Data Elements, Period of Collection, and Hypothesis Alignment for Pierce Transit Sandbox Project Evaluation**

| Data Type | Data Elements | Period and Frequency of Data Collection | Hypothesis Alignment |
|---|---|---|---|
| Traveler Survey Data | Survey Questions addressing:<br><br>• User demographics<br>• ADA status<br>• Puyallup student status<br>• Transit usage before and after the project<br>• Mode shift<br>• Vehicle ownership | At least six months following the launch of the demonstration | 1, 3, 8, 9, 10, 11, 12, 13, 14, 16 |

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| Data Type | Data Elements | Period and Frequency of Data Collection | Hypothesis Alignment |
|---|---|---|---|
| | • Travel behavior changes<br>• Perception of transit service quality<br>• Travel times<br>• Wait times<br>• Sentiment towards transit<br>• Awareness of the project<br>• Changes in perception of transit service and mobility as a result of the project<br>• Accessibility by ADA travelers | | |
| Ridership & Activity Data | • Ridership data from Pierce Transit (daily counts, by route)<br>• Ridership data from Sound Transit (daily counts, by station)<br>• Pierce Transit data on Rides subsidized through TNCs<br>• Total unique users<br>• Heatmap of monthly trip pickups and drop-offs<br>• Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations<br>• Sound Transit license plate data - addresses of car owners are mapped<br>• Any before data on approximate distribution or home location of those accessing transit lines<br>• Parking at transit stations and park & ride lots (vehicle counts over time by station)<br>• Ridership on feeder lines prior to and after implementation<br>• Paratransit ridership<br>• Paratransit activity data | Data is requested from the year 2015 and through the Sandbox demonstration period, to help identify longer running trends that might be underlying leading up to the project. | 2, 4, 6, 7, 8, 9, 10, 11, 16, 18 |
| Cost Data | • Spending on TNC trips<br>• Cost of previous demonstrations<br>• Cost of paratransit services | Pierce Transit supplied data is for the periods of the previous demonstration projects and | 5, 6, 18 |

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| Data Type | Data Elements | Period and Frequency of Data Collection | Hypothesis Alignment |
|---|---|---|---|
|  | • Monthly reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost | through the demonstration period of this Sandbox project. <br><br> All other data specific to this Sandbox project is requested from the beginning of the Sandbox demonstration period through its end. |  |
| Student Enrollment Data | Number of full-time and part-time students enrolled in night classes at Puyallup College, broken out by student type and year | Data is requested from 2015 through the end of the Sandbox project demonstration period | 15 |
| Expert Interviews | Qualitative documentation from stakeholder interviews | Conducted six months after the launch of the demonstration, but it may be conducted later | 17 |

# Detailed Data Collection and Analysis Plan by Evaluation Hypothesis

**Hypothesis 1:** The perception of transit service quality (including the Pierce Transit brand) will increase among riders

> **Performance Metric:** Reported perception of transit service quality by Pierce Transit riders. Reported sentiment on the impact on transportation choice.
>
> **Data Types:**
>
> • **Survey of Pierce Transit Riders and Lyft users (Pierce Transit Service Area)**
>
> A survey will be given to Pierce Transit riders, Lyft riders, as well as those who use the guaranteed ride home, to evaluate the behavioral impacts of project. The survey will ask questions about user demographics, wheelchair usage, Puyallup student status, transit usage before and after the project, mode shift, vehicle ownership and travel behavior changes. The survey will ask questions about the most recent trip of the user using the subsidized services of the project and using Pierce Transit more broadly. Attributes of this travel will be captured, as well as respondent speculation as to how they would have traveled in the absence of the TNC subsidized trip. The

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survey will probe perception of transit service quality, travel times, wait times, and sentiment towards transit, evaluate awareness of the project, and evaluate changes in perception of transit service and mobility as a result of the project.

**Analysis Procedure:**

The survey analysis will evaluate the distribution of responses to questions asked of respondents. The survey analysis will explore questions designed to evaluate perception of transit service quality among Pierce Transit riders. These questions will probe whether the perception of transit service quality has changed as a result of improved first/last mile service, guaranteed ride home services, and improved park-and-ride access to and from Sound Transit stations. The evaluation will identify the degree to which these project components improved perception individually or in combination.

**Data Collection Period for Survey:**

The survey will be implemented at least six months following the launch of the project. Deployment of the survey will require collaboration with Pierce Transit and project partners to establish an approach for deployment of the survey. Deployment of the survey online is strongly preferred, but this requires emails of the Pierce Transit rider population and/or the population using the services of the project.

**Hypothesis 2:** The overall ridership on Pierce Transit increases

**Performance Metric:** Unlinked trips on supported bus and rail lines

**Data Types:**

- **Ridership data from Pierce Transit (by route) and Sound Transit (by station)**
  This is ridership data in the form of unlinked trips for the Pierce Transit system. The data should be broken out by route. Only routes that are affected by the project, either directly or indirectly need to be considered. The time resolution of the data requested to be daily counts. The same resolution of data is requested for the Sound Transit system.
- **Pierce Transit data on Rides subsidized through TNCs**
  This consists of data on the number of rides subsidized through the TNCs. Ideally, data would consist of:

  <De-Identified user ID>
  <time stamp of trip request time>
  <time stamp of trip start time>
  <time stamp of trip end time>
  <trip origin>
  <trip destination>
  <passenger cost>

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<trip cost to Pierce Transit>
<ADA Passenger Status>
<WAV Vehicle> (yes/no)
<number of passengers (if known)>

- **Total unique users**

  This consists of data that describes the number of unique of users over time. It would be satisfied by a complete specification of the data above, but for the purposes of this hypothesis would need to be stated as a cumulative count of unique users taking subsidized rides.

- **Heatmap of monthly trip pickups and drop-offs**

  A heatmap of monthly trip pickups and drop-offs may be useful as provided by TNC operator. The heatmap should distinguish pickups from drop-offs. Data as specified in (2) may make the heatmap un-necessary.

<u>**Analysis Procedure:**</u>

The data will be evaluated using time series analysis. The ridership data of individual lines and stations will be plotted along with data on subsidized rides. Correlation statistics will be computed for the respective time series. Regression analysis is also planned with route and station ridership as the dependent variable over time along with appropriate independent variables such as count of subsidized rides, day of week, and other factors.

