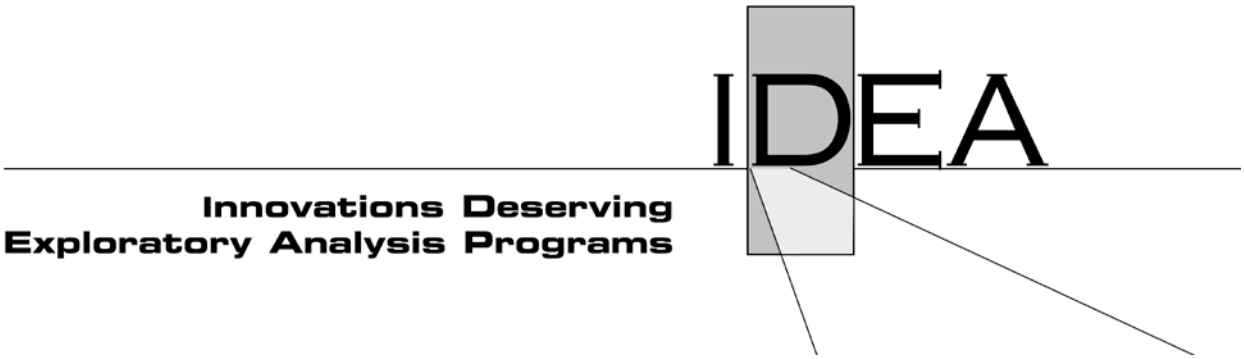

Transit IDEA Program

Flexible Carpooling to Transit Stations

Final Report for
Transit IDEA Project 61

Prepared by:
Paul Minett
Trip Convergence Ltd
Auckland, New Zealand

June 2013

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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Washington, DC 20001

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Jesse Glazer, FHWA, Los Angeles CA;
Eric Schreffler, Consultant, San Diego CA;

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Eric Chipps, Senior Planner, Sound Transit, Seattle, WA
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Robin Mayhew, Puget Sound Regional Council, Seattle, WA
Park Woodworth, King County Metro, Seattle, WA

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- Sound Transit, Seattle, WA: Eric Chipps, Senior Planner
- Trip Convergence Ltd, Auckland, New Zealand: Mr. John Pearce, Director
- Transit IDEA Program of TRB: Mr. Harvey Berlin, Senior Program Officer

In the course of the research, something in the order of 2,000 individual Seattle-Area commuters participated in focus groups or on-line surveys. They were contacted through a variety of channels, and the most successful channel was the Commute Trip Reduction newsletter which went out to many organizations. It was not a requirement of the survey to name the employer organization, but many respondents did. 81 such organizations are listed in Appendix 6. The Principal Investigator acknowledges the contribution of time, effort, and knowledge that everyone involved in the surveys contributed to our understanding of Seattle-Area commuting.

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EXECUTIVE SUMMARY

This project investigated and defined a flexible carpooling service to increase the amount of carpooling to transit stations, and designed a field operating trial to test the concept.

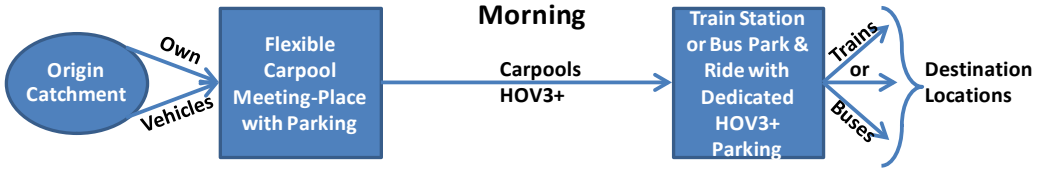
Many transit station parking facilities are full to overflowing. Parking at transit stations often has a high capital cost and limited opportunity for expansion. Arriving commuters using the parking facilities are generally driving alone. Transit ridership could be increased, and the effectiveness of investments in parking at transit stations improved, if mechanisms could be developed that encourage more people to carpool to transit stations.

Flexible carpooling is a system in which morning carpools are formed at designated residential-end meeting-places to travel to designated high-volume destinations. Flexible carpooling is characterized by an absence of the trip-by-trip pre-arrangement found in other carpool formation systems, relying instead on sufficient people arriving at the meeting-place seeking rides (and lining up) and sufficient drivers arriving seeking riders. The person at the front of the line gets into the car at the front of the line. Evening carpools are formed in a similar way at designated work-end meeting-places, although morning riders could also take other modal options to return to the morning meeting-place or other evening destination.

Informal flexible carpooling ("informal" because it is not part of the formal public transport system) can be found operating in Washington, DC/Northern Virginia, and Houston, TX, (known as the "slug-lines") and San Francisco, CA, (known as "casual carpooling"). A 2011 study by the author estimated that San Francisco gains in the order of $30 million of annual benefits from casual carpooling. The fact that thousands of people use these systems daily (5,000 riders daily in San Francisco, CA, and 6,500 in Washington, DC) is seen as evidence that the underlying behaviors can occur, and that this style of carpool formation, without the complex matching systems found in other carpool solutions, can attract significant numbers of users.

The potential pay-off to practice of successfully learning how to catalyze new flexible carpooling routes is thought to be significant.

This project considered adapting flexible carpooling behavior to the question of getting more people to transit stations. If a transit station is a 'high volume destination', could a system be established in which people would form flexible carpools and enable a greater number of people to access any given transit station and therefore increase transit ridership? Could the equivalent of a slug-line be established (a "formal flexible carpool" because it would be part of the formal public transport system) to get people to transit rather than all the way to a final destination? Such a system could contribute to reduction in congestion in many metropolitan areas at a lower cost than expanding parking at transit stations, or providing shuttles on the same routes.



A literature search was conducted and a compendium compiled of existing knowledge about flexible carpooling. Notably it was found that a flexible carpooling route has never been sustainably implemented as a project. All existing routes (slug-lines and casual carpooling) have grown organically in response to local conditions. Only one example was found of a project to implement a flexible carpooling route, in 1979, from Marin County, CA, across the Golden Gate Bridge to downtown San Francisco. While it achieved some level of ridership the project was closed down when project funds ran out.

In the absence of previous projects to implement flexible carpooling, the design of a service and field operating trial would therefore have to include mechanisms to catalyze the start of a new route, potentially

much easier (compared with 1979) in an internet-enabled world, but still with little to follow in terms of prior experience.

In order to find an appropriate route to evaluate, five popular Seattle-area transit station parking facilities were selected and their usage analyzed. A number of potential routes were identified and one, Bonney Lake to Sumner Station, was chosen as the target for design of the field operating trial.

Sumner, WA, is a small town 33 miles south of Seattle. Sound Transit operates the Sounder commuter rail service through Sumner, northwards to Seattle and southwest/northwest to Tacoma, and points in between. Sumner Station has a parking facility for Sounder passengers who arrive at the station by car. The parking facility has 286 spaces in a paved lot, and an adjacent 41-space unpaved lot, for a total of 327 spaces.

The parking at Sumner Station is 'over capacity' as demand exceeds supply, with all 327 spaces usually full by 6:15 am on week-days even though there are six subsequent commuter train services each morning (four northbound that arrive in Seattle before 9 am, and two Tacoma-bound that arrive in Tacoma before 8 am). Sound Transit is considering options for expanding the parking capacity at Sumner Station.

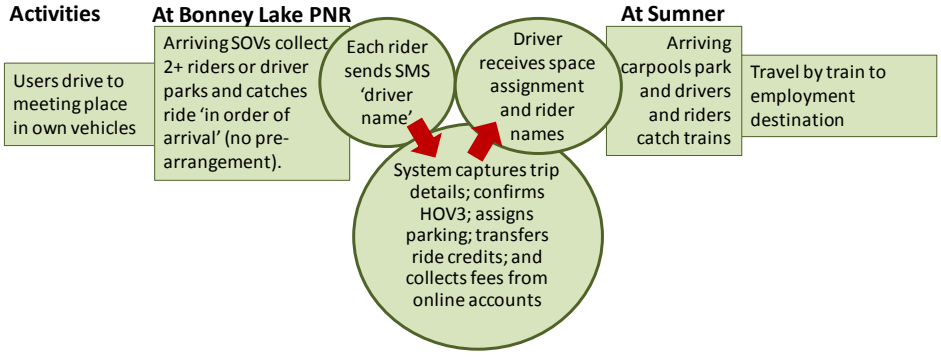
The origin address was identified for every vehicle using the parking at Sumner Station each day for a week. While the full Sumner Station catchment covers a large area, a concentration of users was found originating from the vicinity of Bonney Lake (south-east of Sumner on an escarpment) in a sub-catchment ('the Bonney Lake Catchment') from which the traffic converges onto the SR 410 highway to descend from the escarpment and travel to Sumner Station.

Each day about 100 vehicles from the Bonney Lake Catchment were found parked at Sumner Station. Across a week almost 200 unique vehicles from the Bonney Lake Catchment were seen at Sumner Station, a different grouping of 100 vehicles each day. There are very sound reasons to expect that there is unmet demand for parking at Sumner Station by people who live in the Bonney Lake Catchment.

Very near to the point on the escarpment where the traffic converges on the SR 410 highway, five miles from Sumner Station, there is a bus-station park-and-ride (PNR) with 356 spaces: the Bonney Lake South (SR 410) PNR. The Bonney Lake South PNR has well over 100 empty parking spaces every day.

Every vehicle from the Bonney Lake Catchment found parked at Sumner Station would have driven past the Bonney Lake South PNR on the way to Sumner Station. The opportunity identified by this project is for those commuters to stop at the Bonney Lake South PNR and use flexible carpooling for the remainder of their journey to Sumner Station, thereby reducing demand for parking at Sumner Station and delivering ancillary benefits.

A flexible carpooling field operating trial has been designed to give effect to this opportunity. In return for parking at Bonney Lake South PNR and flexible carpooling to Sumner Station, it is proposed that flexible carpools be offered guaranteed parking (assigned dynamically as carpools are formed and communicated to each carpool) at Sumner Station plus other incentives. 50 Sumner Station parking spaces would be set aside for arriving flexible carpool vehicles from the Bonney Lake Catchment. 100 spaces at Bonney Lake South PNR would be dedicated to the system.



If fully utilized this would reduce demand at Sumner Station by 50 spaces per day, and increase Sounder ridership by 100 people per day. It would be the equivalent of adding 100 parking spaces at the Sumner Station without incurring the estimated $3 million capital and $60,000 annual operating costs associated with such an expansion.

If fully utilized each day, the 'Bonney Lake South PNR to Sumner Station Flexible Carpooling Route' would shorten 466,000 auto trips in the Puget Sound Region per year. Commuter vehicle-miles-travelled (VMT) would be reduced by about 1,150,000 per year, replaced by a combination of carpool and commuter rail travel. Regional fuel conservation would be in the order of 170,000 gallons per year, and greenhouse gas emissions would be reduced by about 1,700 tons per year.

Among other things, the project would test the idea that commuters would carry out two modal transfers (from car to carpool to train) in return for a certain parking space at the train station. Some commuters already make two modal transfers (from car to shuttle to train) at the same facilities.

Survey research with over 1,700 Seattle-area commuters (carried out as part of this project) found that solutions that reduce traffic delays; improve predictability of trip duration; and minimize trip duration could be expected to achieve a positive response. Commuters driving alone and travelling long distances were found to be least satisfied with their commute, so would be more likely to be interested in opportunities to try new solutions. About two thirds of drive-alone and public transport-using respondents reacted positively to a description of flexible carpooling.

There are limitations to the scope and findings of this project. The project:

- has not built political support in the Bonney Lake Catchment, and recruitment of survey respondents from the catchment met with limited success;
- includes an estimate for the cost of staff for enforcement of preferential parking at Sumner Station, but did not test the potential for political and community support or opposition to dedicating some of the parking to arriving carpoolers;
- did not carry out research with users of Sumner Station from catchments other than those from the Bonney Lake Catchment;
- did not evaluate other methods of forming carpools;
- considered but ruled out the idea of implementing preferential parking for carpoolers without providing outreach to users and systems for tracking participation and sharing benefits;
- did not specify a flexible carpooling service that forms carpools at the curb-side rather than within a parking facility.

This project has researched, evaluated, and proposed a field operating trial for a 'flexible carpooling to transit station' route from the Bonney Lake South PNR to Sumner Station, in the Seattle region of Washington State. This report outlines the process followed in choosing this route, in part to clarify the reasons for choosing this route, and in part to enable a similar process to be followed for evaluation of other routes in different locations.

Concurrent with completing this project Sound Transit is continuing to explore options for reducing demand for parking at a number of the region's train stations. Appendix 1 is a five-page brief that has been developed to help market the project to potential partners so that this field operating trial can come into being.

I. INTRODUCTION – FLEXIBLE CARPOOLING TO TRANSIT STATIONS

This research project investigated the potential for a flexible carpooling service that would help commuters access a transit station in the Puget Sound Region of Washington State, and created a preliminary design for a field operating trial (FOT) to test the system.

THE PROBLEM

- Transit station parking facilities are full to overflowing, constraining growth in transit ridership.
- Most parking spaces at transit stations are delivering only one transit passenger.
- There is a high cost of building and a low availability of land for more parking facilities.
- Realizing that the transit station parking facility is full, the commuter decides instead to drive in a single occupant vehicle all the way to the destination, and back again, contributing to congestion and emissions in the region.

THE INNOVATIVE APPROACH

Two core innovations:

1. Introducing a formalized version of casual carpooling/slug lines (called 'flexible carpooling');
    a. What is casual carpooling/slug lines?
        i. There are:
            1. about 7,500 people involved each morning in creating single use, 3+ carpools in 'casual carpooling' in San Francisco (2,500 drivers and 5,000 riders),
            2. about 10,000 each morning in the slug-lines in Northern Virginia, and Washington, D.C. (3,250 drivers and 6,500 riders), and
            3. about 600 each morning in the slug-lines in Houston, TX.
        ii. It's as if there is a taxi stand for carpoolers. Cars drive up and wait, or people line up and wait, and the people at the front of the line get into the car at the front of the line, two riders per car (HOV3), and they travel to the destination for which the pick-up point was established.
        iii. In the evening casual carpoolers and sluggers manage their return journey in a variety of ways.
            1. In San Francisco about 17% use casual carpooling to return, mainly on the longer distance commutes where there are HOV advantages for drivers who pick them up. The evening process is the same as the morning, with riders lining up at the pick-up point and drivers lining up to give them a ride.
            2. In Washington DC there are anecdotally a greater proportion of sluggers who use the system for the return journey (compared with San Francisco), and there are as many as 16 different evening pick-up locations. The greater proportion using the system for returning in

Washington DC might be explained by the greater HOV lane advantage along the I-95 in the evening.

3. Riders in both locations (San Francisco and Washington, DC) also use public transport for their return journeys.

iv. In a recent study of San Francisco park-and-ride usage the authors reported: *"Many saw casual carpooling as a winning option because it was flexible, fast, and free. Few had fears of riding with a stranger because they could choose to enter a car or wait for a different one, there were usually at least two unrelated riders in the car, and the experience with casual carpooling has been good for most."*[1]

v. The Federal Highways Administration has recently reported on a scan tour of the three casual carpooling/slugging locations[2]; and focus groups with casual carpoolers[3].

b. How will casual carpooling/slug lines be formalized? For this project a service is defined that would:

i. Introduce a pick-up point in an area where no casual carpooling or slug line exists (in the Puget Sound Region), in a park-and-ride facility near a residential area;

ii. Create a flexible carpooling route to a transit station that has a parking facility, including arranging dedicated flexible carpool parking spaces at the parking facility, and an evening pick-up point for forming flexible carpools back to the pick-up point from the morning;

iii. Enable confirmation of the assignment of a dedicated parking space for each carpool, to be advised to the driver by text message, as soon as the carpool has been confirmed;

iv. Use an appropriate process to screen participants;

v. Use SMS text messaging to capture trip records;

vi. Use a system of financially valuable ride-credits to reward drivers and riders for using the system, based on the trip records. For each trip, on a real-time or daily batch basis, the system will transfer a ride credit from each rider to the driver, within members' accounts which will be maintained on-line. These ride credits can be:

1. Earned by giving rides, or purchased from the market, online; and

2. Used by taking rides, or sold to the market, online.

The system will have a price-setting mechanism. Members who always ride will pay cash to the system to the value of the ride credits that they buy. Members who always drive will be able to extract cash from sale of ride credits online.

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[1] Study of Park-and-Ride Facilities and Their Use in the San Francisco Bay Area of California, Shirgaokar and Deakin, Transportation Research Record: Journal of the Transportation Research Board, No. 1927, Transportation Research Board of the National Academies, Washington, D.C., 2005, pp.46-54.

[2] Casual Carpooling Scan Report: http://www.fhwa.dot.gov/advancedresearch/pubs/12053/12053.pdf

[3] Casual Carpooling Focus Group Study: http://www.fhwa.dot.gov/advancedresearch/pubs/13053/13053.pdf

vii. Incentives for participation (paid from project funds) will be paid directly into members' system accounts.

viii. In the event that a rider needs to get back to their residential area during the day (a day time emergency) they will be provided with access to a local 'guaranteed ride home' service or equivalent.

The essence of the system will be the same as the casual carpooling/slug lines that operate in San Francisco, Washington, DC, and Houston: there is no pre-arranging of who rides in which car.

2. Using this flexible carpooling system to get people to the transit station parking in the morning, and (optionally) back to the morning pick-up point in the evening. There will be no requirement to use flexible carpooling to return in the evening; however users will be encouraged to use the system in both directions where possible.

THE HYPOTHESES

- Lack of flexibility is suggested to be a key reason why formal carpools do not work as a mode for getting people to the transit station to the extent that transport planners might hope, and the flexibility found in casual carpooling/slugging is suggested as the key factor that explains their success.
    - In a formal carpool (whether formed from 'high tech hitchhiking', social networks, workplace commute trip reduction, or online ride matching) participants are committed to being in a particular seat at a particular time, and if they are late they inconvenience themselves and one or two other people. This is a serious drawback to formal carpooling especially for relatively short trips such as to transit stations.
- Implementing a system that offers flexible carpooling that works in a way similar to casual carpooling could be significantly more successful than other efforts to increase carpooling.
    - A flexible carpooling system has been developed and patented that incorporates technology and enables membership, participation tracking, and online ride credit transfers, (as described above) and is seeking locations for beta trials.
    - The specification for the system includes the outreach and other social initiatives expected to be needed to bring about a successful implementation.
- If a survey shows that there are many (50+) users of a transit station parking facility who drive from a similar area, then a system of flexible carpooling from that area, together with dedicated carpool parking at the transit station, would enable and incentivize those users to consolidate their travel into fewer vehicles, and attract other commuters from the same area (who currently drive directly to work because they do not expect to find parking at the transit station) to flexibly carpool with them to the transit station.
    - The use of SMS text messaging for flexible carpooling may enable monitoring and managing the use of dedicated carpool parking spaces within the transit station.

POTENTIAL PAYOFF FOR PRACTICE

- Increased transit ridership, (equal to the number of riders in flexible carpooling cars, assuming any spaces freed up as a result of ride consolidation will be used by other commuters)
- Greater effectiveness of the investment in transit facilities (increase in effectiveness of transit station parking facilities and trains or buses equal to the number of riders arriving in flexible carpooling cars)
- Reduced fuel consumption and carbon footprint for the community using the system, equal to the:

- Reduced driving by current transit station parkers who become flexible carpool riders; plus
- Reduced driving by new transit riders who were previously driving all the way to work; plus
- Second order effect of reduced time, energy use, and emissions by the remaining traffic on the route of those who were driving all the way to work (due to less traffic on those routes).

II. INVESTIGATIVE APPROACH

OVERVIEW

The following are the key components of this research project:

- Literature search for existing knowledge about flexible carpooling;
- Survey usage patterns of popular transit station parking facilities to identify potential flexible carpooling routes (50+ vehicles from a common origin area);
- Survey potential users to help understand travel behavior and predict utilization[4]; and
- Design and calculate the benefits and costs of a field operating trial.

Note that implementation of the field operating trial is not part of the project.

PROJECT DELIVERABLES

The following are the key deliverables of the project:

- Summary of existing knowledge about flexible carpooling; (*Flexible Carpooling: a Compendium*): http://www.tripconvergence.co.nz/flexiblecarpoolingcompendium.pdf;
- Summary of the process of identifying potential routes (*Stage 1 Report*): http://www.tripconvergence.co.nz/flexiblecarpoolingideastage1report.pdf;
- Design of a field operating trial (this report).

ORGANIZATION OF THIS REPORT

This report describes the work carried out and summarizes the results of the work, in the following major segments:

- Executive summary;
- Introduction, including the problem statement, description of the innovation, and the potential payoff for practice;
- Introduction of the Steering Team (Section III);
- Summary from the literature search (Section IV);
- Summary of the process of choosing a route, mainly the work of Stage 1 (Section V);
- Summary of the findings of research carried out with commuters to understand travel behavior and predict utilization (Section VI);
- Discussion about important factors to be taken into account in the design of the field operating trial (Section VII);

[4] User research was not included in the original specification for this project. The research reported here was added as a no-cost change at the request of the Expert Review Panel at the end of Stage 1.

- The detailed project plan for the field operating trial including a description of the service, an estimate of the impact of the service, the key tasks of the field operating trial project, and an estimate of the cost of the field operating trial (Section VIII).

Six appendices are attached:

1. Lift-out description of the proposed field operating trial for the local market;
2. A detailed description of each of the work steps within the key tasks of the field operating trial project;
3. A detailed estimate of the cost of the field operating trial;
4. A mock-up of a membership card and a car card for users of the system;
5. Extracts from the on-line survey detailing the transport stories of Bonney Lake residents; and
6. A list of Seattle-area employers who's staff participated in the online survey.

III. STEERING TEAM

The steering team for the project drew on staff from key transportation agencies in the region: Washington State Department of Transport (WSDOT), Puget Sound Regional Council (PSRC), Sound Transit (ST), and King County Metro (KCM). Table 1 shows the representative from each agency.

TABLE 1 Steering Team

Agency	Steering Team Member
Sound Transit	Eric Chipps
Washington State Department of Transport	Brian Lagerberg
Puget Sound Regional Council	Robin Mayhew
King County Metro	Park Woodworth

The steering team reviewed and commented on all project steps, provided a sounding board for the Principal Investigator to ensure the project had valid local perspectives, and helped facilitate local activities including meetings and removal of barriers where necessary.

IV. EXISTING KNOWLEDGE ABOUT FLEXIBLE CARPOOLING

Flexible carpooling is characterized by shared trips where there is no prearrangement to carpool, and carloads are made up "on the fly" at dedicated meeting-places with dedicated destinations. The absence of a trip by trip pre-arrangement step sets flexible carpooling apart from all other carpool formation methods.

Flexible Carpooling – A Compendium[5] describes the three known examples of informal flexible carpooling, ("informal" because it is not part of the formal public transport system) which arose spontaneously from local travel communities. They are:

San Francisco (~2,500 3-person carpools daily – locally known as *casual carpools*);
Northern Virginia/Washington DC (~3,000 3-person carpools daily – locally known as the *slug lines*);
Houston TX (~300 3-person carpools daily – locally known as the *slug lines*)

In all three cases the system operates where there is an HOV3 lane. Carpools are formed for the benefit of using the HOV3 lane, saving both time and money for the participants. Given these benefits, it is not clear why informal flexible carpooling has not arisen in other locations where there are HOV3 lanes.

There is a regional benefit as well, especially when the people who are passengers in casual carpools would otherwise have been single-occupant vehicle (SOV) drivers in the general purpose lanes. It has been estimated that San Francisco gains in the order of $30 million per year in benefits from casual carpooling[6].

[5] See: http://www.tripconvergence.co.nz/flexiblecarpoolingcompendium.pdf.

Given these regional benefits it is also not clear why flexible carpooling has not been targeted as a method for reducing traffic at low cost in every city of the world. However, there are no operational examples of formal flexible carpooling, (where it is part of the formal transport system in a city, and has some form of registration and identification system for participants).

Formal flexible carpooling was tested with limited success in Marin County in 1979/80 to provide back-up transportation in case of a bus strike or non-availability of fuel. The project had about 1,400 participants, but appears to have had a low utilization rate and it was closed down when its funding ran out.

More recently Trip Convergence Ltd attempted to catalyze a formal flexible carpooling service in Auckland, New Zealand, but failed to attract enough participants to launch. At the same time the Washington State Department of Transportation (WSDOT) sponsored a much better-funded pilot project in Seattle (the Go520 project carried out by Avego[7]) using an iPhone application to match riders and drivers, and failed to launch for the same reason. In both cases the application process required disclosure of criminal and driving records and at least in the latter case both Avego and WSDOT have stated this was a key reason for the failure. In the Auckland case, Trip Convergence has stated that they made insufficient contact with the origin-end community.

The existence of informal flexible carpooling, and that several thousand people use it each day, suggests that it could be a mechanism for reducing traffic. Within the three cities where informal flexible carpooling operates there are 84 identifiable informal flexible carpooling routes, ranging in size from one to 314 carpools formed daily. The origin of nine of these routes, the Horner Road VA parking lot, is responsible for converting a full lane of traffic to just one third of a lane, with a full car departing every 6.5 seconds during peak. The economic value to the transport system is immense.

The compendium ends by identifying what is not known about flexible carpooling, and hence the focus for further study: how to catalyze a new flexible carpooling route; what market share to expect; what physical characteristics would favor the system; what would motivate new users; and how resilient the system would be to shocks.

V. CHOOSING A ROUTE FOR A FIELD OPERATING TRIAL

The goal of Stage 1 of the project was to find potential flexible carpooling routes that would terminate at a park-and-ride (PNR, including both bus-station park-and-ride facilities, and train-station parking facilities) for the purpose of defining a field operating trial.

- Five well-used Seattle-area PNRs were selected for study;
- Usage of these PNRs was surveyed and analyzed;
- Based on the analysis, nine potential flexible carpooling routes were identified;
- Based on further analysis, four were recommended for further consideration; and
- One, Bonney Lake South (SR 410) PNR to Sumner Train Station, was chosen for the design of the field operating trial.

The Stage 1 report[8] outlines in detail the methods used to find potential routes. The following is summarized from the Stage 1 report.

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[6] Download from http://www.mdpi.com/1996-1073/4/1/126, page 136.

[7] A case study can be found at http://www.ccta.net/assets/documents/Real-Time~Ridesharing/go520%20Case%20Study%20Paper%20from%20ITSA.pdf.

[8] See: http://www.tripconvergence.co.nz/flexiblecarpoolingideastage1report.pdf.

CHOOSING PNRS TO STUDY

The five PNRs were chosen from a regional database of 136 PNRs that ranged in size from 9 to 2,363 spaces and comprised a total of over 37,500 spaces. The database was sorted by size and utilization factor, and Steering Team members gathered information about which of the 47 largest PNRs (>250 spaces) would likely meet the following criteria:

1. Enough vehicles from an origin area, past a convergence point, coming to the station, such that waiting times for flexible carpool formation would be minimal given a reasonable market share of commuters using the route;
2. Sufficient distance from the convergence point to the station such that any time spent getting a fuller vehicle would be repaid through the value of the trips provided to other people (assuming for this purpose that drivers receive (from riders) a ride-credit for providing the ride, and the ride-credit has value);
3. PNRs that were being well used such that reducing demand at those PNRs by implementing flexible carpooling would be useful for the PNR.

The Steering Team debated the merits of many of the PNRs, and made the selection. Table 2 shows the five PNRs chosen for study, and Figure 2 (next page) shows all PNRs in the region with capacity greater than 250 spaces, with the five chosen ones highlighted.

TABLE 2 PNR chosen for study

PSRC#	Year	Q	Name	Address	City	Zip	Capacity	Used	% Used	Spare Capacity
19	2009	1	South Bellevue	2700 Bellevue Way SE	Bellevue	98004	519	558	108%	0
6	2007	1	Lynnwood Transit Center	20101 48th Ave W	Lynnwood	98036	1,260	1,336	106%	0
9	2009	1	South Kirkland	10610 NE 38th Pl	Kirkland	98033	596	622	104%	0
110	2007	1	Sumner Train Station	810 Maple St	Sumner	98390	286	288	101%	0
28	2009	1	South Renton	205 S 7th St	Renton	98055	373	371	99%	2

SURVEYING PNRS TO IDENTIFY POTENTIAL ROUTES

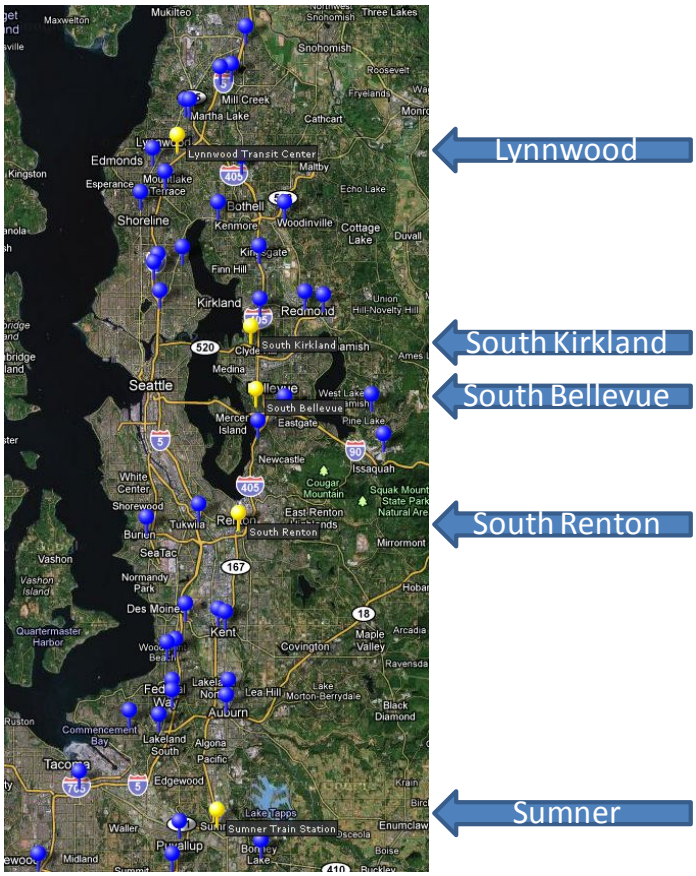
Five PNRs were surveyed in order to learn where the users came from (catchment), how often they came, and how many people were in each vehicle. The method involved creating an inventory of each of the PNRs (recording the license-plate details of parked vehicles each day for five days), observing arriving vehicles and recording the number of people in each vehicle (on one of the five days), and analyzing this data to identify potential flexible carpooling routes.

Catchment

The fieldwork team visited each PNR five working-days in a row and recorded the license-plate details of all the vehicles parked in the PNR at the time. The license-plate details were captured using a camera loaded with license-plate recognition (LPR) software, see Figure 1. In some cases the LPR camera failed to capture the license-plate image so as a back-up (in situations when an image was thought to have been missed) the operator spoke the license-plate details into an audio recorder.

FIGURE 1 License Plate Camera And Sample Picture

FIGURE 2 Map of Seattle Area PNRs >250 spaces with Selected Ones Highlighted



The license-plate details from the LPR software and the voice recorder were translated into a dataset for each day for each PNR, and then combined into a single database, checked, and sent electronically to the Department of Licensing (DOL). The DOL programmatically extracted address details for each license-plate and returned a file of addresses for those that matched. It is noted that without the ability to get this data from the DOL, the method of analysis of origins described below would be unavailable.

In a spreadsheet, each origin address was assigned a color based on the number of days the same vehicle had been present in the PNR, (1 day, red; 2 days, green; 3 days, blue; 4 days, orange; 5 days, pink), and labeled with a cross reference number and a code (see Table 3) to represent which days it was present.

TABLE 3 Potential Presence Codes for Five Days of Observation

Cars that were present only one day	Cars that were present on two of the days	Cars that were present on three of the days	Cars that were present on four of the days	Cars that were present all five days
10000, 01000, 00100, 00010, 00001	11000, 10100, 10010, 10001, 01100, 01010, 01001, 00110, 00101, 00011	11100, 11010, 11001, 10110, 10101, 10011, 01110, 01101, 01011, 00111	11110, 11101, 11011, 10111, 01111	11111

A free internet service (www.gpsvisualizer.com) was used to convert each address into a geo-code (latitude and longitude coordinates). Each address was then also assigned a marker (square, circle, triangle, etc) to depict its compass direction (in octants) from the PNR.

The same internet service enabled plotting of the origin addresses (each with its marker, color, and label) on a Google map. A map was created for each PNR showing all the origins.

Using the origin and destination geo-codes the distance of travel to the PNR was calculated 'as the crow flies' for each vehicle. It is noted that the average distance so calculated will be shorter than the actual average distance travelled by the vehicles.

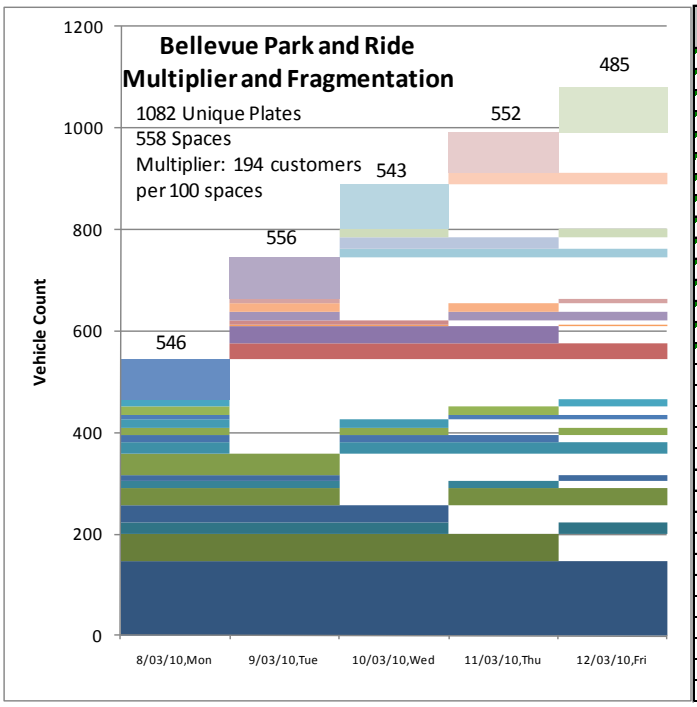
Frequency of Use

The five PNRs had been chosen because they were highly utilized. The high utilization rates were borne out in that all five PNRs were reported as being full on the Tuesday, Wednesday, and Thursday of the observation. With the exception of Sumner, which was full all five days, all PNR were less full on the Monday and Friday.

The expectation held by the project team was that mostly the same vehicles would be present each day, with some lesser number of the same vehicles present on the days with less usage. The total number of vehicles seen in a week would be similar to the number of parking spaces. This turned out to not be the case. Across all five PNRs significant fragmentation of usage was discovered, and the total number of individual vehicles observed across the week approached double the number of parking spaces in each case. For example, Figure 3 shows the vehicles that came each day to the Bellevue PNR, and their patterns of usage.

In Figure 3 the solid bar across the bottom represents the number of plates (147) observed all five days (11111). The second bar represents plates (53) observed for the first four days but not the fifth (11110), and the bar above that, the 22 vehicles present for the first three days, absent on the fourth, and present on the fifth (11101). The single day bar below the number 556 represents the 80 plates present only on the second day (01000). The values for each bar can be found on the adjacent table.

FIGURE 3 Multiplier and Fragmentation at Bellevue



Presence Code	Day 1	Day 2	Day 3	Day 4	Day 5
00001					90
00010				80	
00011				24	24
00100			87		
00101			15		15
00110			24	24	
00111			18	18	18
01000		80			
01001		10			10
01010		17		17	
01011		15		15	15
01100		9	9		
01101		4	4		4
01110		32	32	32	
01111		31	31	31	31
10000	80				
10001	15				15
10010	16			16	
10011	10			10	10
10100	16		16		
10101	14		14		14
10110	15		15	15	
10111	22		22	22	22
11000	41	41			
11001	13	13			13
11010	13	13		13	
11011	35	35		35	35
11100	34	34	34		
11101	22	22	22		22
11110	53	53	53	53	
11111	147	147	147	147	147

The data was reviewed to find out how *reliable* the knowledge of a single day's usage would be in predicting usage on other days. It was found that knowing the usage on any one day of the week would predict between half and two-thirds of the identity of users' vehicles for the other days of the week, and

between 60% and 70% of the total parking-days (across the week) represented by users' vehicles from that one day.

PNR usage contains an interesting dynamic. Many people could use the PNR day-in and day-out, and by arriving early enough each day be assured of a space to park. It would almost be that these people each 'own' a space at the PNR, although not in a 'property rights' context. (Interestingly, King County Metro reportedly paid money to vanpoolers to incentivize them to move their meeting-place out of a busy park-and-ride to a less busy location, suggesting an implied property right). However, this 'ownership' could be easily displaced by other people arriving earlier in the morning.

Whatever the interpretation, it can be envisaged that every day a number of people set out from home with the idea in mind that they will park at a given PNR. The evidence would suggest that most days the number of people heading to popular PNR exceeds the number of spaces available. Order of arrival at the PNR will dictate who of the cohort will be able to use the PNR that day. Use of the public transit system is dependent on there being a space available in the target or a subsequent PNR. The only guarantee of finding a space is through 'early arrival', and it can be expected that those dedicated to using public transit will ensure that they arrive early enough to get a space. Some proportion of those who head towards the PNR would arrive there near the time it gets full and would face uncertainty about their total travel-time. To the extent that users try multiple PNRs, and to the extent that they find no space available at the PNR when they arrive, or have to spend time circulating to find the last available space, their use of the PNR adds travel-time and increases the variability of their travel-time[9].

Occupancy

The average occupancy of vehicles arriving at the surveyed PNR ranged from 1.014 (Sumner) to 1.123 (Kirkland) persons per vehicle. Many of the arriving vehicles with greater than one person subsequently departed, so being a drop-off rather than an HOV arriving to park. It was concluded that very few PNR spaces account for more than a single transit round-trip.

Identifying potential flexible carpooling routes

Several methods were used to find potential flexible carpooling routes from the data: 1) The Google Maps for each PNR were studied visually; 2) The data for each PNR was divided by octant and quintile and large concentrations were checked visually on the maps (see Figure 4 & Figure 5 for an example); 3) The data for each PNR was analyzed using a spreadsheet routine to find high concentrations. Maps were drawn showing the areas of high density origins (50+ convergent trips) (see Figure 6 for an example). The Google Maps 'route function' was used to identify which origin addresses likely fit in the catchment of a given potential route.

[9] This interpretation was confirmed by PNR users during focus group discussions in Stage 2 of the project.