<u>**Data collection period for survey:**</u>

The data collection for the ridership data is requested from 2015 to the present. This is requested to evaluate trends that may have been present prior to the project, which might continue during the project. The data related to subsidized rides should be provided from the beginning of the Sandbox project to the end of the duration of the evaluation period.

**Hypothesis 3:** Users of the new service ride transit more because of the new service

<u>**Performance Metric:**</u> Reported impact on personal ridership by users of the service

<u>**Data Types:**</u>

- **Survey of Pierce Transit Riders and Lyft users (Pierce Transit Service Area)**

  See Hypothesis 1 for a brief description of the survey

<u>**Analysis Procedure:**</u>

The survey analysis will evaluate the distribution of responses to questions asked of respondents. For this hypothesis, the analysis will focus on mode shift questions. Questions will be asked of respondents evaluating their change in travel behavior as a result of subsidized rides and other project components. Questions will require respondents to attribute change in behavior to the project. Distributions of responses and

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cross-tabulations will evaluate the degree to which the project changed behavior and whether such changes occurred with specific types of Pierce Transit riders.

**Data collection period for survey:**

See Hypothesis 1 for a brief description of the survey data collection period.

**Hypothesis 4:** The number of people accessing the Sound Transit stations and Pierce Transit bus lines increases.

**Performance Metric:** Number of riders accessing transit stations and bus lines before and after project.

**Data Types:**

- **Parking at transit stations and park & ride lots**
  This data comprises measurements of parking at transit stations and park & ride lots. Ideal data would be daily counts of vehicles parked over time. This data will be used as a control and input for understanding the degree to which parking is impacted at transit stations and park & ride lots.
- **Ridership on feeder lines prior to implementation**
  This data comprises ridership on lines that feed to Seattle Sound Transit stations and other transit. The IE team will evaluate whether there is a change in ridership supporting the Seattle Sound Transit over time. This will include evaluating whether ridership drops in response to increased use of TNCs. That is, increased use of subsidized rides may be substituting for transit access to the station via bus. Ridership data will help inform the degree to which this substitution is observed.
- **TNC ridership during project**
  This data is the same as specified in Hypothesis 2.
- **Heatmap of monthly trip pickups and drop-offs**
  This data is the same as specified in Hypothesis 2.
- **Total unique users**
  This data is the same as specified in Hypothesis 2.

**Analysis Procedure:**

The analysis procedure will be implemented in a manner similar to Hypothesis 2. Time series of the data collected above will be evaluated to best understand the dynamics of access to the stations. Access to the stations is a function of those parking at stations, those accessing stations by bus, and those accessing stations via subsidized TNC routes. The analysis will evaluate whether the total number of people accessing the station increased during the course of the project. This analysis will be implemented using basic plots, but also other methods, such as regression analysis.

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**Data Collection Period:**

The data collection period for ridership data and park and ride data is requested from the beginning of 2015 to the present, contingent on availability. This longer time series is requested to control for and understand trends in the data that existed prior to the project. For project derived data, data is requested from the beginning of the Sandbox project to the end of the evaluation period.

**Hypothesis 5:** The cost effectiveness of the rideshare service provision will be better than previously demonstrated fixed route services.

**Performance Metric:** Dollars spent per rider accessing Sound Transit stations and Pierce Transit bus routes. This will be broken out by connections at Sound Transit stations and measured by comparing the cost of riders using TNC service versus average transit agency cost for a fixed route service to the same destination.

**Data Types:**

- **Spending on TNC trips**
  This is the amount of funds spent on TNC subsidized trips. If this information is derivable from previous trip-by-trip data, then the evaluation team can construct it from that. Otherwise summary of spending by day or month is preferred.
- **Cost of previous demonstrations of fixed route services**
  Pierce Transit has reported demonstrations of previous fixed route services to improve access to Sound Transit stations. To compare the cost of this project with those demonstrations, Pierce Transit will provide the cost and start and end dates of those demonstrations. Details about the project, such as brief background, number of passengers moved and vehicles operated should be reported to allow the production of basic cost-effective metrics. Such metrics may include $ / trip, $ / mile, $ / hour of operation, and others depending on data availability and comparable metrics.
- **Monthly reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost**
  This data would describe the cost that Pierce Transit has paid to support the project. This may include costs from the TNCs, as well as guaranteed ride home trip costs.

**Analysis Procedure:**

The analysis of cost effectiveness would focus on devising metrics that define the cost effectiveness of this project as well as other projects that will be presented for comparison. Cost effectiveness can be measured in a number of ways, including $ / trip, $ / mile, $ / hour of operation, and others. The analysis will construct these measures of cost effectiveness over comparable time frames of the project and compare them to evaluate the cost effectiveness of the project to previous projects.

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### Data Collection Period:

All Pierce Transit supplied data is for the periods of the previous demonstration projects through the evaluation period of the Sandbox project. All other data specific to the Sandbox project is requested from the beginning of the project demonstration through its end.

**Hypothesis 6:** The cost effectiveness of the ridesharing service will be better than previously demonstrated paratransit services.

### Performance Metric:  Dollars spent per rider relative to dollars spent per paratransit rider.

### Data Types:

- **Spending on TNC trips**
  This is the amount of funds spent on TNC subsidized trips. If this information is derivable from previous trip-by-trip data, then the IE team can construct it from that. Otherwise summary of spending by day or month is preferred.
- **Cost of paratransit services**
  Pierce Transit has reported demonstrations of previous fixed route services to improve access to Sound Transit stations. To compare the cost of this project with those demonstrations, Pierce Transit will provide the cost and start and end dates of those demonstrations. Details about the project, such as brief background, number of passengers moved and vehicles operated should be reported to allow the production of basic cost-effective metrics. Such metrics may include $ / trip, $ / mile, $ / hour of operation, and others depending on data availability and comparable metrics.
- **Monthly reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost**
  This data would describe the cost that Pierce Transit has paid to support the project. This may include costs from the TNCs, as well as guaranteed ride home trip costs.
- **Paratransit ridership (to study increase or decline)**
  This includes any ridership data of paratransit activity during the project.

### Analysis Procedure:

The analysis of cost effectiveness would focus on devising metrics that define the cost effectiveness of this project as well as other projects that will be presented for comparison. Cost effectiveness can be measured in a number of ways, including $ / trip, $ / mile, $ / hour of operation, and others. The analysis will construct these measures of

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cost effectiveness over comparable time frames of the project and compare them to evaluate the cost effectiveness of the project to previous projects.