FIGURE 4 Octants and Quintiles

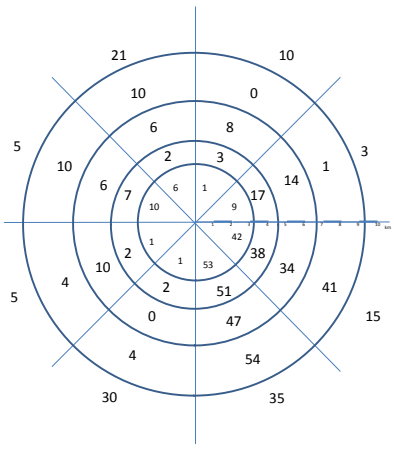
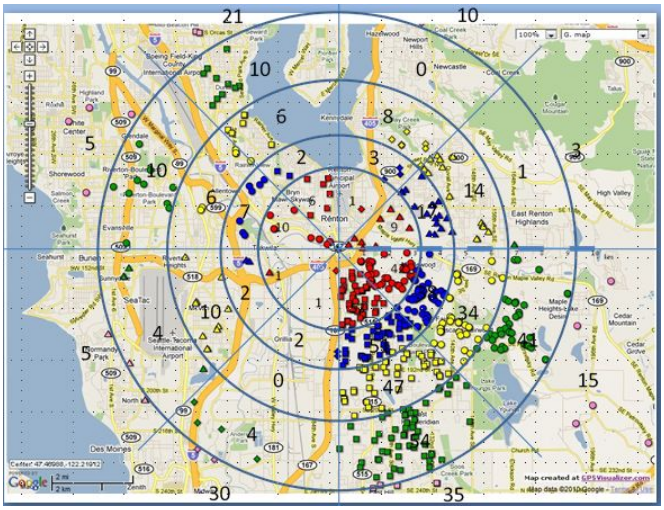
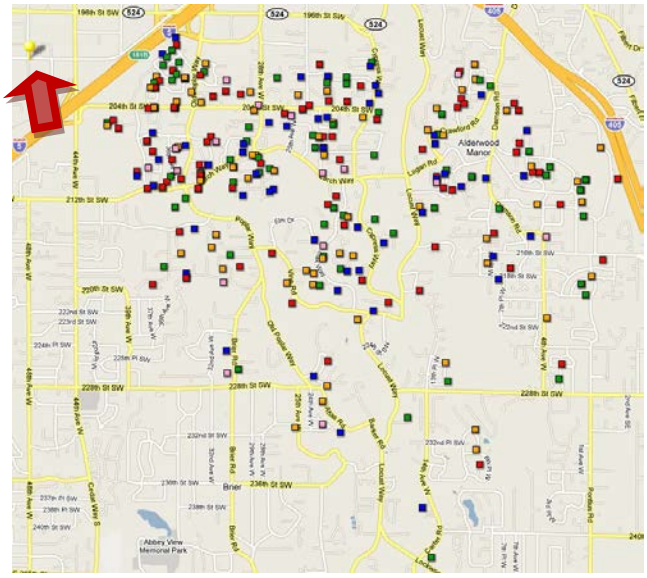


FIGURE 5 Octants and Quintiles Set Over the Map



In Figure 5 the center is South Renton PNR. Each small shapes represents the registered address of a vehicle seen parked at Renton, with a different shape for each compass direction, and a different shade (or color if viewing this report in color) for each quintile (one fifth) by distance from the PNR.

FIGURE 6 Potential Route Brier to Lynnwood, High Density Origin Area Map



In Figure 6, Lynnwood PNR is just above the large arrow. The small squares each represents the registered address of a vehicle parked at Lynwood PNR, with a different shade (or color) depending on how many days of the count-week the vehicle was present).

The fragmentation of usage leads to an interesting dynamic when combining catchment and usage. As shown in Table 4, the Brier catchment of the Lynnwood PNR (shown in Figure 6) delivers about 150 vehicles each day, but across the week 296 different vehicles were seen from the catchment. Clearly a traditional form of carpooling would be unlikely to deliver many carpools from such a catchment.

TABLE 4 Vehicles from Brier Catchment at Lynnwood PNR

Lynnwood	Vehicles in Catchment						Meeting
Route Name	Mon	Tue	Wed	Thu	Fri	Total	Type
Brier	113	164	166	157	144	296	Pick-up

Nine high-density origin areas and the investigated routes were listed in a table with relevant pros and cons, and a recommendation was made of four routes to investigate further.

In Table 5 the routes are displayed in declining order of convergent vehicle miles travelled (VMT). Weekly VMT is calculated as the one-way convergent mileage currently being operated, assuming the registered address is a home address, and that the vehicle travels from that address to the PNR.

TABLE 5 Potential Flexible Carpooling Routes with Convergent Distance and Weekly VMT

		Vehicles in Catchment						Meeting	Convergent	
PNR	Route Name	Mon	Tue	Wed	Thu	Fri	Total	Type	Distance (miles)	Weekly VMT
Sumner	Bonney Lake	67	97	90	101	106	197	Parking	4.8	2212.8
Renton	Petrovitsky Road	97	84	93	91	109	213	Parking	2.7	1279.8
Bellevue	Sammamish	lost	55	61	41	42	107	Parking	6	1194
Bellevue	Newport Hills	lost	122	116	85	70	209	Parking	3	1179
Kirkland	Juanita	26	53	43	42	39	109	Parking	5.6	1136.8
Lynnwood	Mulkiteo	33	38	39	44	40	93	Parking	5.5	1067
Sumner	Orting	21	37	33	28	36	67	Parking	5.6	868
Lynnwood	Brier	113	164	166	157	144	296	Pick-Up	1.1	818.4
Lynnwood	Perrinville	44	76	91	92	65	143	Pick-Up	1.5	552

The Stage 1 report recommended that further investigation be carried out into the following four potential routes:

1. Bonney Lake (maximum VMT reduction and big PNR impact);
2. Petrovitsky Road (medium VMT reduction, high parking impact, especially as a % of PNR capacity);
3. Newport Hills (PNR meeting place and HOV lanes to get to the Transit Station);
4. Brier (Maximum impact on PNR parking, plus develop methods for curb-side implementation).

The report identified two key dimensions for choosing which routes to study further: the likely impact on the PNR (with the greater the number of reduced vehicles the better) and the likely impact on vehicle-miles-travelled (VMT). The Bonney Lake route would have the potential to maximize VMT reductions, while the Brier route would have the potential to maximize impact on the PNR.

The Brier route would be developed with no intervening parking, and would most closely resemble the casual carpooling in San Francisco.

The Bonney Lake and Newport Hills routes would use capacity available (if it is) in existing PNR.

CHOOSING ONE ROUTE

It was realized that the Stage 1 focus on VMT to the PNR was not as important as the VMT impact on regional transportation if greater numbers of people were to utilize transit rather than driving alone. However, comparison between routes on the basis of employment destination would be very difficult because of the diversity of destinations that would be relevant from each PNR, and the difficulty accessing the information.

Community Transit decided that a Brier flexible carpooling route was not a current TDM priority and declined to be involved further.

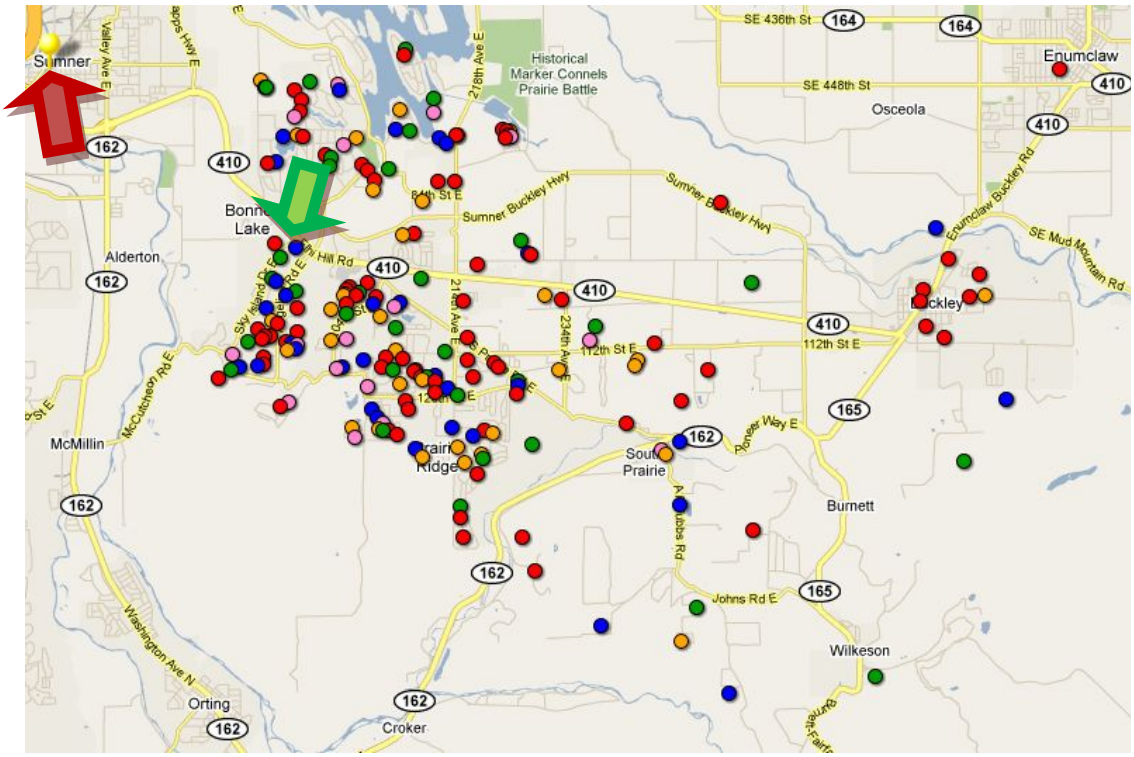
Newport Hills was ruled out because the HOV lanes to Bellevue are not seamless and the benefit seemed minimal. Also the use of South Bellevue PNR as parking for daytime access to Bellevue would be curtailed by increased use for commuting.

With Sound Transit canvassing options for expansion of parking capacity at Sumner Train Station, (currently 286 spaces plus an adjacent 41-space gravel lot) and with in excess of 100 unused spaces daily at Bonney Lake South PNR, (356 spaces) it was decided that the Bonney Lake South PNR to Sumner Station route (the 'Route') would be used as the basis for the detailed field operating trial plan. Table 6 and Figure 7 show detail of the catchment.

TABLE 6 Bonney Lake PNR Catchment Vehicles at Sumner

Sumner	Vehicles in Catchment						Meeting
Route Name	Mon	Tue	Wed	Thu	Fri	Total	Type
Bonney Lake	67	97	90	101	106	197	Parking

FIGURE 7 Bonney Lake PNR Catchment



The Bonney Lake to Sumner situation is one where many people are bypassing a PNR (in this case the Bonney Lake South PNR (just below the downward-pointing arrow on Figure 7)) and driving to a preferred PNR at Sumner (in Figure 7 just above the upward-pointing arrow) to catch the train. The traffic converges to descend off the escarpment on the SR 410, with about 100 vehicles driving past here to the Sumner Train Station, a distance of about 5 miles, each day. There are bus services from Bonney Lake South PNR to Sumner, but these are infrequent. The Bonney Lake South PNR is located at the intersection of 184th Ave E and Elhi Hill Road (SR 410). In the graphic above, dots represent the registered addresses for vehicles seen at Sumner Station during the week of study; with different shades (colors) for those seen one, two, three, four, or five times.

The Sumner Station parking fills up by 6:15 am each day so it is somewhat unlikely that these people are driving in congested traffic on their way to the train. It is reportedly different for their return journey.

The Route is in Pierce County.

FIGURE 8 Sumner Station Parking, Platform, Adjacent Gravel Lot, and Train

Figure 8 shows features of Sumner Station. In a conversation with the station master he expressed the view that any attempt to dedicate parking to carpools would be met with anarchy. Clearly careful outreach will be required. With about 100 vehicles currently arriving each day from the Bonney Lake Catchment, changing their demand to 50 spaces should free up space for other users.

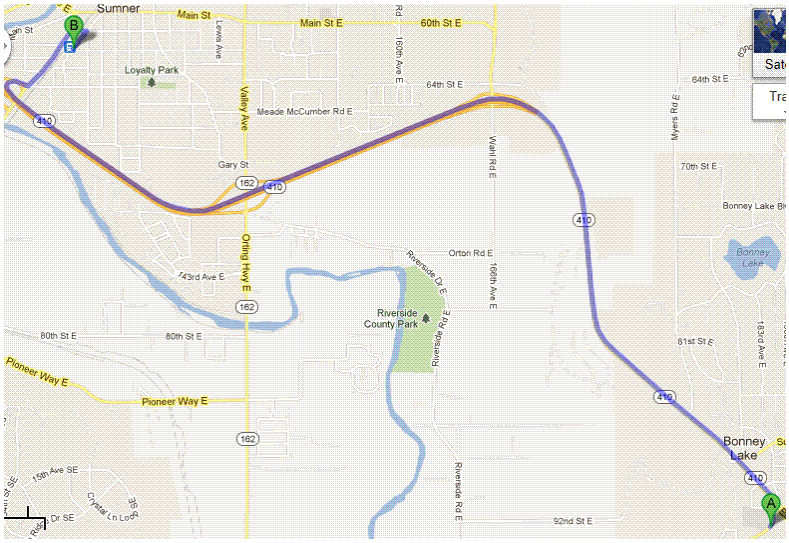
Figure 9 shows Sumner Station parking from above. It has a layout that would be conducive to partitioning off an area to dedicate to carpoolers.

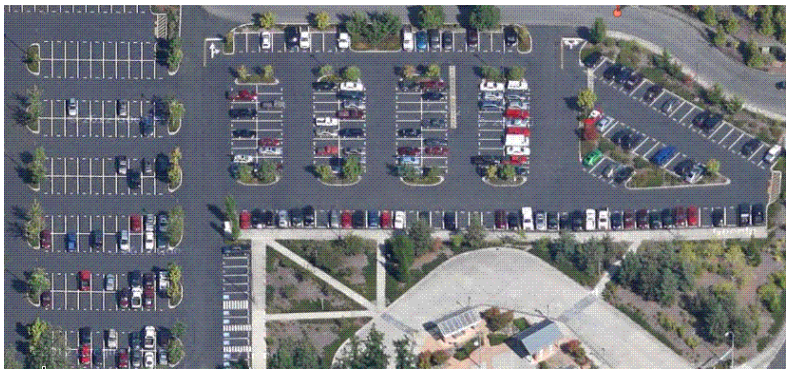
FIGURE 9 Sumner Station PNR Parking Layout

Figure 10 and Figure 11 provide an idea of the layout of Bonney Lake South PNR and the Route.

FIGURE 10 Bonney Lake South PNR Bus Stop and Parking Areas

FIGURE 11 Route From Bonney Lake to Sumner, Bonney Lake PNR Parking Layout





In the course of the research the principal investigator attempted to engage with city administration for Bonney Lake. Having no role in transportation they directed the contact to Sound Transit. The Route is dependent upon support from the residential areas in the Bonney Lake Catchment, and a key outreach target will be to get support from the civic leaders in the catchment. If such support is not forthcoming at the very earliest stages of the project (Pre-Project Task) it would be better to find a different route.

VI. UNDERSTANDING PERSONAL TRAVEL BEHAVIOR AND PREDICTING UTILIZATION

The work in Stage 1 had uncovered a surprising level of fragmentation in the use of the PNRs. Usage did not conform to the expected pattern of a substantial single cohort of commuters travelling every day to the PNR. Across the course of a week the number of different vehicles observed using the PNR was approximately double the number of spaces, with just 26% of the vehicles being present every day.

To help understand this fragmentation, and to assist in predicting utilization (to reduce the risk) of a pilot project, qualitative research was carried out with users of PNRs and quantitative research was carried out with users of the transportation system[10].

Following a conceptual framework called 'Outcome-Driven Innovation'[11], four 'virtual' (telephone conference call) focus groups were used to identify commuters' desired outcomes while making a trip, and an internet-based survey was used to gather data from a larger population about trip-making patterns and the importance of and satisfaction with their ability to achieve their outcomes.

Key findings are summarized below.

CUSTOMER RESEARCH

VIRTUAL FOCUS GROUPS

Focus group participants were recruited by intercepting passengers on the platforms at Renton and Sumner Train Stations. Interested participants contacted the Commuter Challenge office. Participants were rewarded with a $50 fuel voucher that was mailed out subsequent to the focus groups.

The focus groups were carried out by telephone conference call. The conversations helped the researcher identify the range of travel patterns[12], mix of modes, and potential reasons for variation from standard patterns.

Key items of interest included:

- Respondents have several different travel patterns;
- Travel patterns can incorporate several modes;
- Choice of travel pattern is made well in advance of the trip (it is not 'dynamic');
- Respondents planning for their travel pattern for the 'to work' (usually morning) trip is often driven by their needs for the 'homeward' (usually evening) trip;
- The surmised issues of PNR usage described in the previous section relating to access to the PNR from day to day were confirmed;
- 56 outcomes were identified related to the overall job of 'getting to and from a destination'.

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[10] User research was not included in the original specification for this project. The research reported here was added as a no-cost change at the request of the Expert Review Panel at the end of Stage 1.

[11] As described by Lance A. Bettencourt, Service Innovation: How to go from Customer Needs to Breakthrough Services, McGraw Hill 2010, and by Anthony W. Ulwick, What Customers Want: Using Outcome-Driven Innovation to Create Breakthrough Products and Services, McGraw Hill 2005.

[12] The term 'travel patterns' is used in this context to mean the mix of modes a person might use at different times or on different days to make the same trip. In other contexts it is used to mean the different places a person might travel to, regardless of mode, over a day or a week.

INTERNET BASED SURVEY

An online survey was created in Survey Monkey (www.surveymonkey.com). The survey link was sent to a variety of list-serves and organizations with commuter distribution lists with requests for them to encourage their members to complete the survey. An incentive was offered for those completing the survey (entry in a prize drawing for a $500 gift certificate) with additional entries for referring friends to complete the survey. Commuter Challenge handed out flyers on the platform at Sumner Train Station, at the Safeway stores in Orting and Bonney Lake, and at the Bonney Lake South PNR. A Seattle Times Online Ad was purchased to drive response rates.

A total of over 2,800 full and partial responses were received. The dataset was cleaned and 1,926 responses were used as the database for analysis, of which 1,757 were from Washington State, and 37 were from the Bonney Lake Catchment.

Compared with the population at large, the sample is over-represented with people who use public transportation and under-represented with people who drive alone. This is clear through the statistics of main mode. Table 7 shows how the to-work mode-mix of the Seattle region component of the sample differs from the to-work mode-mix of Seattle residents from the 2005-2007 American Community Survey. Drive alone is 33% of the sample compared with 71% for the general population, while public transport is 42% of the sample compared with only 8% for the general population.

TABLE 7 Main Mode from Survey, Compared with the 2005-2007 American Community Survey (ACS) for the Seattle-Tacoma Metropolitan Area

Mode	Survey	ACS
Bike	4%	1%
Drive Alone	33%	71%
Public Transport	42%	8%
Share	12%	12%
Telework	1%	5%
Walk	3%	3%
Other/None	4%	

The reason that the sample is over-represented with people who use public transportation is most likely that the most successful recruitment method for survey respondents was through the Seattle Commute Trip Reduction email list, which goes out to people who have in some way engaged with reducing their drive-alone travel. And further, flyers were handed out at PNRs. Efforts at recruiting the general population were much less successful. A banner advertisement on the Seattle Times' website (cost: $1,000) resulted in no completed surveys, and advertising on FaceBook yielded similarly poor response rates.