**Data Collection Period:**

All paratransit ridership data is requested from the beginning of 2015 through the evaluation period of this Sandbox project. All other data that is specific to the Sandbox project is requested from the beginning of the project demonstration through its end.

**Hypothesis 7:** The program will reduce parking lot use.

**Performance Metric:** Park and ride utilization
**Data Types:**

- **Park and ride vehicle counts over time (by station)**

  This data is the same as described in Hypothesis 4. Pierce Transit is also requested to provide parking lot size, in the form of the number of parking spaces.

**Analysis Procedure:**

The analysis will evaluate whether park and ride utilization has changed as a result of the project. This analysis will plot utilization over time. It may also draw from other resources, such as ridership to ascertain whether utilization has changed as a result of changes in ridership or as a result of changes stemming from the project. A summary of parking activity at park and ride lots will be included in the evaluation.

**Data Collection Period:**

All park and ride data is requested from the beginning of 2015 through the evaluation period of this Sandbox project.

**Hypothesis 8:** The overall travel times of users decrease

**Performance Metric:** Reported travel time of users for the most recent trip, and for the average trip when using the service. This is compared with the travel times of the same trip prior to the project.

**Data Types:**

- **Survey of Pierce Transit Riders and Lyft users (of subsidized trips)**
  The survey will be implemented as described in Hypothesis 1.
- **ETA Heatmap (over time)**
  The IE team will evaluate the information that may be available in the ETA heatmap. The ETA heatmaps may not contain information that is useful for the

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purposes of confirming this hypothesis. The raw data listed in Hypothesis 2 would be preferred. This information would supersede the value of the ETA Heatmap.

- **Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations**

  This data would be that which is described in Hypothesis 2. This data of actual activity would be most useful in evaluating changes in travel times, and to evaluate how those travel times would compare against travel times of existing public transit times.

**Analysis Procedure:**

The IE team would run a script on Google Maps to determine transit travel times using activity data origins and start times. That is, data from the TNC activity data would be fed to Google Maps to evaluate what the transit travel time would have been with that trip. This would be compared against the time reported through the activity data. These differences in travel times would be tested to determine the degree to which the mean is statistically different from zero. The IE team would further use the survey to evaluate whether respondents feel that they can travel faster to the location.

**Data Collection Period:**

The data collection period would consist of activity since the start of the Sandbox project demonstration.

**Hypothesis 9:** The overall wait times of users decrease.

**Performance Metric:**  Reported overall wait time of travelers

**Data Types:**

- **Survey of Pierce Transit Riders and Lyft users (of subsidized trips)**

  The survey will be implemented as described in Hypothesis 1.

- **ETA Heatmap**

  This is as described in Hypothesis 8.

- **Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations**

  This data would be that which is described in Hypothesis 2. The difference between the <time stamp of trip request time> and <time stamp of trip start time> would be used to compute the wait time.

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### Analysis Procedure:

This analysis would be executed very similarly to the analysis defined in Hypothesis 8, only the variable of interest would be wait time. The Google Maps script would be modified to extract wait time, which the IE team believes is possible (right now it only gets total travel time).

### Data Collection Period:

The data collection period would consist of activity since the start of the Sandbox project demonstration through its end.

**Hypothesis 10:** Passengers using wheelchairs will (on average) report improved mobility

### Performance Metric:
Reported travel times, wait times, mobility, and accessibility by wheelchair users

### Data Types:

- **Paratransit activity data**
  Paratransit activity consists of data that is structured very similar to the requested data on TNC activity. For reference, paratransit trip activity data could be characterized with the same fields.

    <De-Identified user ID>
    <time stamp of trip request time>
    <time stamp of trip start time>
    <time stamp of trip end time>
    <trip origin>
    <trip destination>
    <passenger cost>
    <trip cost to Pierce Transit>
    <number of passengers (if known)>

- **Survey of Pierce Transit Riders and Lyft service users who are wheelchair users**
  The survey is as described in Hypothesis 1, with the subset of wheelchair user respondents extracted.

- **Reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost for wheelchair users**
  This is the same as the TNC activity data as described in Hypothesis 2, but only for wheelchair users.

### Analysis Procedure:

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This analysis would be executed very similarly to the analysis defined in Hypothesis 8, only the variable of interest would be wait time. The Google Maps script would be modified to extract wait time, which the evaluation team believes is possible (right now it only gets total travel time).

**Data Collection Period:**

For paratransit activity, data would be requested starting in 2015, to establish a baseline of travel activity behavior before the project. The data collection period would consist of activity since the start of the project.

**Hypothesis 11:** By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction.

**Performance Metric:**

Estimated before and after VMT of service users.

**Data Types:**

- **Survey of Pierce Transit Riders and Lyft users (of subsidized trips)**

  The survey will be implemented as described in Hypothesis 1.

- **Monthly reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost**

  This is the same as the TNC subsidized activity data as described in Hypothesis 2. We need to have an estimate of the driving that occurs as a result of the TNC activity.

- **Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations.**

  This is the same as the TNC activity data as described in Hypothesis 2.

**Analysis Procedure:**

The analysis of this hypothesis will use both the survey data and available activity data to develop an estimate of changes in VMT as a result of the project. The survey data informs behavioral changes that result in changes in VMT, either in personal or shared vehicles. The activity data informs two things. First, it informs how the population used the system, which helps determine whether the survey sample is representative of the population in terms of use. Second, it informs activity from the system, which helps estimate how much driving occurs in TNC vehicles as a result of the project. These two impacts offset each other. It is impossible for survey respondents to know the full implications of TNC driving, simply as a

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result of their activity patterns. The two data sources must be combined to produce a complete understanding of net impacts. The analysis will use respondent questions, population weighting, as well as TNC and any related activity data to evaluate the net impact of the project on VMT.

**Data Collection Period:**

All data pertinent to this hypothesis should be collected according to the survey implementation schedule and data related to the initiation of the Sandbox project demonstration.

**Hypothesis 12:** The perception of transit service quality will increase for Pierce College Puyallup students

**Performance Metric:**

Reported perception of transit service quality by Pierce College Puyallup students

**Data Types:**

- **Survey of Users who are Pierce College Puyallup students**

The survey will be implemented as described in Hypothesis 1.

**Analysis Procedure:**

The survey will contain questions that evaluate the change in perception of transit for all respondents. The responses of those who are Pierce College Puyallup students will be analyzed separately.