Even though the sample is over-represented with people who use public transportation and under-represented with people who drive alone, valid information can be extracted from segments of the sample, where relevant, and from the whole sample for questions where the mode-mix is not thought to be a driving force. Comparisons between views of people with different main-modes will also be of interest.

The sample from the Bonney Lake Catchment was too small for statistical analysis and comparison with broader regional averages. Selected excerpts of the answers from the 37 Bonney Lake Catchment respondents are included in this report as Appendix 5.

UNDERSTANDING PERSONAL TRAVEL BEHAVIOR

COMPLEXITY

The most significant finding is the extent to which respondents utilize multiple modes (chained together) within their main daily trip (mostly to-work), and how respondents have a number of pre-planned travel

patterns (combinations of trip legs that chain different modes together) that they interchange depending on the circumstances of the day, and how most switching between patterns is planned well in advance. In other words, the decision about how to travel is not 'dynamic'.

Of the 1,757 Washington State respondents 454 (26%) selected one mode only, 30% selected two modes, 26% selected three, 14% selected four, and 3% selected five. In all there were almost 300 different modal combinations selected (including single-modes). The top modal combinations (sorted by distance, each at least 1% of the total) are shown in Table 8.

In all the respondents travel a total of 500,000 miles each way every 20 days, approximately 12 million commuter miles per year.

TABLE 8 Top Modal Combinations by Mentions, Trips (20 Work Days), and Distance (20 Work Days), Ranked by Distance (Washington State Respondents)

	Mentions		Trips (one way) 20 days		Distance (one way) 20 days (miles)	
Mode Combination (Pattern)	Count	% of all	Count	% of all trips	Miles	% of all miles
Drive alone	825	26.2%	9,789	31.0%	151,866	30.4%
Drive alone+Bus+Walk >100 meters	99	3.1%	1,356	4.3%	27,673	5.5%
Drive alone+Bus	86	2.7%	1,066	3.4%	22,511	4.5%
Bus	175	5.6%	1,629	5.2%	19,255	3.9%
Walk >100 meters+Bus+Walk >100 meters	196	6.2%	2,347	7.4%	18,551	3.7%
Carpool as rider	140	4.4%	1,133	3.6%	17,670	3.5%
Carpool as driver	107	3.4%	1,013	3.2%	15,642	3.1%
Telework	200	6.4%	736	2.3%	14,889	3.0%
Cycle	174	5.5%	1,350	4.3%	9,913	2.0%
Drive alone+Train+Walk >100 meters	21	0.7%	249	0.8%	8,633	1.7%
Drive alone+Train+Bus	21	0.7%	235	0.7%	7,882	1.6%
Walk >100 meters+Bus	77	2.4%	703	2.2%	6,613	1.3%
Drive alone+Carpool as rider	23	0.7%	189	0.6%	5,593	1.1%
Drive alone+Walk >100 meters	57	1.8%	484	1.5%	5,588	1.1%
Drive alone+Vanpool as rider	13	0.4%	178	0.6%	4,947	1.0%
All other patterns (279 of them)	933	29.6%	9,128	28.9%	162,872	32.6%
Total	3147	100%	31,584	100%	500,098	100%

PREFERRED PATTERNS

The survey asked: *If you have more than one travel pattern, which is your preferred pattern?* As shown in Table 9, 55% have more than one travel pattern (Have >1 Pattern), and 32% use their preferred pattern most (Have >1 Pattern, Preferred Pattern).

TABLE 9 Most Used Patterns by Preference

Preference	Most Used Pattern	%
Have Only One Pattern	757	45%
Have >1 Pattern, Preferred Pattern	525	32%
Have >1 Pattern, Non-Preferred Pattern	383	23%
Total Respondents Who Declared Preference	1665	100%

The point of this analysis is that it emphasizes the danger in assuming anything about people's travel preferences – once they move away from driving alone their patterns become complex, and their preferences likely become very specific to their location and route.

CHANGING BETWEEN PATTERNS

The survey asked (of people who had more than one travel pattern): *Which of the following list of items explains what mostly causes you to not use your preferred travel pattern for your trip?*

In general this question explained why people using alternatives revert to driving alone. Key reasons include having an errand to run, responding to the weather forecast, having meetings early or late, having after-work engagements, child or parent-care requirements, changes to carpool arrangements, and for teleworkers the demands of their job that they go to the office.

The survey asked: *When you do use a different travel pattern, when do you mostly decide what you will do?* The responses set out in Table 10 show that only about 20% of the change decisions are made in a dynamic way.

TABLE 10 WHEN COMMUTERS DECIDE TO CHANGE THEIR TRAVEL PATTERN

When Deciding	Count
I decide in the morning	219
I decide several days or even weeks before	232
I decide the day before	209
I decide the night before	196
I don't really do this	31
I don't think there is a pattern	104

IMPACT OF TRANSPORT BENEFITS

The survey explored the range of transport benefits received by respondents, and it is clear to see that transport behavior is influenced by incentives. See Table 11, which is sorted in order from the greatest to the lowest proportion of ridesharing. Note that when transit is subsidized with no parking subsidy sharing (carpool and vanpool) is lowest. When parking is subsidized with no transit subsidy sharing is highest. Transit share is highest when alternatives are partly or fully funded by employer. Driving alone is highest when free parking is provided with no other benefits.

TABLE 11 Impact of Transportation Related Benefits on Mode Choice

	# of	% of person days						
Transport Benefit Received	People	Bike	PT	Drive	Share	Telework	Walk	Total
Parking subsidized, no transit subsidy	49	4%	3%	55%	31%	6%	1%	100%
Parking cash-out plus some transit subsidy, full or partial	17	11%	32%	17%	22%	10%	7%	100%
Free parking plus transit subsidy	238	6%	25%	45%	18%	3%	3%	100%
No Transport related benefits	293	5%	17%	55%	15%	3%	6%	100%
Parking subsidized, full transit subsidy	25	2%	21%	55%	15%	8%	0%	100%
Other	9	16%	13%	57%	13%	1%	0%	100%
Free parking alone	210	3%	2%	76%	13%	4%	2%	100%
Not Stated	28	1%	2%	82%	11%	2%	3%	100%
Alternatives partly funded by employer	485	4%	67%	14%	10%	2%	3%	100%
Parking subsidized, partial transit subsidy	20	7%	40%	39%	8%	4%	3%	100%
Transit or Alternatives paid in full, no parking subsidy	383	4%	67%	16%	7%	1%	5%	100%
Grand total	1757	4%	41%	36%	12%	3%	4%	100%

In summary, the use of alternatives to driving alone is driven by the availability of alternatives and the incentives that exist for using them. The use of alternatives leads to incredible travel pattern complexity, and it becomes difficult to categorize people by their travel patterns. People have multiple travel patterns, each involving one or more modes. Many people do not manage to use their preferred travel pattern most of the time. There is a somewhat predictable list of reasons for changing away from the preferred travel pattern, and, when change occurs, about a fifth of the time the decision is made on the morning of the trip – the rest of the time it is much further in advance. Caution should be used interpreting the proportions in this data because the sample is over-represented by people who use alternatives to driving alone.

PREDICTING UTILIZATION

If a flexible carpooling service is established to a transit station, will people use the service? Part of the purpose of the survey was to attempt to answer this question. It is known that people are notoriously bad at predicting their future actions with regard to purchase or adoption of new methods, so the survey didn't ask this question directly.

The impetus for a consumer to change to a new (product or) service can be expected to be driven by dissatisfaction with the status quo – dissatisfaction with either the cost or the quality, or the cost given the quality, of the existing service. This dissatisfaction might exist even without a viable alternative, or it could come about as a result of becoming aware of a new alternative.

When considering introducing a new service it is important to understand the level of satisfaction with the status quo. It is also useful to be able to compare the new service with the status quo and identify the ways in which the new service might be considered to be superior.

When seeking to innovate for services, the Outcome Driven Innovation process suggests that understanding how well the current offering helps customers achieve their important outcomes can inform the design of new services.

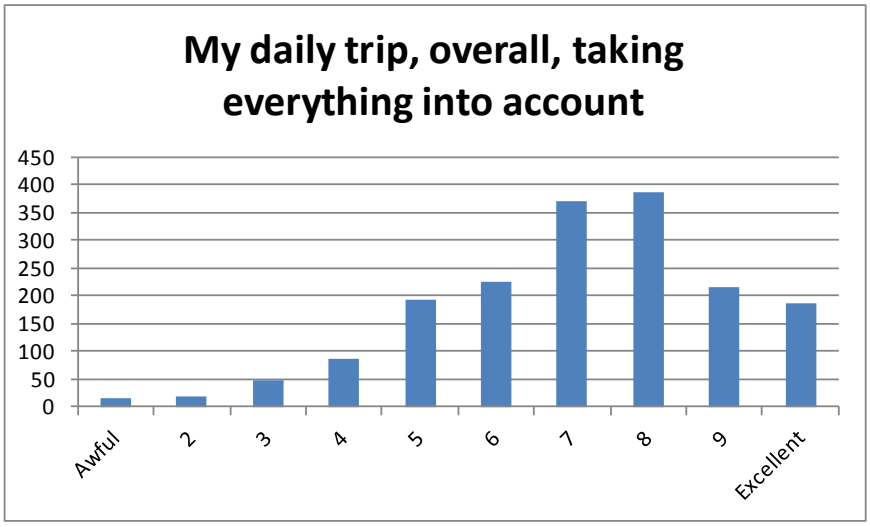
The survey sought three types of information that could contribute to a prediction about the likely utilization of a service for flexible carpooling to transit stations:

- Ratings of 'excellence' of the existing solutions;
- Ratings of importance of outcomes and satisfaction with the ability to achieve them using current solutions; and
- Ratings of likelihood to try a spontaneous carpooling service if one was available on their route.

Excellence of Existing Solutions

After being asked a number of other questions, respondents were asked: *Overall, please rate the following on a scale of 1 to 10 where 1 is awful and 10 is excellent: My daily trip, overall, taking everything into account.* Figure 12 shows the ratings.

FIGURE 12 Overall Rating for the Trip



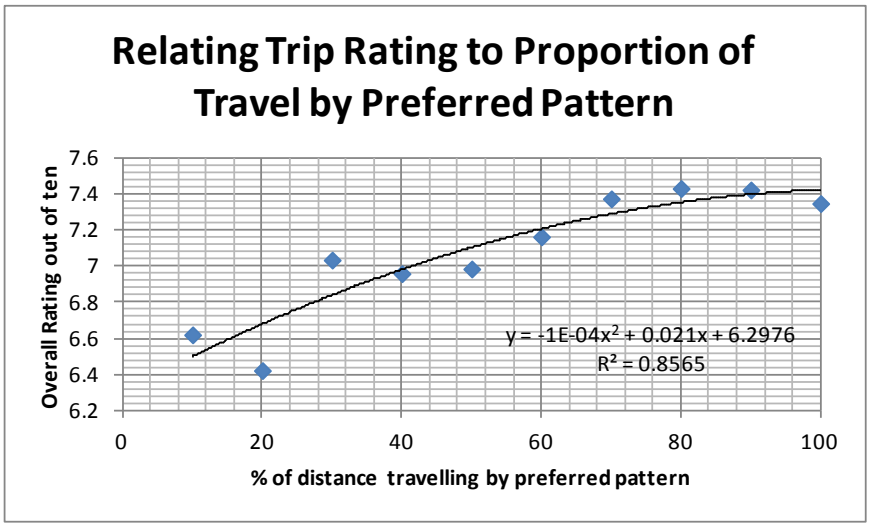
Given the opportunity to register disapproval with the transport system respondents gave what appears to be quite a high rating.

The development of alternative modes of transport is at least partially predicated on an assumption that there is a level of discontent. These numbers call that discontent into question.

OVERALL TRIP RATING BY PROPORTION OF PREFERRED MODE

Figure 13 shows that there is a positive correlation between the proportion of daily trip distance traveled by preferred mode (over 20 days) and the overall rating of the daily trip. The greater the proportion of travel by preferred mode, the higher the overall rating. There is a very strong fit of the regression line.

FIGURE 13 Relating Trip Rating to the Proportion of Travel by Preferred Pattern



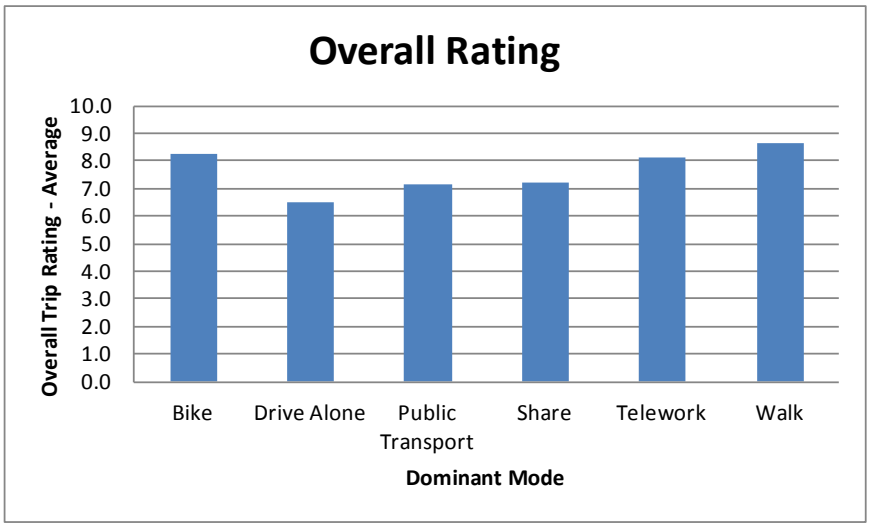
It can be expected that a consumer rating a service at 6.6 would be more likely to seek out an alternative (or respond to an offer of an alternative) than one who rates the service at 7.4, all other factors being equal.

Solutions that result in preferred patterns being used a greater proportion of the time are likely to raise overall trip ratings.

OVERALL TRIP RATING BY DOMINANT MODE

Overall trip rating was analyzed by dominant mode category. As can be seen in Figure 14, driving alone attracts the lowest rating (6.5) while all alternatives to driving alone achieve higher average ratings.

FIGURE 14 Relating Trip Ratings to Main Mode

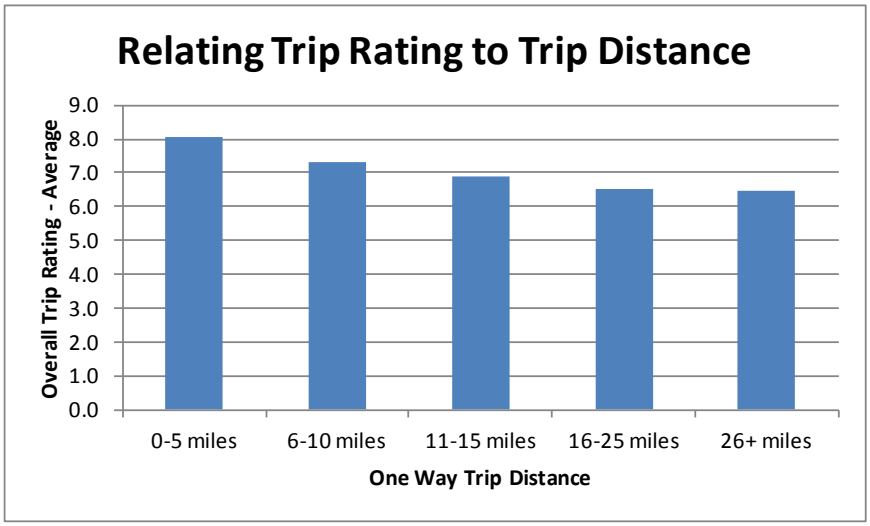


Again, it can be expected that consumers rating the service they receive at 6.5 (alone drivers) are more likely to be responsive to an alternative than those who rate it at 7.2 (sharers). Solutions that lead to greater use of alternatives to driving alone are likely to raise overall trip ratings.

OVERALL TRIP RATING BY TRIP DISTANCE

Figure 15 shows the relationship of trip distance to overall trip ratings. Longer distances lead to lower ratings.

FIGURE 15 Relating Trip Rating to Trip Distance



Solutions that raise the ratings of longer trips are likely to have greater attraction than ones for shorter trips. It is also likely that shorter trips are taken by the higher rated alternatives such as cycling and walking.

In summary, the overall rating of respondents' daily trip from awful to excellent provides a higher than expected average rating. This would suggest a low level of interest in making change. When analyzing by different dimensions those most likely to be interested in change (due to lower average ratings) are those who are less able to use their preferred travel pattern; those who are driving alone; and those who are driving long distances.

Ratings of Importance and Satisfaction with Outcomes

The survey asked about importance and satisfaction for 56 outcomes that had been identified as sub-outcomes of the job: getting to and from a destination. Each outcome was set within the context in which it occurs. The following is an example of how the questions were asked:

The first set of outcomes is related to PLANNING A TRIP, before you make it. This is when you are needing to use something other than your usual travel patterns. When you are deciding about such a trip, which statement best describes how important each outcome is, and how satisfied you are that you can achieve it? Please take into account all the mode/route/time options and other solutions that you have available to you.

Outcome	*Not Important*	*Fairly important, not very satisfied*	*Fairly important, very satisfied*	*Very important, not very satisfied*	*Very important, very satisfied*
Not forgetting important things you need to take or do.	o	o	o	o	o

In the analysis, all ratings of 'fairly important' and 'very important' were assigned a 1, and for each outcome the proportion of respondents who rated the outcome as fairly or very important was converted to a score out of ten. (If 85% of the respondents rated the outcome as fairly or very important, the outcome was assigned an importance score of 8.5).

Similarly, all ratings of very satisfied were assigned a 1, and for each outcome the proportion of respondents who rated themselves 'very satisfied that they could achieve the outcome' was converted to a score out of ten. (If 55% of the respondents rated an outcome 'very satisfied', the outcome was assigned a satisfaction score of 5.5).

Importance

Most of the outcomes were rated as being important. Table 12 shows the 22 outcomes rated as fairly or very important by more than 90% of respondents). The context of each outcome to the total trip-making experience is shown in parentheses.

TABLE 12 Outcomes Rated as Fairly or Very Important by More Than 90% of Respondents

Outcomes	Importance Score
Getting there not taking longer than you planned. (Making the Trip)	9.9
Being ready to leave on time. (Setting Out for the Trip)	9.9
Not arriving late. (Planning a Trip)	9.8
Being able to start work or study (at work or school) at times that work best for you. (Your Lifestyle)	9.7
Keeping away from situations that might not be safe. (Making the Trip)	9.7
Not having a personal loss such as losing your things, or your vehicle or things getting damaged. (Making the Trip)	9.7
Not being held up because of there being more traffic than expected. (Making the Trip)	9.6
Not being held up because of lane closures, accidents, construction, bad weather, that you had not planned for. (Making the Trip)	9.6
Getting back home not taking longer than you planned. (Making the Trip)	9.6
Keeping the planned trip time short – going there. (Planning a Trip)	9.6
Not feeling stressed during the trip. (Making the Trip)	9.6
Not feeling tired, wet, cold, grimy, stressed, etc., when you get to work or school. (Making the Trip)	9.6
Not forgetting important things like your wallet, transit passes, umbrella, and so on. (Setting Out for the Trip)	9.6
Keeping the planned trip time short – coming home. (Planning a Trip)	9.5
Being able to make a good new plan if you get held up during the trip. (Making the Trip)	9.4
Being able to relax during the trip. (Making the Trip)	9.3
Not feeling like you will be wasting time on the trip. (Planning a Trip)	9.2
Easily finding the best mode and route each time. (Planning a Trip)	9.2
Easily finding out about choices of routes. (Planning a Trip)	9.2
The payment systems being simple to work with. (Making Payment for the Trip)	9.2
Being able to make payment quickly. (Making Payment for the Trip)	9.2
It being easy to know how much you have to pay. (Making Payment for the Trip)	9.1

Satisfaction

Overall, satisfaction received lower scores than importance. Table 13 shows the eleven outcomes for which more than 70% of respondents said they were very satisfied with their ability to achieve the outcome using existing solutions.