**Data Collection Period:**

The data collection period will be consistent with the survey implementation schedule.

**Hypothesis 13:** Riders that use the guaranteed ride home will report improved mobility and accessibility[1]

**Performance Metric:**

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[1] Please note that 'accessibility' is used to refer to 'access to transit services'.

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Change in mobility and accessibility satisfaction by users of guaranteed ride home.

**Data Types:**

- **Survey of users who use the guaranteed ride home**

  Those using a guaranteed ride home may be given a separate survey from the one described in Hypothesis 1. This will depend on whether the guaranteed ride home population is distinctly identifiable with a separate email list from the more general population surveyed in Hypothesis 1. If a separate email list is available, the survey given to the guaranteed ride home population can be more focused on the circumstances of using this service, and shorter than the Hypothesis 1 survey. However, if there is no such list, then the Hypothesis 1 survey will look for these users, and ask them a few detailed questions about their changes in mobility and accessibility as a result.

**Analysis Procedure:**

The survey will contain questions assessing the satisfaction with regards to mobility and accessibility as a result of the guaranteed ride home. The analysis will evaluate the distribution of responses to these questions to ascertain the degree to which the guaranteed ride home changed behavior and increased mobility and accessibility satisfaction.

**Data Collection Period:**

The survey will be implemented at least six months following the launch of the project. Deployment of the survey will require collaboration with Pierce Transit and project partners to establish an approach for deployment of the survey. Deployment of the survey online is strongly preferred, but this requires emails of the Pierce Transit rider population and/or the population using the services of the project.

**Hypothesis 14:** The guaranteed ride home enables increased transit use.

**Performance Metric:**

Change in reported transit ridership due to guaranteed ride home.

**Data Types:**

- **Survey of users who use the guaranteed ride home**

  This is the survey as described in Hypothesis 13.

**Analysis Procedure:**

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The questions in this survey will evaluate changes in travel behavior as a result of the guaranteed ride home. The analysis will evaluate the distributions of responses to ascertain who may have increased transit as a result of the guaranteed ride home and determine the approximate frequency and quantity of unlinked trips increased (or decreased) as a result of the guaranteed ride home.

**Data Collection Period:**

The data collection period will be consistent with that specified in Hypothesis 13.

**Hypothesis 15:** Student enrollment may increase, especially those enrolled in night classes

**Performance Metric:**

Student enrollment in night classes that end after fixed route service ends

**Data Types:**

- **Student enrollment**
    Student enrollment data is the number of full-time and part-time students enrolled at Puyallup College, mainly in night classes that end after fixed route service ends. This data should be broken out by student type and year.

**Analysis Procedure:**

The analysis will evaluate the trend in student enrollment before the project and through the project to determine if there are any noticeable departures in trend as a result of the project.

**Data Collection Period:**

Data is requested from 2015 through the end of the Sandbox project performance period.

**Hypothesis 16:** The spatial spread of people using Pierce Transit and Sound Transit increases

**Performance Metric:**

Spatial distribution of riders

**Data Types:**

- Survey of Pierce Transit Riders and Lyft users (of subsidized trips)
- Data on Trip date, Trip pick-up and drop-off times, Trip pick-up and drop-off locations
- Sound Transit license plate data - addresses of car owners are mapped

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- Any before data on approximate distribution or home location of those accessing transit lines

**Analysis Procedure:**

The analysis procedure will seek to evaluate spatial metrics of transit user geographic spread over time. This can be constructed as spread of user by home location, and/or the spread of trip origins and destinations over time. The insights of this analysis will be contingent on the temporal and spatial quality of this data. The locations do not have to be precise. Aggregation to census block would be sufficient to complete the analysis for both types of data. A metric will be calculated defining spatial spread. This metric might be "average distance to the cluster centroid" with 5% outlier removal, or something similar. This spatial metric, calculated over time at monthly intervals, can be plotted to evaluate whether the spread of trips and users is increasing.

**Data Collection Period:**

Data is requested from the beginning of 2015 to the end of the Sandbox project performance period. Data on user location may be available up to year 2015, but the IE team recognizes that trip data may not be available that far back. If available, data is requested back to 2015.

**Hypothesis 17:** Produce lessons learned through Stakeholder interviews

**Performance Metric:**

N/A

**Data Types:**

At least three interviewees with knowledge of the project.

**Analysis Procedure:**

An expert interview protocol will be developed. The interviews will be conducted and synthesized from notes and recordings into a summary describing key insights from experts directly involved in the project.

**Data collection period:**

This data collection will be conducted six months after the launch of the project, but it may be conducted later. It will be conducted as late as possible such that all implementation lessons learned are captured during the interviews.

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**Hypothesis 18:** First and last mile service to passengers with disabilities is equivalent to that provided to passengers without disabilities

### Performance Metric:

Average wait time (or planning time) of general population and persons with disabilities making similar trips, Average travel time of general population and persons with disabilities making similar trips, Average travel distance of general population and persons with disabilities making similar trips, Average fare of general population and persons with disabilities making similar trips, Hours and days of service for the general population and persons with disabilities making similar trips, WAV trip requests, Trips provided with WAV.

### Data Types:

- **Ride-share providers (TNCs)**

  This data would be structured the same as the activity data listed in Hypothesis 2.

- **Paratransit activity data**

- **Reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, total daily cost for ADA travelers**

  TNCs may provide summary reports of daily activity for non-ADA and ADA travelers. The summary reports may provide comparative data that can compare attributes of trips for both traveler types, including trip counts for each. Comparisons would be requested for travelers of non-ADA and ADA travelers within the same Census Block or Block Group.

### Analysis Procedure:

The raw data would be most useful to analyze the relative comparison of equivalent service. The data is only needed for regions in which ADA travelers request trips. That is, it is likely that if no ADA service is requested of the TNC in a particular region, then trip data from that region is not needed for this analysis. The analysis would draw comparisons of ADA trips and non-ADA trips from the same area of origin.

### Data Collection Period:

The data collection period would consist of data generated from the launch of the Sandbox project to the end of period of performance for the project.

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# Appendix A. Selected Draft Survey Questions

This section presents draft questions for the survey of app users. These survey questions are subject to revision and not all questions are presented. These questions provide examples of the proposed structure of selected key questions. The survey questions will be revised and augmented with input from the Pierce Transit project team.