TABLE 13 Top Eleven Outcomes by Satisfaction (More Than 70% of Respondents Very Satisfied)

Outcomes	Satisfaction Score
Not having a personal loss such as losing your things, or your vehicle or things getting damaged. (Making the Trip)	8.2
Not forgetting important things like your wallet, transit passes, umbrella, and so on. (Setting Out for the Trip)	8
Keeping away from situations that might not be safe. (Making the Trip)	7.6
Being able to make payment quickly. (Making Payment for the Trip)	7.6
The payment systems being simple to work with. (Making Payment for the Trip)	7.4
Not paying more than is required. (Making Payment for the Trip)	7.4
Having all the right things you need like toll money, tickets, transponder, for all parts of the trip. (Setting Out for the Trip)	7.4
Not getting citations – speeding tickets, parking tickets, tickets for failing to pay on the bus or train. (Making the Trip)	7.3
Being ready to leave on time. (Setting Out for the Trip)	7.2
Feeling like a good citizen. (Your Lifestyle)	7.2
Not forgetting important things you need to take or do. (Planning a Trip)	7.2

The outcomes with the lowest levels of satisfaction are listed in Table 14.

TABLE 14 Lowest Ten Outcomes by Satisfaction (Fewer Than 50% of Respondents Very Satisfied)

Outcomes	Satisfaction Score
Making better use of public transport. (Your Lifestyle)	4.9
If you have a car, not driving it in city traffic. (Your Lifestyle)	4.9
Being able to make a new plan if the current weather and traffic are bad. (Setting Out for the Trip)	4.7
Not having to deal with socially undesirable people. (Making the Trip)	4.7
Not being held up because of lane closures, accidents, construction, bad weather, that you had not planned for. (Making the Trip)	4.4
Other people being ready to leave on time. (Setting Out for the Trip)	4.4
Not arriving too early. (Planning a Trip)	4.3
Not being held up because of there being more traffic than expected. (Making the Trip)	4.2
Telling your family and co-workers about your plan for the trip. (Setting Out for the Trip)	3.9
Looking successful. (Your Lifestyle)	3.8

Opportunity

There is no point innovating for an unimportant outcome – it costs money and no-one values the result. Innovating for an outcome just because it shows low levels of satisfaction, without first learning how important it is, can have this result. The combination of importance and satisfaction clarifies opportunities.

A simple algorithm is used to calculate an opportunity score for each outcome. The difference between the importance score and the satisfaction score (or zero if the satisfaction score is greater than the importance score) is added to the importance score.

$$\text{Opportunity} = \text{importance} + \max(\text{importance} - \text{satisfaction}, 0)$$

The full list of 56 outcomes is shown in Table 15, with opportunity scores and their ranking by opportunity score. They are shown in the order they were presented to respondents, and the contexts in which they were presented. Shading is used in the Opportunity Score column to highlight the ten highest and the ten lowest opportunities.

TABLE 15 OUTCOME STATEMENTS WITH OPPORTUNITY SCORES AND RANK

	Outcomes	Importance Score	Satisfaction Score	Opportunity Score	Rank
Planning a Trip	Not forgetting important things you need to take or do.	8.8	7.2	10.5	42
	Easily finding the address of a new destination.	8.9	6.8	11.1	35
	Easily finding out about choices of routes.	9.2	5.9	12.5	16
	Easily finding out about choices of modes (walk, cycle, ride share, drive, bus, train, ferry).	8.3	5.0	11.6	24
	Easily finding the best mode and route each time.	9.2	5.4	13.1	8
	Not arriving late.	9.9	6.7	13.0	10
	Not arriving too early.	6.6	4.4	8.9	53
	Keeping the planned trip time short – going there.	9.6	5.6	13.7	6
	Keeping the planned trip time short – coming home.	9.5	5.2	13.7	5
	Not feeling like you will be wasting time on the trip.	9.2	5.3	13.1	9
	Keeping the total planned cost of the trip as low as possible.	8.7	6.2	11.3	29
	Not feeling like you will be wasting money on the trip.	8.7	6.2	11.3	30
Setting Out for the Trip	Being ready to leave on time.	9.9	7.2	12.5	17
	Other people being ready to leave on time.	7.4	4.4	10.4	44
	Not forgetting important things like your wallet, transit passes, umbrella, and so on.	9.6	8.0	11.2	32
	Finding out about current weather and traffic.	8.5	5.9	11.2	34
	Being able to make a new plan if the current weather and traffic are bad.	8.7	4.7	12.8	11
	Telling your family and co-workers about your plan for the trip.	5.1	3.9	6.3	56
	Having all the right things you need like toll money, tickets, transponder, for all parts of the trip.	8.9	7.4	10.4	45
Making the Trip	Getting there not taking longer than you planned.	9.9	6.0	13.8	4
	Getting back home not taking longer than you planned.	9.7	5.2	14.1	3
	Not making mistakes on the trip that you had not allowed time for, such as taking wrong turns or catching wrong services.	8.9	6.5	11.4	28
	Not being held up because of there being more traffic than expected.	9.6	4.2	14.9	1
	Not being held up because of lane closures, accidents, construction, bad weather, that you had not planned for.	9.6	4.4	14.7	2
	Not talking to other people unless you want to.	6.9	5.4	8.4	54
	Not having to deal with socially undesirable people.	7.3	4.7	9.9	47
	The trip not costing more than you planned.	8.6	6.8	10.5	43
	Making sure you do errands that you had planned to do, like getting groceries, dropping or picking up at day-care, dry-cleaning, or school.	8.8	6.7	11.0	36
	Not getting citations – speeding tickets, parking tickets, tickets for failing to pay on the bus or train.	8.4	7.3	9.5	49
	Not feeling tired, wet, cold, grimy, stressed, etc., when you get to work or school.	9.6	6.8	12.4	19
	Not feeling tired, wet, cold, grimy, stressed, etc., when you get home.	8.8	5.9	11.7	22
	Not getting caught in bad weather that you were not ready for.	8.9	6.2	11.6	23
	Being able to relax during the trip.	9.3	6.6	12.0	20
	Not feeling stressed during the trip.	9.6	6.6	12.7	13
	Keeping away from situations that might not be safe.	9.7	7.6	11.7	21
	Not having a personal loss such as losing your things, or your vehicle or things getting damaged.	9.7	8.2	11.2	33
	Tracking your progress on the trip so you know if you are going to be on time or late.	8.8	6.0	11.5	26
	Being able to make a good new plan if you get held up during the trip.	9.4	5.3	13.5	7
	Being able to let people know about your new plan if it changes during the trip.	8.0	6.1	9.8	48
Making Payment for the Trip	The payment systems being simple to work with.	9.2	7.4	11.0	37
	It being easy to know how much you have to pay.	9.1	6.9	11.3	31
	Being able to make payment quickly.	9.2	7.6	10.7	39
	Not paying more than is required.	9.0	7.4	10.6	41
	Not paying less than is required.	7.8	6.5	9.0	52
	Not forgetting to pay for some part of the trip where there is an honor system for payment.	7.8	6.4	9.2	51
Your Lifestyle	Reducing your carbon footprint.	9.0	5.6	12.4	18
	Being seen as a good citizen.	7.7	6.2	9.3	50
	Feeling like a good citizen.	8.9	7.2	10.6	40
	Looking successful.	5.2	3.8	6.5	55
	Getting enough sleep while still making needed trips.	9.0	5.4	12.6	14
	Being able to start work or study (at work or school) at times that work best for you.	9.7	6.9	12.6	15
	If you have a car, not driving it in city traffic.	7.6	4.9	10.4	46
	If you have a car, not driving it so much.	8.4	5.3	11.4	27
	If you have a car, having less wear and tear on it.	8.5	5.5	11.6	25
	If you have a car, knowing how much it costs you to own and operate it.	8.2	5.7	10.7	38
	Making better use of public transport.	8.8	5.0	12.7	12

Solutions that reduce traffic delays (rank 1 & 2), improve predictability of trip duration (rank 3 & 4), minimize trip duration (rank 5 & 6), and enable better mode and route identification (rank 8), and better trip re-planning when delayed (rank 7), are all more likely to achieve a positive response from commuters (compared with other solutions).

Likelihood to Try a Spontaneous Carpooling Service

In order to measure affinity for the behavioral response of riding or driving in a carpool without pre-arrangement with people who would be referred to as strangers, the survey described the existing 'informal flexible carpooling' that occurs in other places. Note that the purpose of this question was not to gather 'stated intention' to use the specific 'more formalized' version of the service that is the subject of the project.

The survey asked: *In San Francisco CA and Washington DC there is a spontaneous carpooling system in which people go to meeting-places and carpool with the next two people going their way. It is always to a high volume destination. The meeting-places and destinations are well known, so only people who want those destinations participate.*

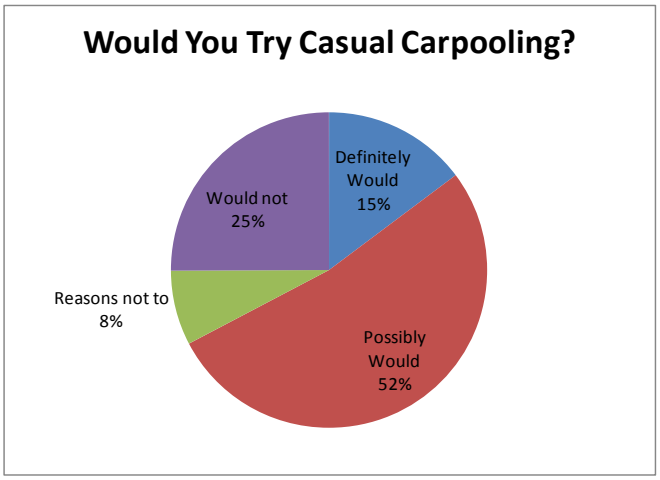
Several thousand people do this each day from many pick-up points in these two cities. There are always three people per car. Riders sometimes pay a small amount towards the costs of tolls when the carpools have to pay to cross a bridge. Because the carpools get to go in the carpool lane, they save a lot of time. Half the people who do this are women, and they feel safe doing it, even though they do not know the other people in the car.

If this kind of spontaneous carpooling was available on your commuter route, how likely would you be to try it? Please choose the answer that fits best for you.

	Answer option:	Responses	%
O	*Never, I cannot see myself doing something like that*	424	24
O	*Possibly, if I was convinced it was safe*	369	21
O	*Possibly, if other people I knew were doing it too*	142	8
O	*Possibly, if it saved me enough time or money*	368	21
O	*I would definitely try it.*	178	10
O	*Definitely, it sounds like something I would enjoy*	61	3
O	*Definitely, I have done it before*	19	1
O	*None of the above. My answer is:*	191	11

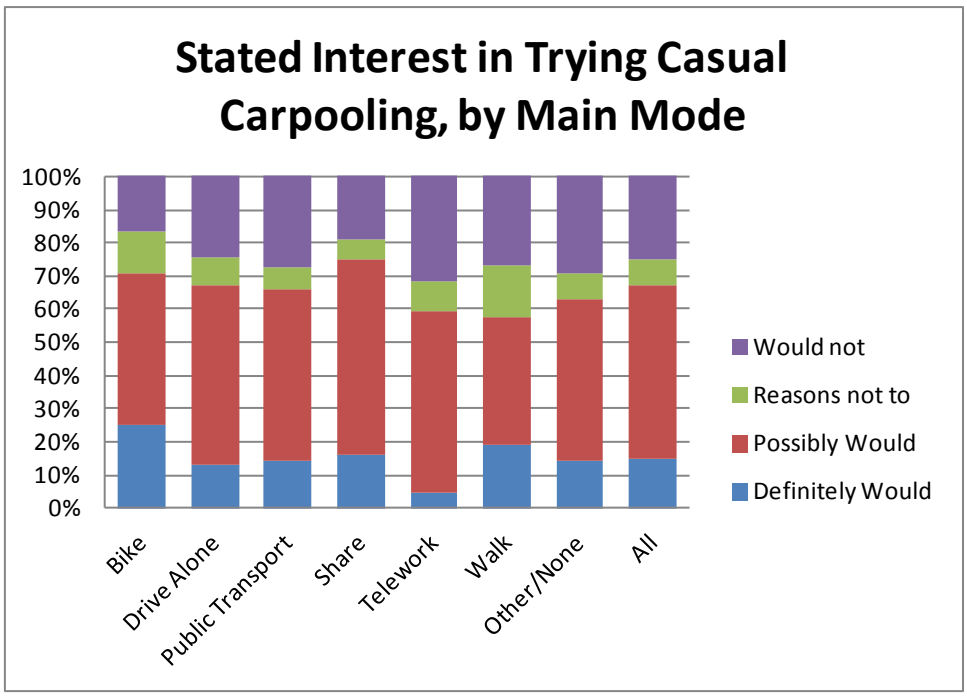
The 191 additional answers were coded, and all responses reduced to the four categories shown in Figure 16.

FIGURE 16 Proportion of Respondents Who Would, and Would Not, Try Casual Carpooling



When analyzed by main mode, as shown in Figure 17, it can be seen that cyclists are most definite (25%), and existing sharers are overall most interested (74%). Walkers are least interested (58%), but that is not surprising because they do not travel great distances. Drive-alones and public transport users have similar levels of interest (68% and 67%).

FIGURE 17 Proportion Who Would Try Casual Carpooling, by Main Mode



Predicting Utilization, Summary

It is usual to provide adjustments to price to offset risk for potential consumers of a new product. In the case of food products, this might include free in-store taste testing, followed by deep discounts via coupons. In the case of transportation it is through the provision of incentives and other preferential treatment such as premium parking. The value of the foregoing analysis is that it helps to anticipate the extent of incentives required, given any preferential treatment offered, to achieve use of the system.

About two thirds of respondents express interest in trying casual carpooling, which bodes well for flexible carpooling as long as some conditions are met. Expressions of interest do not necessarily convert to actual utilization, and the final design of the service and incentives for participating will be important. Of particularly important consideration will be that potential users of the service will be asked to make two modal transfers on their trip: the first from drive alone to carpool, and the second from carpool to train.

Based on overall trip ratings, where it is surmised that interest in change is most likely when ratings are lowest, driving alone and driving long distances both attract lower overall ratings. A service targeted at people who drive alone and who travel long distances would likely get more utilization than one targeted at existing sharers or those with shorter trips.

Based on high-opportunity underserved outcomes a service that could reduce traffic delays, improve predictability of trip duration, minimize trip duration, and enable trip re-planning when delayed is likely to achieve a positive response from commuters. It will be important in the design of a trial that messages emphasizing the appropriate aspects of flexible carpooling come to the fore. In San Francisco, casual carpooling can be seen to serve the first three of these outcomes because it enables travelers to use the HOV lanes and so avoid traffic delays, improve predictability of trip duration, and minimize trip duration.

The online survey gathered only a few respondents from the Bonney Lake Catchment, and their data is not statistically reliable for predicting utilization on the field operating trial route. A selection of answers by these respondents is included as Appendix 5 in order to give a voice to potential users of the service.

VII. DESIGN OF THE FIELD OPERATING TRIAL - DISCUSSION

The objective is to design an alternative to driving alone that has a high level of utilization at the best possible cost.

The conceptual underpinning of a flexible carpooling service is sound – a service that enables greater levels of ridesharing will reduce traffic and deliver a range of benefits to the users and the wider community. The question is: can it be done at an appropriate cost?

It is difficult to match the convenience of a personal vehicle waiting to be used at the instant the user is ready, and by its use accompanying the user so that the ability to return is also certain with a similar level of convenience. While the value of that convenience might be seen to decline when there is traffic congestion, and to decline more the worse the traffic congestion, the fact that such a large proportion of commuters continue to drive alone suggests that the value of the convenience exceeds the perceived cost of the delay. It might be that part of the cost of delay is overlooked by the user who can always travel with the hope that delay will not be as bad as 'usual', and the occasional time that it is not, helps to reduce the perception of the cost of delay.

Public transport that operates on a separated right of way, whether bus rapid transit or light or heavy rail, if it meets certain criteria can match the convenience of a personal vehicle. It should depart with minimal headways (some say 10 minutes or less in both directions), it should be located near to the traveler's home, and it should go near to the traveler's destination. In this way the convenience is matched while the cost of delay is minimized. With regard to the nearness to the traveler's home, a well placed PNR on the way to which there is no congestion, at which there is available capacity, accessing a public transport service with high frequency and minimal delay, will also be perceived as avoiding the cost of delay.

Taxis cruising past, as in New York City, provide a similar amount of convenience without the cost or inconvenience of parking a vehicle.

Given a desire to carpool, flexible carpooling is the carpool formation methodology that has convenience most similar to a private vehicle, as long as there are enough people using the system and the route is from a convenient meeting-place to very near the rider's destination. The simple steps are: 1) when ready go to the meeting place; 2) get in the next vehicle; 3) get dropped at the destination. If there is an HOV facility that provides a bypass around congested traffic, the cost of delay will be minimized in the same way as public transport on a separated carriageway. As long as there is return capacity with similar convenience the system should succeed.

A flexible carpooling service that helps users access a PNR that has frequent public transport service on a separated carriageway can be expected to be relevant for users for whom the public transport service is relevant, especially if the flexible carpooling service receives some form of valuable priority that is also relevant to the user – such as guaranteed parking or access via an HOV facility.

This study began with an assumption that a flexible carpooling service to a PNR would help reduce demand for PNR capacity expansion, improving the utilization of PNR and rolling stock assets of the transit provider. In addition by increasing use of transit such a service would reduce travel on the region's roads. The study has highlighted several factors that should be taken into account in the design of the service:

1) Choose an origin-end catchment to work with, and a specific route in mind; (Source/Logic: The 1979 Marin County project was seen to be quite successful initially, but reportedly then dissipated its impact by going 'county wide'. The WSDOT Go520 project received interest from all over the region, and then could not gather enough users to launch a single route. The Trip Convergence Auckland project did not have a certain route, and received interest from people who were not making any trips, and then could not gather enough users to form a single route).

2) Provide preferential treatment at the meeting-place and at the PNR; (Source/Logic: The above discussion about making flexible carpooling as close to being as convenient as driving alone).

3) Begin operations with enough users so that it operates from day 1; (Source/Logic: The customer research and analysis. If the project does not start operating with enough people it will not get going. In this regard, allow enough time to build an interested user base before launch).

4) Use incentives to encourage usage, especially to achieve #3; (Source/Logic: The survey research showed the impact of transportation related benefits. The greater the incentives, the more likely people are to make the changes. Incentives help to reduce risk for people who are considering joining in).

5) Design the service for the origin-end catchment. Incorporate origin-end people into the decision-making about the service as early as possible; (Source/Logic: This is the culmination of a number of different threads of thought, that to date have not apparently been tested for carpooling pilot projects, but which are not uncommon in other transport-related projects. A recent example is the Edmonton LocalMotion project[13] that engaged the community in a number of initiatives to increase the use of sustainable transportation options).

6) Market only to the origin-end catchment (don't dissipate the effort by dealing with people 'out of the catchment'); (Source/Logic: This is related to #1 and #5. If the full focus of any marketing is brought onto the catchment, and if sufficient effort is brought, it is expected that the community can be engaged. This will be different to the various trials reported above. It will also be different to the effort to get Bonney Lake Catchment participation in the survey research for this report, which in spite of some local outreach was only 37 respondents).

7) Once operational, monitor usage and tweak to maximize. Have a plan to reduce incentives and operational costs over the period of the field operating trial, and don't make the period un-necessarily short; (Source/Logic: It is important to maximize participation in the beginning, and then to try to find the best-cost level of operation. Participants may save money using the system. Sound Transit, Pierce Transit, and the broader community will also save money and time, and experience reduced externalities and it is appropriate for the broader community to share some of its gains with the participants).

8) Engage with the origin-end community and offer them community incentives as a reward for achieving the targets of the project. (Source/Logic: This is related to #1, #5, and #6, and some transportation futures work the principal investigator participated in during January 2012 whilst at the TRB Annual Meeting. It is also related to a theme of user management of common pool resources as a potential approach for improving management of those resources. The concept is to get the local (origin-end) community to take some responsibility for the amount of traffic they send out onto the system each day. It is a different focus from the traditional employment-end focus of carpooling initiatives).

The field operating trial is envisaged as a sequence of experiments on the same route, each one building on the previous one, until the route is successfully catalyzed. Testing includes both launching the route and making it sustainable. The risk-issues associated with such a trial are a consequence of its innovative nature, and the cost estimate reflects the probable need to test several combinations of various parameters before success is achieved. The main parameters to be tested include technology, incentives, safety perceptions, community outreach, and community commitment.

Casual carpooling has been estimated to benefit the San Francisco community in the order of $30 million per year in time, transit costs not expended, energy conserved, emissions avoided, etc., and all at no public cost except the use of some curb-space. A formal system will not likely have the same level of net benefits because costs will be incurred. The purpose of the field operating trial is to determine if flexible carpooling can be established to improve the number of people arriving to use the Sounder Service. Once the mechanism

[13] http://www.edmonton.ca/environmental/programs/local-motion-eco-friendly-transportation.aspx

for establishing services has been found, subsequent experiments (in the field operating trial and beyond) will focus on reducing the ongoing operating costs of the service. It can be expected that future implementations will cost less to establish, and less to operate.

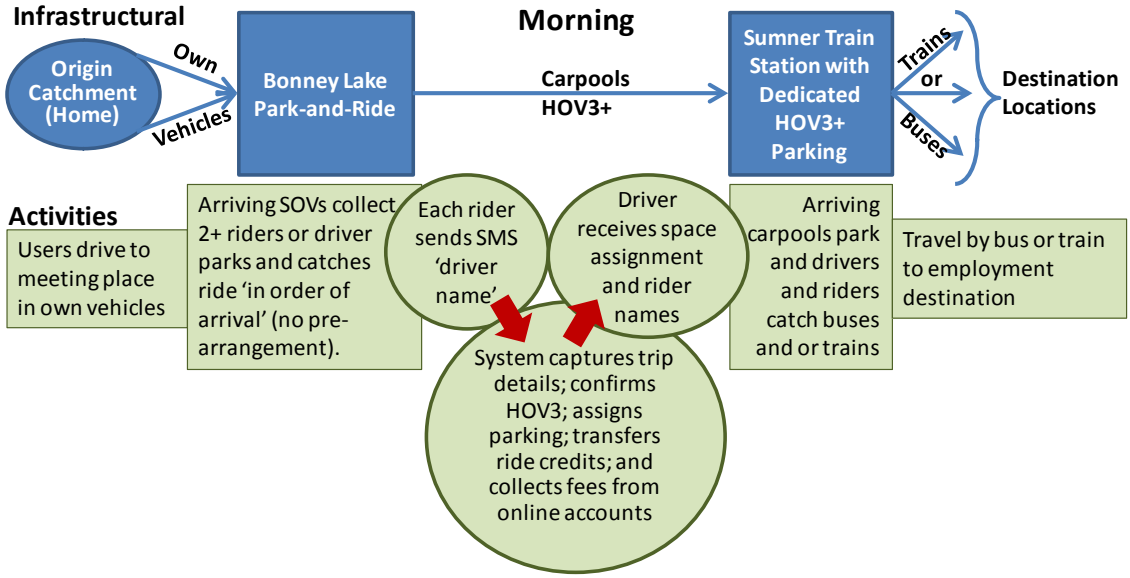
VIII. DETAILED PROJECT PLAN FOR FIELD OPERATING TRIAL

DESCRIPTION OF THE POTENTIAL SERVICE

The opportunity identified by this project is for commuters from the Bonney Lake Catchment to stop at the Bonney Lake South PNR and use flexible carpooling for the remainder of their journey to Sumner Station, thereby reducing demand for parking at Sumner Station.

In return for parking at Bonney Lake South PNR and flexible carpooling to Sumner Station, it is proposed that flexible carpools be offered guaranteed parking at Sumner Station plus other incentives. See Figure 18. 50 Sumner Station parking spaces would be set aside for arriving flexible carpool vehicles from the Bonney Lake Catchment. 100 spaces at Bonney Lake South PNR would be dedicated to the system.

FIGURE 18 The Flexible Carpooling System: Morning

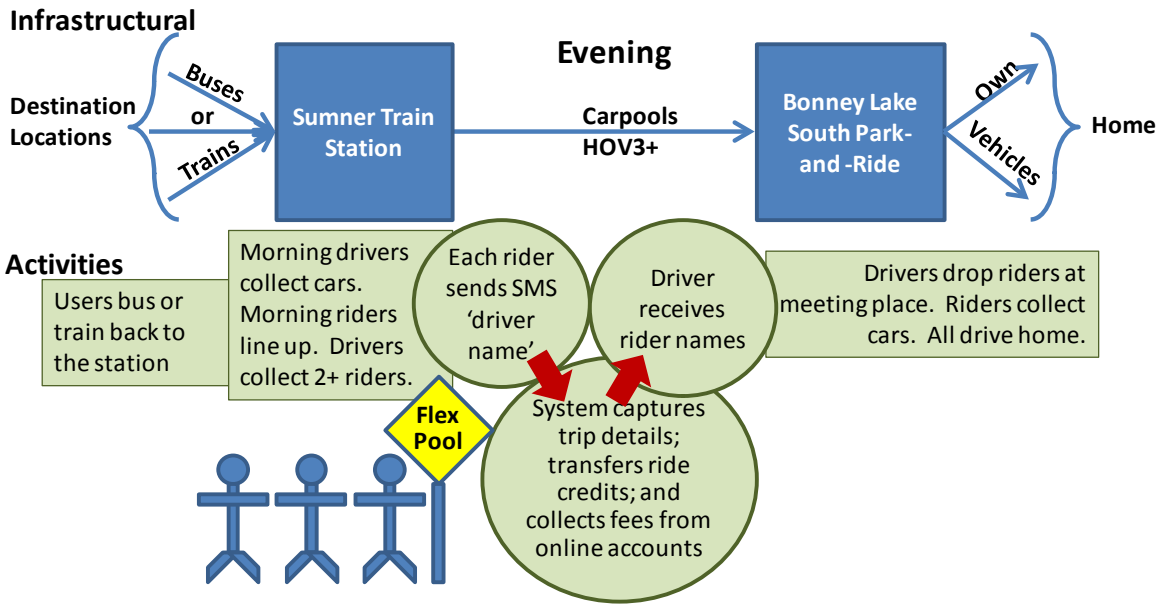


Each morning 150 commuters from the Bonney Lake Catchment would converge on the Bonney Lake South PNR, form carpools in the order of their arrival, leave 100 vehicles behind and travel in 50 HOV3 (high occupancy, 3 person) vehicles to Sumner Station.

As each carpool is formed, text messaging would transmit details to an on-line tracking system. The tracking system would assign a Sumner Station parking space to the carpool and send the details to the driver via SMS text message. For safety reasons, drivers would be encouraged to only read the message on arrival at Sumner Station. New rules and signage at Sumner Station would ensure that only drivers with the appropriate authorizing text message would use the dedicated parking.

In the evening (see Figure 19) as each train arrives at Sumner Station the flexible carpoolers would again form carpools for the return to Bonney Lake South PNR. In the event flexible carpooling rides are not available the Pierce Transit 496 bus service (which travels from Sumner Station to the Bonney Lake South PNR) would provide a back-up for those who were riders in the morning to get back to their cars at Bonney Lake South PNR in the evening.

FIGURE 19 The Flexible Carpool System: Evening



INTENT OF THE SERVICE

The field operating trial project would be promoted with four key purposes:

1. Increasing the effective capacity of Sumner Station by shifting some of the parking demand to Bonney Lake South PNR (Sumner Station is currently used at capacity; the Bonney Lake South PNR currently has over 100 unused spaces each day);
2. Giving people from the Bonney Lake Catchment an additional option for how they get to work, and increasing the availability of the Sounder commuter train as a viable option for them more days of the week;
3. Reducing the amount of traffic from the Bonney Lake Catchment that is found on the region's roads, both morning and night. (This is particularly important for people who would travel on WA-167 which has notable congestion particularly southbound in the evening, making it difficult for them to get home).
4. Testing a new approach to forming carpools that can be expected to help reduce traffic congestion in many metropolitan areas.

KEY FEATURES OF THE SERVICE AND THE FIELD OPERATING TRIAL

The following are key features of the service, responding to the design considerations identified in the discussion in Section VII:

1. Outreach to the Bonney Lake Catchment, especially people who commute to destinations served by the Sounder Commuter rail from Sumner Station, incorporating the concept of 'community grants', to engage them in the service;
2. Outreach to users of parking at Sumner Station (the whole catchment) to minimize their opposition to the service, in particular to the dedication of parking spaces at Sumner to arriving flexible carpoolers from the Bonney Lake Catchment;
3. A pick-up point in the Bonney Lake South PNR, with appropriate signage, and 100 parking spaces for riders to leave their vehicles;

4. A flexible carpooling route to Sumner Station, with 50 dedicated flexible carpool parking spaces at Sumner Station, and an evening pick-up point for forming flexible carpools back to the Bonney Lake South PNR:
5. An appropriate application and screening process to maximize the safety of the members and their possessions from harm or loss caused by other members (an appropriate process will be one that does not deter people from participating, and might be as simple as being certain that the applicant has a valid driver's license, mobile phone, and credit-card account);
6. SMS text messaging technology to capture trip records:
    i. Approved members are assigned a unique 'member-name' and receive a membership card and car-card (for a mock-up see Appendix 4);
    ii. Member-name and mobile phone number will be linked in an online member-account database;
    iii. Boarding riders send an SMS of the driver's member-name to the system, the system looks-up the driver's mobile phone number from the member-name database, and the rider's member-name from the mobile phone number database, and the system sends a confirmation SMS to the driver incorporating the rider's member-name;
    iv. Drivers do not need to operate cell-phones while driving.
7. A ride-credit system rewards drivers, based on the trip record. On receipt of a valid SMS trip record, the system transfers a ride credit from each rider to the driver, in the members' on-line accounts. These ride credits can be:
    i. Earned by giving rides, or purchased from the market, online; and
    ii. Used by taking rides, or sold to the market, online.

    The system will have a price-setting mechanism. Members who always ride pay cash to the system in the value of the ride credits that they buy. Members who always drive can withdraw cash from sale of ride credits online. Members who both ride and drive will only need to buy or sell ride-credits if their use of the system is not in balance.
8. Incentives are paid for participation (from the project funds) directly into members' accounts based on actual usage, at a sufficient level to achieve full usage. Incentives will be reduced over time to establish the optimum level at which ongoing full usage can be maintained at the best cost. Each time a member uses the system they are entered into a prize drawing for weekly, monthly, and annual prizes.
9. The essence of the system is the same as the casual carpooling/slug lines that operate in San Francisco, Washington, DC, and Houston: there is no pre-arranging of who rides in which car.
10. This flexible carpooling system is used to get people from the Bonney Lake South PNR to Sumner Station in the morning, and (optionally) back to the Bonney Lake South PNR in the evening. There is no requirement to use flexible carpooling to return to Bonney Lake South PNR; however users are encouraged to use the system in both directions where possible.
11. Each morning 150 people within the Bonney Lake Catchment drive to the Bonney Lake South PNR. 100 people park their vehicles and get into the cars of the other 50 people. 50 3-person carpools travel to Sumner Station where they park in dedicated flexible carpooling spaces. By participating in flexible carpooling the driver is guaranteed a parking space at Sumner Station.
12. As soon as a qualifying carpool has been identified via the SMS system (at least two riders have sent a text message for the same driver), a parking space allocation system reserves a space for

that carpool at Sumner Station. According to agreed rules, after a certain time each day any unused dedicated flexible carpool spaces become available to all users.

13. It is noted that non-compliance with parking rules at Sumner Station might be an issue, and it is important that in establishing dedicated parking for flexible carpoolers the appropriate legal framework and penalties be established so that staff can enforce the rules.
14. Riders have access to a local 'guaranteed ride home' service to use in the event that a rider needs to get back to the Bonney Lake South PNR during the day (a day-time emergency).
15. In finalizing the design of the initial implementation of the system, including pre-launch outreach, an experimental matrix is established identifying the parameters to be tested, and the initial setting for each parameter. In the event that further refinements are needed to catalyze the route, subsequent iterations would test different settings for the parameters. The main parameters have been identified as: technology; incentives; safety provisions; community outreach; and community commitment.

TASKS FOR FIELD OPERATING TRIAL PROJECT

The objective of the field operating trial project is:

- To establish a working example of flexible carpooling to a transit station;
- To confirm what it takes in terms of community outreach, incentives, and other important parameters to achieve full utilization of the service; and
- To fine-tune the service based on customer experience in-use such that usage levels are maintained over time, and additional services can be introduced more quickly, and at lower cost, in other locations.

Table 16 outlines the tasks required to bring about and carry out the Field Operating Trial. The contents of Table 16 are explained in greater detail in Appendix 2.

TABLE 16 TASKS REQUIRED FOR FIELD OPERATING TRIAL

Task Heading	Task Objective
Pre Project: Secure funding for field operating trial	• Based on the information in this report, and other sources, obtain funding for the field operating trial.
Task 1: Secure permissions for field operating trial	• Appropriate permissions in place.
Task 2: Prepare for field operating trial	• Community fully engaged. All the necessary systems in place, all required equipment and signage installed.
Task 3: Open for membership	• Pre-registration of enough people that the system will be fully subscribed from day one.
Task 4: Launch the system	• All participants know in advance of the system starting, what they are going to do on the day the system starts and on subsequent days, and therefore the system works smoothly from day one.
Task 5: Operate, gather feedback, tweak and enhance as necessary,	• Optimistic: Smooth ongoing operations and a progressive reduction in demand on staff and incentives to keep the system working. • Pessimistic: Responding to failure to secure sufficient users, or failure of the system to operate to user's satisfaction, design next

	implementation experiment on the same route, building on knowledge gained from iterations to date.
Task 6: Report on the trial, findings and methodology	• Share the process and the results in such a way that if the project has been successful it is easy for others to get to the same point more quickly and at lower cost.

ESTIMATING THE IMPACT OF THE SERVICE

The service will provide additional fares for the Sounder service, plus increase the movement of people through Sumner Station without expanding facilities at the station. The impact is calculated assuming full usage, and the estimate of the cost of the trial will incorporate sufficient incentives and other benefits to achieve this level of utilization. Table 17 shows the main benefits. Table 18 shows the equivalent cost of achieving the same benefits by adding parking capacity at Sumner Station.

- Key assumptions:
  - 50 parking spaces set aside for flexible carpools arriving at Sumner Station;
  - 100 parking spaces available at Bonney Lake South PNR for people to park their vehicles and join flexible carpools to Sumner Station;
  - Full usage, 230 days per year;
  - Three members per car arriving at Sumner Station;
  - 100 'new' Sounder users per day from the Bonney Lake Catchment, not necessarily the same people every day, some will be completely new users, but others will be people who already use the service intermittently;
  - Participants use the service on average 3 days each week (therefore needing 250 users for there to be 150 each day);
  - There is enough capacity on Sounder to absorb 100 additional passengers per day;
  - Destination of all 'additional' Sounder users is an average of 25 miles from Bonney Lake South PNR (some would be going to Seattle, others to Tacoma, others to other Sounder stops;

Destinations	Miles from Bonney Lake PNR
Seattle	38
Renton	25
Tacoma	16
Auburn	14

  - All new Sounder users would otherwise drive to their destination, using vehicles with an average energy efficiency of 22 mpg;
  - 75% of the avoided trip distance would have been in congested traffic (across both morning and afternoon), and the ratio of energy and emissions reductions by the rest of the traffic to the savings by the vehicles removed is 3:1.
  - Journey patterns in the morning are taken in reverse in the afternoon. (Pierce Transit Route 496 bus provides back-up in case participants are unable to get a flexible carpool ride from Sumner Station to Bonney Lake South PNR in the afternoon, price nil when

transferring from Sounder using ORCA card, though services do not appear to be timed for convenient interface);

- Cost to build additional parking capacity at Sumner Station is $30,000 per parking space; and operational expenditures are 2% of capital cost, per year, and the discount factor for comparing projects is 5% per annum.
- Sounder fares from Sumner are: Tacoma: $3.00; Auburn: $3.00; Seattle: $4.25.
- It is expected that the majority of users will drive to Bonney Lake South PNR instead of driving to Sumner or their employment location. There will be no reduction in the number of vehicle trips taken, but rather a reduction in the length of the trips.

TABLE 17 Impact of the route

Factor	Daily Impact	Annual Impact
Number of shortened vehicle trips (count each direction as a single trip)	200	46,000
Reduction in Vehicle Miles Traveled (VMT)	5,000	1,150,000
Fuel savings for Participants from fewer VMT (gallons)	227	52,273
Fuel savings for Remaining Traffic from less congestion	511	117,614
Carbon emission reductions from fuel savings @ 20 lbs per gallon (tons)	7	1,699

TABLE 18 Cost of Comparable Increase in Capacity at Sumner Station

Present Value of Costs of Providing Capacity through Construction at Sumner	$
Construction costs (100 spaces @ $30,000 each)	3,000,000
Present value of annual operating costs ($60,000/5%)	1,200,000
Present Value of Costs of Providing Capacity through Construction at Sumner	4,200,000

COST ESTIMATE FOR THE FIELD OPERATING TRIAL

The estimate of the cost of the field operating trial is divided into four key components:

1. Costs of setting up the service, including recruiting the first users;
2. Ongoing operating costs;
3. Incentives required for establishing and maintaining usage levels;
4. Contingency for additional iterations.

The estimate includes costs that might be contributed to the project 'in kind' by agencies with an interest in the project. These costs have been included to ensure the estimate includes all potential cost items and can be relevant for other jurisdictions. The full detail of the estimate including an explanation of all line items is included as Appendix 3.

The estimate has been cast as a 'base case' with a provision for additional iterations as a separate section (see Table 19). The estimate assumes no revenue from users, and no revenue from sponsorships. In reality both these revenue streams may be available, but it is prudent to not expect them. Table 20 shows the estimate in slightly more detail.

The estimate is also summarized by cost component and task at the end of Appendix 3.

Some of the costs could be provided 'in-kind' by a willing/enthusiastic origin-end promoter, enabling a total somewhat less than the full estimate in the following pages.