1. Including yourself, how many people live in your current household?

   o 1
   o 2
   o 3
   o 4
   o 5
   o 6
   o More than 6

2. What best describes your relation to the other people in your current household? (Please check all that apply)

   o Parent/Guardian(s)
   o Relatives (e.g., siblings, etc.)
   o Housemates/Roommates
   o Partner/Significant Other
   o Children (who are under your guardianship)

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3.  Please list the year, make, and model of your household's CURRENT vehicles, those that are owned or leased (e.g., 2014 Ford Fusion):

|  | Year | Make | Model |
|---|---|---|---|
| **Vehicle 1** |  |  |  |
| **Vehicle 2** |  |  |  |
| **Vehicle 3** |  |  |  |
| **Vehicle 4** |  |  |  |
| **Vehicle 5** |  |  |  |

4.  In the last year, approximately how many miles have you driven on these vehicles? (not cumulative odometer reading)

   (If the vehicle was owned for less than a year, please approximate your annual miles, based on how much you have driven it thus far.)

   <Vehicle piped from above>  <Miles driven drop down>

   <Vehicle piped from above>  <Miles driven drop down>

   <Vehicle piped from above>  <Miles driven drop down>

5.  Which of the following modes of transportation have you used **within Pierce County in the last two years**? (Please check all that apply.)

   o   Drive alone
   o   Drive/Ride with family/friend (non-commute)
   o   Walk (to a destination)
   o   Public Bus
   o   Express Bus
   o   Light rail
   o   Seattle Sound Transit
   o   Uber/Lyft or other ride-hail service
   o   UberPOOL/Lyft Line or other shared-ride service
   o   Taxi
   o   Bicycle
   o   Motorcycle or scooter
   o   Carpool (for commuting)
   o   Vanpool
   o   Employer Shuttle (for commuting)

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     o  Car Rental within Pierce County
     o  Other, please specify:


Note: This question is used to narrow down the modes used by the respondent. Only modes selected are presented in the following questions about changes in mode use. For all questions that carry forward, respondents are only asked questions about modes that they have used. Subsequent questions narrow this down further.

   6.  Please indicate about how frequently you CURRENTLY use the following modes (based on your travel patterns over the past 3 months).

| | Not available to me or not in my area | Never in the last year | Less than once a month | Once a month | Every other week | 1 to 3 days per week | 4 to 6 days per week | Once a day | 2 to 4 times a day | More than 4 times a day |
|---|---|---|---|---|---|---|---|---|---|---|
| Drive alone | | | | | | | | | | |
| Drive/Ride with family/friend (non-commute) | | | | | | | | | | |
| Walk (to a destination) | | | | | | | | | | |
| Public Bus | | | | | | | | | | |
| Express Bus | | | | | | | | | | |
| Tacoma Link light rail | | | | | | | | | | |
| Seattle Sound Transit | | | | | | | | | | |

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| | Not available to me or not in my area | Never in the last year | Less than once a month | Once a month | Every other week | 1 to 3 days per week | 4 to 6 days per week | Once a day | 2 to 4 times a day | More than 4 times a day |
|---|---|---|---|---|---|---|---|---|---|---|
| Uber/Lyft or other ride-hail service | | | | | | | | | | |
| UberPOOL / Lyft Line or other shared-ride service | | | | | | | | | | |
| Taxi | | | | | | | | | | |
| Bicycle | | | | | | | | | | |
| Motorcycle or scooter | | | | | | | | | | |
| Carpool (for commuting) | | | | | | | | | | |
| Vanpool | | | | | | | | | | |
| Employer Shuttle (for commuting) | | | | | | | | | | |
| Car Rental within Pierce County | | | | | | | | | | |
| Other, as specified: | | | | | | | | | | |

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7. Please indicate which modes have changed as a result of using Pierce Transit subsidized rides, and which modes have been unaffected.

| Only modes selected above (used) shown. These are examples | Yes, my use of this mode HAS CHANGED due to Pierce Transit supported rides | No, my use of this mode has NOT CHANGED due to Pierce Transit supported rides |
| --- | --- | --- |
| Drive alone | | |
| Drive/ride with others (non-commute) | | |
| Carpool (for commuting) | | |
| Bus | | |
| Light Rail | | |
| Bicycle | | |
| Walk (to a destination) | | |
| Uber/Lyft | | |
| Taxi | | |

8. Overall, how much more or less often have you used these modes because of the first mile/last mile Lyft rides supported by Pierce Transit?

Overall, because of these Pierce Transit supported rides, I travel by…

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| *Only modes selected above (Changed) are shown. These are examples.* | Much more often | More often (2) | About the same (3) | Less often (4) | Much less often (5) |
|---|---|---|---|---|---|
| Drive alone | | | | | |
| Drive/ride with others (non-commute) | | | | | |
| Carpool (for commuting) | | | | | |
| Bus | | | | | |
| Light Rail | | | | | |
| Bicycle | | | | | |
| Walk (to a destination) | | | | | |
| Uber/Lyft | | | | | |
| Taxi | | | | | |

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9. Please indicate about how frequently you used the following modes one year ago.

| Only modes selected above (Changed) are shown. These are examples. | Not available to me or not in my area | Never in the last year | Less than once a month | Once a month | Every other week | 1 to 3 days per week | 4 to 6 days per week | Once a day | 2 to 4 times a day | More than 4 times a day |
|---|---|---|---|---|---|---|---|---|---|---|
| <Mode that changed> | | | | | | | | | | |
| <Mode that changed> | | | | | | | | | | |
| <Mode that changed> | | | | | | | | | | |

>>>>>>>>>**Branch Rule: TRANSIT_MORE>>>>>>>>>>>>>>>>>>>>START**

IF Public transit is used Much more often OR More often is selected THEN NEXT

>>>>>>>>>**>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>**

10. What is the main reason you are taking public transportation more? (Please select all that apply.)

- o  I got rid of a car and so I use public transport more now
- o  I have switched to public transit to save money
- o  I have better access TO public transportation
- o  I have better access FROM public transportation
- o  I have better access BOTH TO and FROM public transportation
- o  Other, please specify: (4) _____

>>>>>>>>>>>>>>>>>>>**Branch Rule: TRANSIT_MORE**>>>>>>>>>>>>>>>>>>>**END**

>>>>>>>>>**Branch Rule: TRANSIT_LESS**>>>>>>>>>>>>>>>>>>>>>>>>**START**

IF Public transit is used Much less often OR Less often is selected THEN NEXT

>>>>>>>>>**>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>**

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11. Why are you are taking public transportation less? (Please select all that apply.)