TABLE 19 Field Operating Trial Project Cost estimate

Cost Category	Pre-Launch	Year 1	Total
Costs of setting up the service	$333,500	$36,225	$369,725
Ongoing operating costs	$0	$121,210	$121,210
Incentives	$10,000	$238,000	$248,000
Contingencies to enable iterations	$0	$46,575	$46,575
Total Estimated Costs	$343,500	$442,010	$785,510

TABLE 20 Project Cost estimate with Next Level of Detail

Cost Category		Pre-Launch	Year 1	Total
Costs of setting up the service				
	Permissions Total	10,000	0	10,000
	Enabling Software Total	55,000	0	55,000
	Physical Supplies Total	43,000	0	43,000
	Staffing and Activities Total	82,000	31,500	113,500
	Marketing program including collateral Total	100,000	0	100,000
	Contingencies (15%) Total	43,500	4,725	48,225
	Total	**333,500**	**36,225**	**369,725**
Ongoing Operating Costs Total				
	Management	0	20,000	20,000
	Staff	0	15,000	15,000
	Internet access	0	600	600
	Text messaging	0	4,600	4,600
	Access fees	0	36,000	36,000
	Licence fees	0	9,200	9,200
	Advertising	0	2,000	2,000
	Public liability insurance	0	6,000	6,000
	Guaranteed Ride Home	0	2,000	2,000
	Miscellaneous overheads	0	10,000	10,000
	Contingencies (15%)	0	15,810	15,810
	Total	**0**	**121,210**	**121,210**
Incentives Total				
	Prize drawings	10,000	25,000	35,000
	Participation payments	0	138,000	138,000
	Community grants	0	75,000	75,000
	Total	**10,000**	**238,000**	**248,000**
Contingencies to enable iterations				
	Staffing and Activities	0	22,500	22,500
	Contingencies	0	3,375	3,375
	Ongoing Operating Costs	0	20,700	20,700
	Incentives	0	0	0
	Total	**0**	**46,575**	**46,575**
Total Estimated Costs		**343,500**	**442,010**	**785,510**

In evaluating the ongoing operating costs of the field operating trial it is important to recognize that in a regional deployment the operating costs per route should be significantly lower because system costs would be shared between several routes.

Appendix 1. PROPOSAL FOR BONNEY LAKE RESIDENTS TO GAIN BETTER ACCESS

(This is a five-page brief that has been developed to help market the project to potential partners. Note that for marketing purposes the gneric description 'flexible carpooling is replaced with 'express carpooling').

Introduction

This proposal is for a project that uses express carpooling[14] to enable better access for Bonney Lake residents who wish to commute via Sumner Train Station. The impacts of the project will include: more effective use of the Bonney Lake South park-and-ride facility; less traffic on SR410 between Bonney Lake PNR and Sumner Station in the morning and between Sumner Station and Bonney Lake PNR in the evening; and easier access to parking at Sumner Station for people arriving from Bonney Lake. The project will enable more people to use the rail-based public transportation system and reduce demand for private vehicle travel (VMT) on the region's other roads.

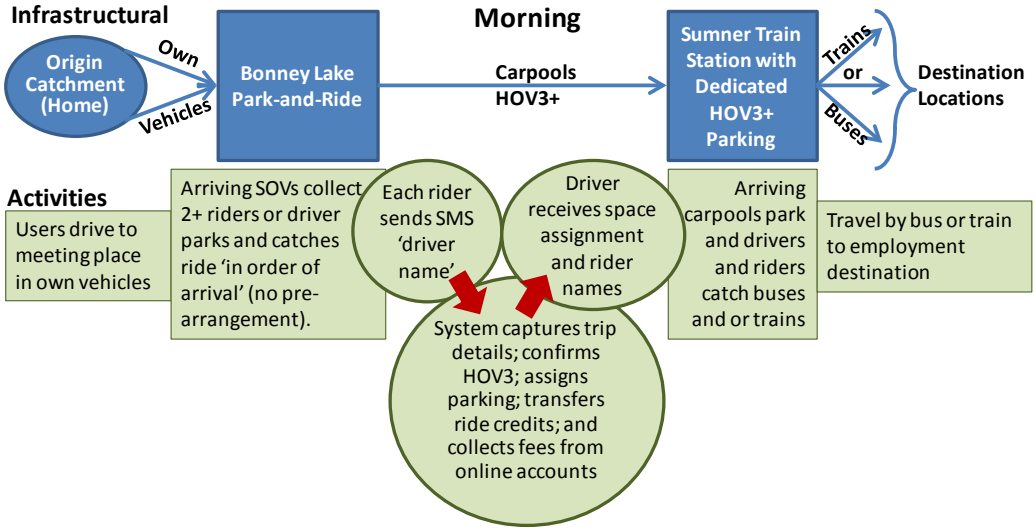
Express carpooling is a system that enables carpool formation without pre-arrangement of each separate trip. 'Matching' occurs when the riders and drivers arrive at the front of the line at an origin-end meeting-place dedicated to a high-volume destination. The traditional problem in carpooling of finding a third or fourth member for the carpool is resolved by use of the meeting-place.

System Overview

Figures 1 & 2 show the morning and evening flows respectively, where the destination of the morning carpool is Sumner Station, while the destination of the commuters can be very diverse across the region as long as the destination is served by the public transport system.

In the morning, members of the system travel to Bonney Lake South PNR in their own vehicles (or if living within walking or cycling distance, on foot or by bicycle). At Bonney Lake South PNR those wishing to drive will line up to pick up passengers. Those wishing to ride will park their vehicle (or bicycle) and line up to wait for a ride. At any time during the morning rush there might be a line of riders awaiting a ride, or drivers awaiting riders.

Figure 1: Express Carpooling System, Morning Flow



[14] Express carpooling is a patented transportation system belonging to Trip Convergence Ltd of Auckland, New Zealand. US Patent Number 7,953,618 B2. All rights reserved.

Arriving at the front of the line, riders get into the car at the front of the line. At least two riders per car, though the operational rules could be changed to increase this number without harming the system.

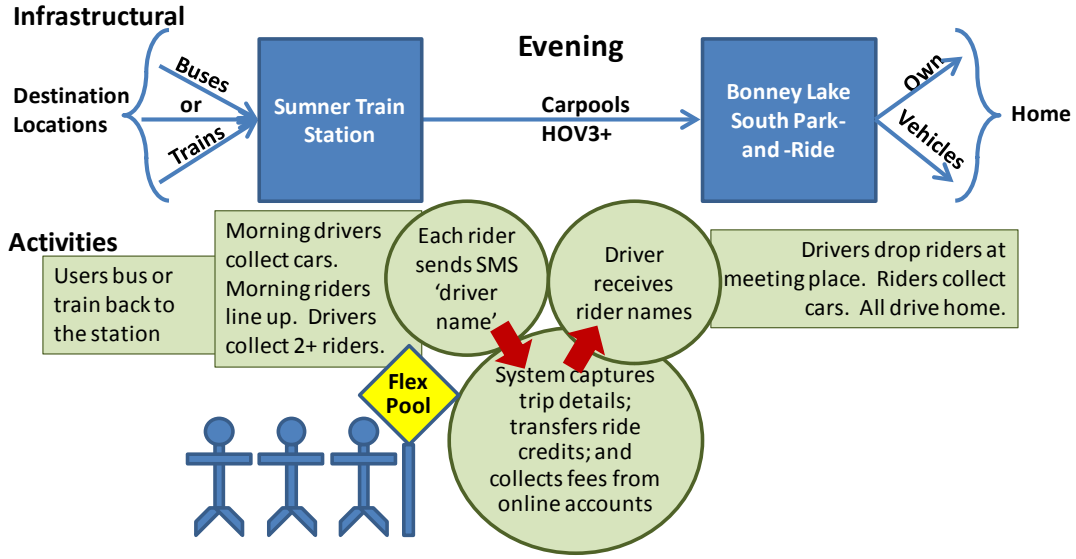
Once in the car, each rider sends an SMS text message to the Express Carpooling System with the driver's user-name. When the system detects the qualifying number of riders in a car, **the system assigns a parking space** (at Sumner Station) to the carpool and sends an SMS text message to the driver containing the names of the riders and the parking space number assigned to the carpool. For safety reasons the driver does not need to view this text message until arriving at Sumner.

On arrival at Sumner Station the driver consults the text message to find the assigned parking space number, and proceeds to park in that space. Signage and other mechanisms ensure that the space is available. The prime parking spaces at the station are dedicated to the system.

The driver and riders catch their respective trains and or buses to their work destinations.

In the background the accounting system transfers ride-credits from riders to drivers, charges users service fees, pays relevant incentives, and compiles data for reporting purposes.

Figure 2: Express Carpooling System, Evening Flow



In the evening the members use trains or buses to return to Sumner. Drivers from the morning collect their cars. Riders from the morning line up at the well-signposted Express Carpool pick-up spot. Drivers drive round to the Express Carpool pick-up spot and collect riders. Riders send SMS text message of the driver's user-name to the system. The system sends an SMS of the riders' names to the driver, and carries out accounting as needed. The carpool arrives back at Bonney Lake South PNR, and all riders disembark and use their own means to return home.

In case a rider from the morning fails to get a ride back in the evening there is an emergency ride home system that the rider can call on.

Next Steps

This project can deliver positive change for citizens of Bonney Lake. To move forward the project needs support from the City of Bonney Lake, Pierce Transit, WSDOT, and Sound Transit. In addition to the access benefits for Bonney Lake citizens, the project is estimated to deliver a reduction of 1.15 million annual vehicle miles travelled (VMT) in the region.

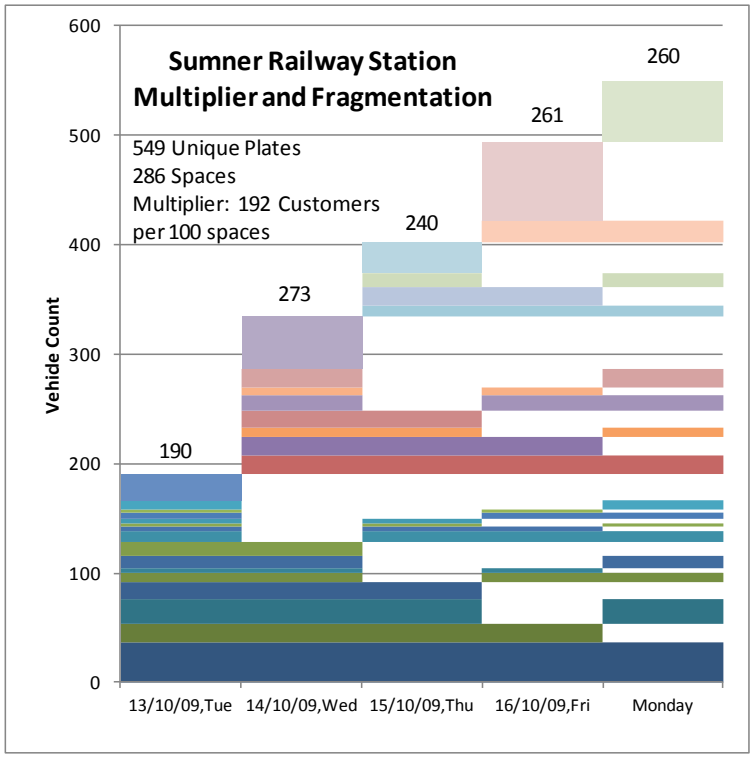
Attachment: Research that confirms there are enough commuters from Bonney Lake for this solution to work.

Attachment: Confirming that there are enough commuters passing by Bonney Lake South heading for Sumner

Express carpooling works best when there are many commuters making convergent trips from an origin catchment, past a meeting-place, to a destination. The greater the number of convergent trips the greater the chance that the project will succeed.

In a study for the Transportation Research Board[15], five Seattle area Park-and-Rides were surveyed for usage and catchment area. The most promising route identified by the project is the Bonney Lake to Sumner Station route. The following process was carried out:

1. Five days (Tuesday to Monday) inventory was gathered of license plates of all vehicles parked at Sumner Station;



Interpretation: Over the week, 549 unique vehicles were observed, even though the train station has only 286 spaces. 37 vehicles (represented by the blue bar across the bottom of the graph) were seen all five days. 16 vehicles (represented by the olive-green bar just above the blue bar) were seen on the first four days but not on the fifth. At the other end of the scale, the light green box at the top of the Monday column represents 55 vehicles that were seen only on the Monday. This data challenges the conventional view that the same group of people uses the park-and-ride every day. It also suggests that there is significant latent demand for parking at Sumner Station.

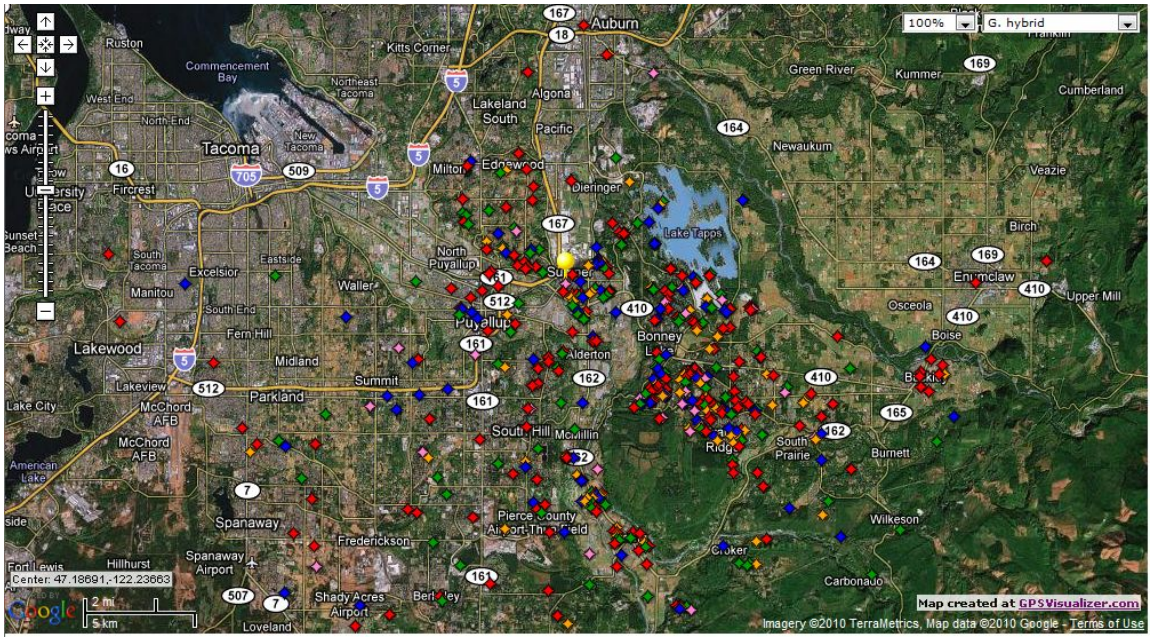
2. Observation to quantify existing level of carpooling to the facility;

Intensity	Capacity	Vehicles Arriving	People Arriving	Vehicle Occupancy	Vehicles Departing	Full By
Sumner	286	221	224	1.01	12	6:15 a.m.

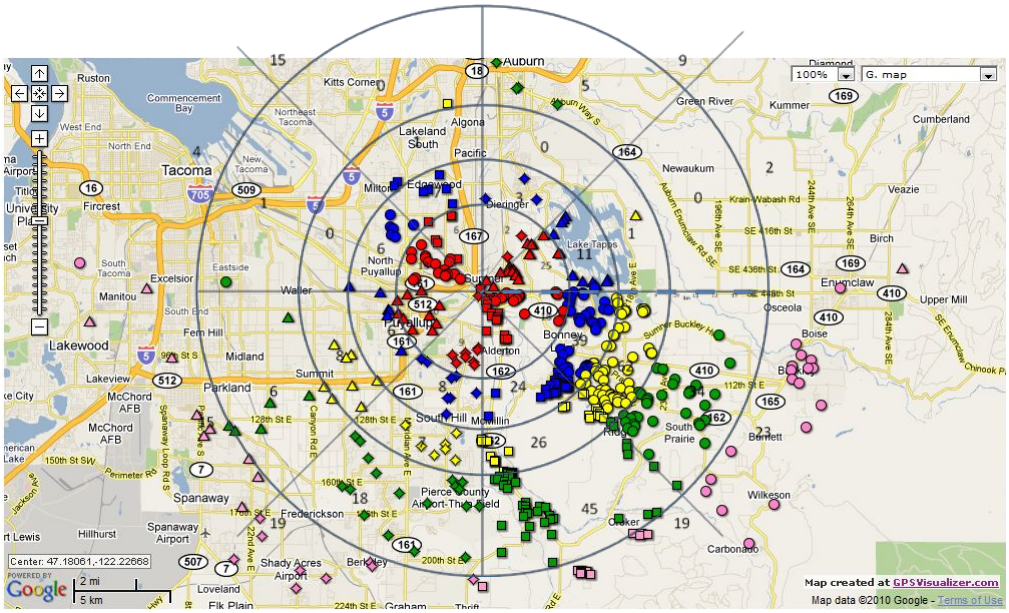
While it appears that some carpools arrived, it is not clear whether they parked, or were 'kiss and ride' drop-offs.

[15] Transit IDEA #61, Flexible Carpooling to Transit Stations

3. The origin addresses of all observed vehicles were mapped based on data from Department of Licensing. The following map shows the home address locations of all 549 vehicles observed at Sumner Station. The markers are color-coded according to how often the vehicle was observed (1 day, red; 2 days, green; 3 days, blue; 4 days, orange; 5 days, pink).

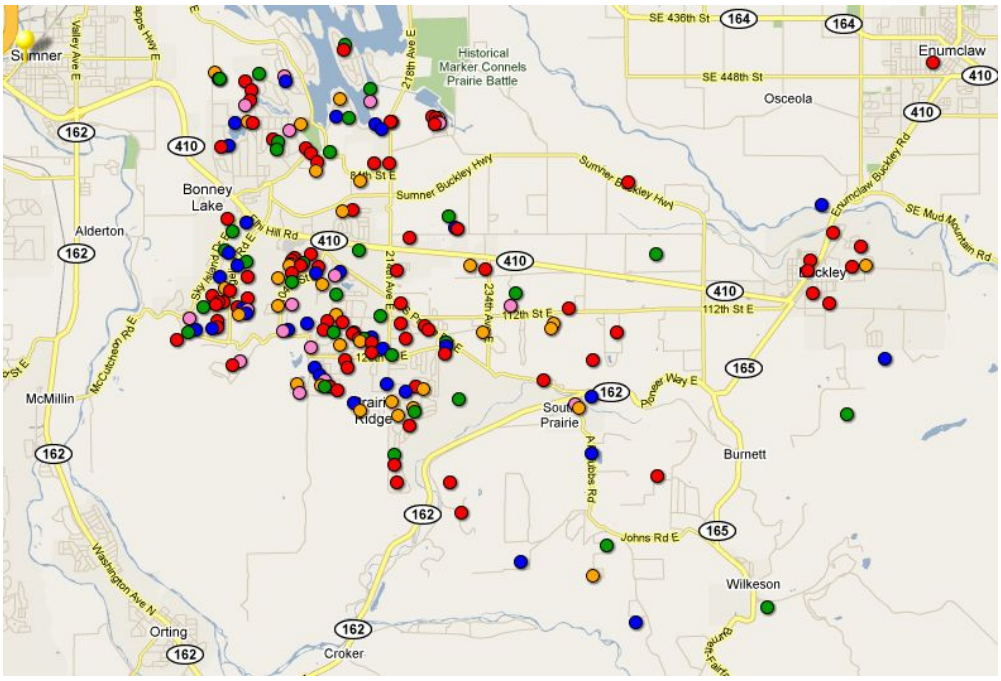


4. Tools such as octants and quintiles were used to identify potential concentrations of users, potential meeting-places, and routes, and these were confirmed with local experts. In the map below it is easy to see the concentration of Sumner Trains Station users originating from Bonney Lake and beyond.