- o Using TNC/Ridesourcing is faster
- o Using TNC/Ridesourcing is cheaper
- o I need to travel at times when public transit is not in service
- o Public transit is not frequent enough
- o Public transit routes do not serve the places I need to go well enough
- o I prefer to travel alone
- o Other, please specify: _____

>>>>>>>>>>>>>>>**Branch Rule: TRANSIT_LESS**>>>>>>>>>>>>>>>>**END**

>>>>>>>>>**Branch Rule: CHANGED PERSONAL DRIVING**>>>>>>>>>>>>>>>>>>>>>>**START**

    IF Drive Alone is More OR Less THEN NEXT

>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

12. To the best of your ability, please try to estimate what you think is the **change** in how many miles you have driven per **month** in your personal vehicle(s) as a result of Pierce Transit subsidized rides and the guaranteed ride home.

    **<vehicle 1>** change: drop-down {More, Less, No change }

    **<vehicle 1>** miles: drop-down {0, … , 100, 200, … , More than 3,000}

>>>>>>>>>>>>>>>>**Branch Rule: CHANGED PERSONAL DRIVING** >>>>>>>>>>>>>>>>>**END**

13. **<Have you / Has your household>** gotten rid of vehicles since this program started?

- o No, **<I / we>** have not gotten rid of any vehicles.
- o Yes, AND definitely because of improved access to Pierce Transit through a subsidized TNC.
- o Yes, AND partially because of improved access to Pierce Transit through a subsidized TNC.
- o **<I / we>** have gotten rid of a car(s), BUT NOT because of anything related to improved access to or from Pierce Transit.

14. What is the make, model, and year of the vehicle you got rid of, and how much you drove it annually?

15. Would **<you / your household>** still have gotten rid of the vehicle(s) had this program not been in place? (Please select one response.)

- o Yes, definitely
- o Yes, probably
- o No, **<I / my household>** would probably still have the vehicle
- o No, I definitely would still have the vehicle

16. If the program went away (e.g., elimination of subsidization of rides to transit and park & rides, guaranteed ride home, etc.), do you think **<you/ your household>** would acquire **a** car?

- o Definitely acquire a car
- o Probably acquire a car
- o Probably not acquire a car
- o Definitely not acquire a car

17. If you can, please give your **best estimate** of how many **miles per year** you think you would have driven on ALL the vehicle(s) that **<you/your household>** would have acquired (in total)?

Drop Down Menu: {I do not know, 0, 500, 1,000, …}

We would like to now talk about your most recent trip using Pierce Transit subsidized rides.

18. What transit system did you connect to or from?

- o Light rail
- o Seattle Sound Transit
- o Sound Transit Express Bus
- o Pierce Transit Bus
- o I did not connect to transit on this trip
- o Other, please specify:

>>>>>>>>CONNECTED TO PUBLIC TRANSIT>>>>>>>>>>>>>>>>>>>>>>>>>>>>>START
IF Connected to public transit THEN NEXT
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

19. Was the trip connecting TO or FROM public transit?

- o TO
- o FROM

20. What station or bus route did you connect to?

<Drop down list>

21. What was origin of your most recent trip using a subsidized Lyft ride from Pierce Transit? Please indicate two streets that cross near this location, and the city

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City:
Street #1:
Street #2:

22. What type of place was this?

- o  Home
- o  Work
- o  Social / Recreational
- o  Other, please specify:

>>>>>>>CONNECTED TO PUBLIC TRANSIT>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>END

23. What was the approximate final destination of this trip (after connecting to or from transit)? Please indicate two streets that cross near this location, and the city.

City:
Street #1:
Street #2:

24. What type of place was this?

- o  Home
- o  Work
- o  Social / Recreational
- o  Other, please specify:

25. If the Pierce Transit subsidized rides were not available, then how would you have connected to Transit?

- a.  I would not have (or did not) connect to transit, I would have driven all the way
- b.  I would not have made the trip
- c.  Pierce Transit bus
- d.  Driven alone and parked at the station or park and ride lot
- e.  Got a ride from friend or family
- f.  Uber or Lyft
- g.  Taxi
- h.  Bicycle
- i.  Walk
- j.  Other, please specify:

26. Was this trip a guaranteed ride home after Pierce Transit operating hours?

- a.  Yes
- b.  No
- c.  I do not know

27. At what time did you start this trip (from your origin)?

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&lt;Drop down menu of hours&gt;

28. What day was this trip?

    a. Monday
    b. Tuesday
    c. Wednesday
    d. Thursday
    e. Friday
    f. Saturday
    g. Sunday

The following questions probe your perceptions of how the Pierce Transit subsidized rides have impacted your travel time and travel quality.

29. Overall, I think the quality of Pierce Transit has increased in the last year as a result of these subsidized rides and guaranteed rides home.

    a. Strongly agree
    b. Agree
    c. Neither agree nor agree
    d. Disagree
    e. Strongly disagree

30. As a result of using Pierce Transit subsidized rides, my access TO and FROM public transit has

    a. Greatly improved
    b. Somewhat improved
    c. Not really changed
    d. Somewhat worsened
    e. Significantly worsened

31. As a result of using Pierce Transit subsidized rides, my overall travel times using public transit have:

    a. Greatly declined
    b. Somewhat declined
    c. Not really changed
    d. Somewhat increased
    e. Significantly increased

32. As a result of using Pierce Transit subsidized rides, my overall wait times using public transit have:

    a. Greatly declined
    b. Somewhat declined
    c. Not really changed
    d. Somewhat increased
    e. Significantly increased

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33. As a result of using the guaranteed ride home, I am using public transit:

    a. Much more than before
    b. More than before
    c. About the same
    d. Less than before
    e. Much less than before

34. How have the Pierce Transit subsidized rides, impacted the locations to which you travel?

    o I travel to the same places I always travel, the locations have not changed
    o I now travel to locations that I could not reach before

35. What is your gender?

    o Male
    o Female
    o Prefer not to answer

36. In what year were you born?

    Drop-down <years>

37. Do you use a wheelchair?

    o Yes
    o No

38. Do you have other disabilities that require specialized accommodations for transportation?

    o Yes
    o No

39. Do you require transportation vehicles and infrastructure that is ADA compliant to get around?

    o Yes
    o No

40. Are you a student at Pierce College Pullayup?

    o Yes
    o No

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41. What is the highest level of education you have completed?

    o   Less than high school
    o   Currently in high school
    o   High school/GED
    o   Currently in 2-year college
    o   2-year college degree
    o   Currently in 4-year college
    o   4-year college degree
    o   Currently in post-graduate degree
    o   Post-graduate degree (MA, MS, PhD, MD, JD, etc.)
    o   Prefer not to answer

42. What is your race or ethnicity? (Please check all that apply.)

    o   African American
    o   American Indian or Alaskan Native
    o   Asian
    o   Caucasian/White
    o   Hispanic or Latino
    o   Middle-Eastern
    o   Native Hawaiian or Pacific Islander
    o   South Asian (e.g., Indian, Pakistani, etc.)
    o   Southeast Asian
    o   Prefer not to answer

43. What kind of housing do you currently live in?

    o   Detached single-family home
    o   Attached single-family home
    o   Building with more than 100 units
    o   Building with between 10 and 100 units
    o   Building/house with fewer than 10 units
    o   Mobile home/RV/Trailer

44. Approximately what was your gross (pre-tax) household income in 2017? (Your household includes the people who live with you with whom you share income.)

    o   Less than $10,000
    o   $10,000 to $14,999
    o   $15,000 to $24,999
    o   $25,000 to $34,999
    o   $35,000 to $49,999
    o   $50,000 to $74,999
    o   $75,000 to $99,999
    o   $100,000 to $149,999

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      o  $150,000 to $199,999
      o  $200,000 or more
      o  Prefer not to answer

45. Please indicate two streets that cross near your HOME location as well as the city.

    City
    Street #1
    Street #2

46. Please indicate two streets that cross near your WORK location as well as the city.

    City
    Street #1
    Street #2

47. This survey asked a lot of questions about your travel behavior with Pierce Transit If you would like, please feel free to elaborate here on how you travel and the rides provided by Pierce Transit has affected your travel behavior.

Your comments (if you provide any) will only be reviewed confidentially in support of your other responses. You will not be contacted about them. Anything you write may help support the impact analysis, or clarify responses you provided in the survey.

You can tell us about elements we might have missed through the survey questions or that you feel need additional clarification. This is completely optional, you can write as much as you would like or nothing at all. If you do choose to provide comments, please try to convey constructive and helpful; what you write will be read. In either case, thank you again for taking this survey.

<Comment Box>

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# Addendum. Documentation of Evaluation Plan Variance Following Demonstration Deployment

The evaluation plans for the MOD Sandbox Demonstration projects were developed in the planning phase of the project, prior to the execution of the demonstration. As part of this process, data structures and data availability were anticipated. As project implementation proceeded, certain elements of the project and data availability changed.

This addendum presents differences between the planned and executed analyses for the independent evaluation of the Pierce Transit Limited Access Connections project. Due to changes resulting from limited survey sample sizes, data availability issues, and other circumstances, some of the hypotheses proposed as part of the original scope of work were modified or their analyses were adjusted to better encompass these changes. In this addendum, changes that were made to each hypothesis (if any) and the key reasons why study methods may have differed from what was planned are identified and discussed. Some hypotheses and their proposed analytical approaches did not change significantly or at all. In these cases, it is noted that there were no differences between the proposed and executed analyses.

| Hypothesis 1: | The perception of public transit service quality (including the Pierce Transit brand) will improve among riders. |
|---|---|

**Proposed analysis:** The analysis outlined in the evaluation plan proposed evaluating the distribution of responses to questions asked of respondents. The survey analysis would explore questions designed to evaluate perception of transit service quality among Pierce Transit riders. These questions would probe whether the perception of transit service quality has changed as a result of improved first/last mile service, guaranteed ride home services, and improved park-and-ride access to and from Sound Transit stations. The evaluation would identify the degree to which these project components improved perception individually or in combination.

**Executed analysis:** The questions planned in the evaluation were all asked and analyzed as part of the overall evaluation. The key question used to evaluate Hypothesis 1 within this group strictly proposed whether the project had improved the quality of Pierce Transit. The other questions were applied to the analysis of other hypotheses in the evaluation

| Hypothesis 2: | The overall ridership on Pierce Transit increases. |
|---|---|

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**Proposed analysis:** The analysis outlined in the evaluation plan proposed evaluating the hypothesis using a time series analysis. The ridership data of individual lines and stations would be plotted along with data on subsidized rides. Correlation statistics would be computed for the respective time series. Regression analysis was planned with route and station ridership as the dependent variable over time along with appropriate independent variables such as count of subsidized rides, day of week, and other factors.

**Executed analysis:** The analysis applied a time series of ridership data. Data on individual routes were obtained and analyzed. The analysis ultimately drew conclusions from the time series analysis of total ridership across all routes, which showed limited overall effects of aggregate ridership.

| Hypothesis 3: | Users of the new service ride public transit more because of the new service. |
|---|---|

There were no major differences between the proposed and executed analyses for Hypothesis 3. Before and after survey questions gauged user ratings of mobility and their satisfaction with paratransit services before and after the pilot. Results were disaggregated by gender to evaluate any correlations.

| Hypothesis 4: | The number of people accessing the Sound Transit stations and Pierce Transit bus lines increases. |
|---|---|

**Proposed analysis:** The analysis procedure would be implemented in a manner similar to Hypothesis 2. Time series of the data collected above would be evaluated to best understand the dynamics of access to the stations. Access to the stations is a function of those parking at stations, those accessing stations by bus, and those accessing stations via subsidized TNC routes. The analysis would evaluate whether the total number of people accessing the station increased during the project. This analysis would be implemented using basic plots, but also other methods, such as regression analysis.

**Executed analysis:** The analysis evaluated ridership data from Sound Transit and built off of the analysis of Pierce Transit lines explored in Hypothesis 2. Origin and destination data of the TNC data was not precise enough to evaluate station access activity. The aggregate analysis of Sound Transit boardings showed aggregate trends that were generally unaffected by the project.

| Hypothesis 5: | The cost effectiveness of the rideshare service provision will be better than previously demonstrated fixed route services. |
|---|---|

There were no differences between the proposed and executed analyses for Hypothesis 5. Cost effectiveness metrics were calculated and compared against previously demonstrated fixed route services.

| Hypothesis 6: | The cost effectiveness of the rideshare service will be better than previously demonstrated paratransit services. |
|---|---|

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There were no differences between the proposed and executed analyses for Hypothesis 5. Cost effectiveness metrics were calculated and compared against previously demonstrated fixed route services.

**Hypothesis 7:**             The program will reduce parking lot use.

**Proposed analysis:** The analysis would evaluate whether park-and-ride utilization changed as a result of the project. This analysis would plot utilization over time. It may have also drawn from other resources, such as ridership to ascertain whether utilization changed as a result of changes in ridership or as a result of changes stemming from the project. A summary of parking activity at park-and-ride lots would be included in the evaluation.

**Executed analysis:** The executed analysis mostly adhered to the original plan. Ridership was ultimately not used to draw conclusions, but survey data on usage of parking activity was incorporated into the analysis.

**Hypothesis 8:**             The overall travel times of users decrease.

**Proposed analysis:** The analysis would apply a script on Google Maps to determine transit travel times using activity data origins and start times. That is, data from the TNC activity data would be fed to Google Maps to evaluate what the transit travel time would have been with that trip. This would be compared against the time reported through the activity data. These differences in travel times would be tested to determine the degree to which the mean is statistically different from zero. The IE team would further use the survey to evaluate whether respondents felt that they could travel faster to the location.

**Executed analysis:** The resolution of location data was not precise enough to enable an evaluation of transit travel times using external trip planners.  The analysis instead relied on survey data, which asked users how travel times changed for users as a result of the project.

**Hypothesis 9:**             The overall wait times of users decrease.

**Proposed analysis:** This analysis would have been executed very similarly to the analysis defined in Hypothesis 8, only the variable of interest would be wait time. The Google Maps script would be modified to extract wait time, which the IE team believed was possible.

**Executed analysis:**  Additional methods were identified to obtain wait times outside of Google Maps. However, the resolution of trip location data was not precise enough to enable an evaluation of wait times using external trip planners.  The analysis instead relied on survey data, which asked users how wait times changed for users as a result of the project.

**Hypothesis 10:**             Passengers using wheelchairs will (on average) report improved mobility.

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**Proposed analysis:** This analysis would have been executed using a combination of activity data from paratransit, a survey, and reports from the rideshare partner on usage, including average utilization trends by time of day and day of week, trip distance, trip cost, and total daily cost for wheelchair users.

**Executed analysis:** The project did not service any trips for persons using wheelchairs, because no such trips were requested. The survey data was used for one respondent that reported having disabilities that prevented him or her from driving an automobile. The individual responses of this person were evaluated and discussed.

| Hypothesis 11: | By increasing transit ridership, trip substitution and mode shift will result in a net VMT reduction. |
|---|---|

There were no differences between the proposed and executed analyses for Hypothesis 5. Cost effectiveness metrics were calculated and compared against previously demonstrated fixed route services.

| Hypothesis 12: | The perception of public transit service quality will increase for Pierce College Puyallup students. |
|---|---|

There were no differences between the proposed and executed analyses for Hypothesis 5. Cost effectiveness metrics were calculated and compared against previously demonstrated fixed route services.

| Hypothesis 13: | Riders that use the guaranteed ride home will report improved mobility and accessibility. |
|---|---|

**Proposed analysis:** The survey would contain questions assessing riders' satisfaction with regards to mobility and accessibility as a result of the guaranteed ride home. The analysis would evaluate the distribution of responses to these questions to ascertain the degree to which the guaranteed ride home changed behavior and increased mobility and accessibility satisfaction.

**Executed analysis:** The analysis focused more on the application of activity data of the guaranteed ride home trips over time. The data was analyzed as a time-series during the course of the project as well as the frequency of use among individuals.

| Hypothesis 14: | The guaranteed ride home enables increased transit use. |
|---|---|

**Proposed analysis:** Questions in a survey would evaluate changes in travel behavior as a result of the guaranteed ride home. The analysis would evaluate the distributions of responses to ascertain who may have increased transit use as a result of the guaranteed ride home and determine the approximate frequency and quantity of unlinked trips increased (or decreased) as a result of the guaranteed ride home.

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**Executed analysis:** The analysis was executed mostly as planned. The data was not available to determine the quantity of change in unlinked trips as a result of the guaranteed ride home. The analysis was addressed with survey data as planned.

| Hypothesis 15: | Student enrollment may increase, especially those enrolled in night classes. |
|---|---|

There were no differences between the proposed and executed analyses for Hypothesis 5. Cost effectiveness metrics were calculated and compared against previously demonstrated fixed route services.

| Hypothesis 16: | The spatial spread of people using Pierce Transit and Sound Transit increases. |
|---|---|

**Proposed analysis:** The analysis procedure would seek to evaluate spatial metrics of transit user geographic spread over time. This could be constructed as spread of user by home location, and/or the spread of trip origins and destinations over time. The insights of this analysis would be contingent on the temporal and spatial quality of this data. Locations would not need to be precise. Aggregation to census block would be sufficient to complete the analysis for both types of data. A metric will be calculated defining spatial spread. This metric might be "average distance to the cluster centroid" with 5% outlier removal, or something similar. This spatial metric, calculated over time at monthly intervals, could be plotted to evaluate whether the spread of trips and users was increasing.

**Executed analysis:** The data planned for analysis of this hypothesis was not available. This included data on the approximate distribution of home locations of users accessing public transit to be compared with approximate home locations of system users within the survey. Data of the appropriate nature and resolution was not available for either population.

| Hypothesis 17: | The process of deploying the project will produce lessons learned and recommendations for future research and deployment. |
|---|---|

There were no differences between the proposed and executed analyses for Hypothesis 17.

| Hypothesis 18: | First and last mile service to passengers with disabilities is equivalent to that provided to passengers without disabilities. |
|---|---|

**Proposed analysis:** The raw data would be most useful to analyze the relative comparison of equivalent service. The data is only needed for regions in which ADA travelers request trips. That is, it is likely that if no ADA service is requested of the TNC in a particular region, then trip data from that region is not needed for this analysis. The analysis would draw comparisons of ADA trips and non-ADA trips from the same area of origin.

**Executed analysis:** No wheelchair accessible vehicles (WAVs) were requested as a part of the project and therefore an analysis of the hypothesis as planned was not conducted. However, the evaluation team

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did conduct an analysis of wait times and travel times of Lyft FMLM non-WAV trips from available activity data.

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