In total 197 different vehicles had been seen originating on the escarpment that would pass by the Bonney Lake South PNR on their way to Sumner Station each morning. The count by day and in total is seen in the following table. (The total is less than the sum of the days because some vehicles were observed on multiple days).

Sumner	Vehicles in Catchment						Meeting
Route Name	Mon	Tue	Wed	Thu	Fri	Total	Type
Bonney Lake	67	97	90	101	106	197	Parking



5. The extent of trip convergence was quantified, including the potential to have sufficient usage of an express carpooling service for it to operate reliably. 150 daily users (50 drivers, 100 riders) is thought to be a size that will deliver reliability. In determining the size of the implementation from Bonney Lake to Sumner Station, potential was taken into account for demand from the Bonney Lake South catchment where people are driving all the way to work rather than using the Sounder service due to the lack of parking at Sumner. A service that accommodates 150 daily users is thought to be the right size for the Bonney Lake South to Sumner route. Each day there are at least 100 empty spaces at Bonney Lake South PNR, so this is seen as in ideal meeting place.

Appendix 2. DETAILED PROJECT DESCRIPTION FOR FIELD OPERATING TRIAL

Pre Project: Secure funding for field operating trial

The objective will be to have a fully funded field operating trial:

i. Secure letters of support from all relevant agencies, including civic leaders in the Bonney Lake Catchment; (If the Bonney Lake Catchment civic leaders are not supportive, seek a different route).

ii. Use the information in this report, together with appropriate additional information, to create funding request documents;

iii. Submit funding request documents to appropriate agencies;

iv. Follow up until funding is secured.

Task 1: Secure permissions for field operating trial

The objective will be to have appropriate permissions in place:

i. Establish any required new governance or organizational requirements including steering team and working team (the existing steering team might continue, or need to be reconstituted).

ii. Secure permission from Pierce Transit to establish a 'pick up point' at Bonney Lake South PNR with 100 parking spaces to be used;

iii. Secure permission from Sound Transit for 50 priority parking spaces for flexible carpoolers at Sumner Station, (and curb space, signage, and flow for evening pick-up);

iv. Work with Sound Transit to determine the rules for use of the spaces and work through any issues with making these rules enforceable;

v. Secure license agreement from Trip Convergence Ltd for use of the patented flexible carpooling IP.

Task 2: Prepare for field operating trial

The objective will be to have the community fully engaged, all the necessary systems in place, and to install all required equipment and signage:

i. Initiate outreach program in the Bonney Lake Catchment. Work with civic leaders to access service clubs, neighborhood associations, council, non-government volunteer groups, planned unit developments, body corporates, churches, etc., and the public to discuss the project and seek their engagement;

ii. Initiate outreach program to all Sumner Station parking users. Work with civic leaders and users to minimize likelihood of opposition to the project;

iii. Confirm with local motor vehicle insurance providers that there are no policy restrictions or limitations related to carpooling, to ensure that if participation requires additional or alternative insurance this requirement can be incorporated into the application process;

iv. Engage marketing agency

v. Prepare marketing material, order signage;

vi. Establish registration website to capture name, email address, phone number, residential suburb, destination suburb, and frequency and current mode(s) of travel of interested participants;

vii. Add functionality to take and process applications;

viii. Establish SMS text messaging trip tracking system;

ix. Establish online member-account management capability (incorporating tracking of financial account balances, tracking ride-credit balances by route, transferring ride-credits from rider to driver (integrated with SMS trip tracking system), member purchase of ride-credits, member sale of ride-credits, credit card payment, pay-out mechanism, lost and found reporting by trip, trip feedback by trip with moderation step, summarization of activity, prize draw mechanism).

x. Working with the Steering Committee:

   a. agree member application process, including any screening criteria;[16]

   b. establish local committee from within the Bonney Lake Catchment;

   c. sign off application and approval process, including any membership fees or other charges;

   d. sign off incentive payments amounts and mechanisms, including incentives to community groups and civic authorities in the Bonney Lake Catchment;

   e. agree the evening return process;[17]

   f. agree the ride-credit price-setting process;

   g. agree the extent of and mechanisms for the guaranteed ride home service;

xi. Sign all agreements, buy liability insurance, complete other administrative details;

xii. Install signage and security devices[18] at morning and evening pick up locations;

xiii. Recruit and train temporary staff to assist with all arrangements including:

   a. attendance at Bonney Lake South PNR and Sumner Station for the mornings and afternoons once the system launches

   b. gathering feedback

   c. issue of membership cards

   d. processing of member applications

   e. other administration as required

xiv. Test, test, test, and get operational sign-off;

xv. Report to Steering Committee on regular basis.

Task 3: Open for membership

The objective will be to have pre-registration of enough people that the system will be fully subscribed from day one. Some of these activities will be concurrent with Task 2.

i. As soon as the route and the funding are certain, open a website for registrations. These are not membership applications, but 'positions in the queue' so that early promotion of the system can lead to positive action by interested people;

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[16] Based on the results of the WSDOT GO-520 project in which screening questions were seen to be a barrier to sign-up, the process for approving membership will be a key design feature to be handled with the help of the local committee.

[17] In the evening returning drivers will be encouraged to (but will not be compelled to) provide rides for returning riders, using the pick up point at Sumner for assembly purposes. The arrival of many people on each train will most likely facilitate this.

[18] CCTV

ii. Tell residents and Sumner Station users in the Bonney Lake Catchment (Bonney Lake, Buckley, Enumclaw, etc) about the upcoming change and the opportunity, and call for people to go to the website and register (gather name, email address, phone number, residential suburb, destination suburb, frequency and current mode(s) of travel):

   a. Put up advertising at Bonney Lake South PNR, Sumner Station and at appropriate locations in the Bonney Lake Catchment;

   b. Place stories in local media;

   c. Make presentations at local halls (facilitated by local community groups such as Rotary, churches, other volunteer groups);

   d. Use digital outreach (Facebook, for example) to email addresses in the Bonney Lake Catchment (including sourced from available existing ride-matching databases);

   e. Deliver personalized mail to all Bonney Lake Catchment residents informing them of the upcoming system and encouraging them to register;

iii. On the target date, about a month before launch, email all people in the queue (or if there are more than needed, just the first 250 who registered, in order) and give them a time limited opportunity to complete the application process. Apply pre-screening process and approve members according to any agreed rules. Invite additional applications, and advertise further if necessary to meet target number of members;

iv. Get signatures, gather payments (if any), issue membership cards and car-cards, issue ride credits, invite to launch, discuss procedures.

Task 4: Launch the system

The objective will be to ensure that all participants know in advance of the system starting, what they are going to do on the day the system starts and on subsequent days, and that therefore the system works smoothly from day one.

i. Hold a social event the day before actual launch, including all approved members, their families, and transportation officials

ii. Walk members through how the system will work on the following day. Possibly hold the event in two parts, one part at Bonney Lake South PNR and the other at Sumner Station. Demonstrate the proper use of the SMS texting system. Answer any questions. Reiterate safety and security procedures which are achieved through two key features of the system: the membership card and tracking mechanisms, and the participants looking out for each other.[19]

iii. On day-one be prepared for the system to not work according to plan, have 'plan b's' and staff on hand to ensure the system does work. Continue to support the system until it has settled down sufficiently to be left alone.

[19] It is important to reiterate this as part of the launch process, as it will only be effective if it is operated properly. Members will be expected to look out for each other (as is the case in casual carpooling and slug-lines). They will be expected to look at the photo id on the membership card of fellow riders in the line, and to check that the car is a member's car before getting in (the presence of a member's car-card will be evidence of this). By capturing the details of their movements, plus requiring at least two riders per driver, the safety of the participants will be maximized by ensuring all conform to the agreed behaviors. The use of 'ride experience reporting' (a feature of the software) will ensure that any non-conforming behaviors are exposed and moderated, through a reporting process similar to the 'buyer/seller rating' process popularized by E-Bay.

Task 5: Operate, gather feedback, tweak and enhance as necessary,

The objective will be to have smooth ongoing operations and a progressive reduction in demand on staff to keep the system working.

i. Deliberately keep pressure on the system to get it settled down

ii. Use email to survey users to find out how the system is going for them. Also use face to face interviews at the facilities (both ends). Document feedback and incorporate as necessary or appropriate to improve the system. Only make changes in a measured and controlled way.

iii. Report usage and provide an information rich environment for users

iv. Use the level of incentives needed to get full usage of the capacity as soon as possible, and then working to a plan, adjust incentive levels to determine the impact of change, and to find, over the life of the project, the optimum level (which could be nil). Test additional ideas for incentives especially if there is churn in participation and it is necessary to recruit new users including ideas such as 'finder's fee' or 'finder's discount' to incentivize existing users to do recruiting.

v. Enforcement of dedicated parking is a potential usage issue. Define the legal parameters and ensure operational staff has support to inform, educate, and if all else fails cite infringers.

Task 6: Report on the trial, findings and methodology

The objective will be to share the process and the results in such a way that if the project has been successful it is easy for others to get to the same point more quickly and at lower cost. If the project has not been as successful as hoped, then the purpose of the report will be to expose possible reasons and inform others as to what might be done differently for subsequent trials.

i. Document the process of establishing the trial, what worked and what did not, and make suggestions for how others might do things the same or differently

ii. Include examples of all assets used in the trial, including application forms, meeting agendas, etc

iii. Show the results of the trial, focusing on the various different phases:

    a. Outreach

    b. Registration

    c. Application

    d. Processing

    e. Launch

    f. Feedback and modification

iv. Get report reviewed by the Steering Committee, modify as necessary and submit to appropriate journals for publication

Appendix 3. DETAILED PROJECT COST ESTIMATE FOR FIELD OPERATING TRIAL

Costs have been estimated for a one year field operating trial. Table 21 shows the amounts estimated by line item, and Table 22 provides explanations of the costs taken into account. The spreadsheet used to create this estimate can be accessed at:

http://www.tripconvergence.co.nz/flexiblecarpoolingideacostestimatefinal.xlsx.

TABLE 21 COST ESTIMATE

Cost Category	Pre-Launch	Year 1	Total
Costs of setting up the service			
Permissions			
Access agreement: Sound Transit for Sumner Station			0
Access agreement: Pierce Transit for Bonney Lake PNR			0
License agreement: Patented Flexible Carpooling system			0
Legal expenses associated with concluding the above	10,000		10,000
Permissions Total	**10,000**	**0**	**10,000**
Enabling Software			
Website for initial registration	5,000		5,000
Website functionality for applications and application processing	5,000		5,000
SMS Text trip tracking database system	10,000		10,000
Website functionality for member account management	35,000		35,000
Enabling Software Total	**55,000**	**0**	**55,000**
Physical Supplies			
Signage: Bonney Lake PNR	10,000		10,000
Signage: Sumner Station	10,000		10,000
Membership Cards	2,500		2,500
Car Cards	500		500
CCTV monitoring for Bonney Lake PNR	10,000		10,000
CCTV monitoring for Sumner Station	10,000		10,000
Physical Supplies Total	**43,000**	**0**	**43,000**
Staffing and Activities			
Securing permissions and funding for the field operating trial	10,000		10,000
Support services from marketing agency	15,000	15,000	30,000
Overseeing software development	5,000	2,000	7,000
Establishing the governance structure, getting up to speed	5,000		5,000
Overseeing and participating in community outreach process	5,000	5,000	10,000
Liaising with marketing agency	5,000	5,000	10,000
Liaising with Steering Team	10,000	5,000	15,000
Administrative Overheads	10,000		10,000
Overseeing temporary staff	2,000	2,000	4,000
Temporary Staff	5,000	5,000	10,000
Membership application processing	5,000		5,000
Launch party	5,000		5,000
Preparing Reports about the project		15,000	15,000
Staffing and Activities Total	**82,000**	**54,000**	**136,000**
Marketing program including collateral			
Billboards	20,000		20,000
Newspaper advertising	10,000		10,000
Raido advertising	15,000		15,000
Email advertising	6,000		6,000
Direct mail advertising	44,000		44,000
Community meetings	5,000		5,000
Marketing program including collateral total	**100,000**	**0**	**100,000**

Table 21 Continued

Cost Category	Pre-Launch	Year 1	Total
Contingencies			
Contingencies	43,500	8,100	51,600
Contingencies Total	**43,500**	**8,100**	**51,600**
Costs of setting up the service Total	**333,500**	**62,100**	**395,600**
Ongoing Operating Costs			
Management		20,000	20,000
Staff		15,000	15,000
Internet access		600	600
Text messaging		4,600	4,600
Access fees		36,000	36,000
Licence fees		9,200	9,200
Advertising		20,000	20,000
Public liability insurance		6,000	6,000
Guaranteed Ride Home		2,000	2,000
Miscellaneous overheads		10,000	10,000
Contingencies (15%)		18,510	18,510
Ongoing Operating Costs Total	**0**	**141,910**	**141,910**
Incentives			
Prize draw for registering	10,000		10,000
Prize draw for trial activity		25,000	25,000
Participation payments for trial		138,000	138,000
Community grant for achieving project goals		75,000	75,000
Incentives Total	**10,000**	**238,000**	**248,000**
Total Project Costs	**343,500**	**442,010**	**785,510**

TABLE 22 DETAILS OF COSTS INCLUDED IN THE ESTIMATE.

Table 22 **Details of Costs Included in the Estimate for the Field Operating Trial**			
		Line Item	**Description**
Costs of Setting Up the Service	Permissions	Access agreement: Sound Transit for Sumner Station	Establish the basis on which the service uses destination-end parking spaces. See cost in the ongoing operating costs below as 'access fees', allowing $1 per weekday per space. This line item might be provided 'in kind' by Sound Transit.
		Access agreement: Pierce Transit for Bonney Lake South PNR	Establish the basis on which the service uses origin-end parking spaces. See cost in the ongoing operating costs below as 'access fees', allowing $1 per weekday per space. This line item might be provided 'in kind' by Pierce Transit.
		License agreement: Patented Flexible Carpooling IP	Establish the basis on which the service uses the patented flexible carpooling intellectual property, requiring a licence agreement with Trip Convergence Ltd, Auckland, NZ. In the ongoing operating costs below this item is shown as License Fees and is allowed at the rate of $0.20 per system trip.
		Legal expense associated with concluding the above	The above agreements will probably require drafting by a legal team. This item is an allowance of $10,000.
	Enabling software	Website for initial registration	Estimate of cost of setting up a website to inform people about the service and for them to provide registration of interest. Allowance of $5,000. This line item might be provided 'in kind' by Trip Convergence Ltd.
		Website functionality for applications and application processing	Estimate of cost of capturing full applications (additional to the registration of interest). Allowance of $5,000. This line item might be provided 'in kind' by Trip Convergence Ltd.
		SMS Text trip tracking database system	Estimate of cost of text messaging look-up and Sumner parking allocation and advice system. Allowance of $10,000. This line item might be provided 'in kind' by Trip Convergence Ltd.
		Website functionality for member account management	Estimate of cost of online member account management system. Allowance of $35,000. This line item might be provided 'in kind' by Trip Convergence Ltd.
	Physical Supplies	Signage: Bonney Lake South PNR	Estimate of cost to make and install signage including any pavement markings. Allowance of $10,000.
		Signage: Sumner Station	Estimate of cost to make and install signage including any pavement markings. Allowance of $10,000.
		Membership Cards	Assume 250 members, each to be issued a plastic membership card with photo and QR code, at a unit cost estimated at $10.
		Car Cards	Assume 250 members, each to be issued a cardboard car card at a unit cost estimated at $2.
		CCTV monitoring for Bonney Lake South PNR	Allowance for the project to buy and install CCTV to monitor the pick-up location at Bonney Lake as a security enhancement. $10,000. Priced estimate on file.
		CCTV monitoring for Sumner Station	Allowance for the project to buy and install CCTV to monitor the evening pick-up location at Sumner Station as a security enhancement. $10,000. Priced estimate on file.
	Staffing and	Securing permissions and funding for the field operating trial	Allowance for the time of a staff member to carry out all the negotiations, fill in the application forms, etc., to get the needed permissions and funding. Estimated at 20 days at $500 per day.

Table 22 **Details of Costs Included in the Estimate for the Field Operating Trial**			
		Line Item	**Description**
		Support services from marketing agency	Assumes a marketing agency will be engaged to coordinate all marketing activity. This line item is for the agency's fee over and above the actual cost allowances in the other line items. Estimated at $30,000, 50% before launch and 50% in the immediate post-launch period.
		Overseeing software development	Allows for time of a staff member to oversee the development of the software for the project. Estimated at 14 days at $500 per day.
		Establishing the governance structure, getting up to speed	Allowance for time of staff member to put in place the governance structure for the project (Steering Team, Local Team, etc) and to help those joining the teams get up to speed. Estimated 10 days at $500 per day.
		Overseeing and participating in community outreach process	Allowance for time of staff member to organize and participate in community outreach, particularly to Bonney Lake, Buckley, and Enumclaw residents, and also to other users of Sumner Station. Estimated at 10 days at $500 per day, before and after launch.
		Liaising with marketing agency	Allowance for time of staff member to liaise with and instruct the marketing agency. 20 days at $500 per day, half before launch and half during the initial operations period.
		Liaising with Steering Team	Allowance for time of staff member to liaise with the Steering Team and carry out all necessary activities to prepare for their meetings and follow up afterwards. 30 days at $500 per day.
		Overseeing temporary staff	Allowance for time of staff member to oversee temporary staff employed to implement aspects of the project. 8 days at $500 per day.
		Temporary staff	This line item is distinct from 'staff' for ongoing operations, though in reality they might be the same people. In the pre-launch phase these people will be doing additional outreach work under the direction of the manager. Allowance of 250 hours at $20 full cost per hour before launch and the same again immediately after launch.
		Membership application processing	Allowance for time of staff or service purchased from other agency to carry out any checks decided on by the Steering Team. Allowance of $20 per application, 250 applications (assume all are successful).
		Launch party	Allowance for one-off social event to occur the day before the system begins to operate. $5,000.
		Preparing reports about the project	Allowance for time of staff member to gather data and prepare reports about the project. Allowance of 30 days at $500 per day, during the post-launch period.
	Marketing Program Including Collateral	Billboards	To get cut-through for the project there will be a comprehensive marketing program. Billboards may be one component. Allowance of $20,000.
		Newspaper advertising	To get cut-through for the project there will be a comprehensive marketing program. Newspaper advertising may be one component. Allowance of $10,000.
		Radio Advertising	To get cut-through for the project there will be a comprehensive marketing program. Radio advertising may be one component. Allowance of $15,000.
		Email advertising	To get cut-through for the project there will be a comprehensive marketing program. An email blast may be one component. Allowance of $6,000 to access appropriate lists.

Table 22 **Details of Costs Included in the Estimate for the Field Operating Trial**			
		Line Item	**Description**
		Direct mail advertising	To get cut-through for the project there will be a comprehensive marketing program. Direct mail advertising may be one component. The PSRC estimates for 2010 show about 22,000 households in the Bonney Lake Catchment area. Allowing an addressed item to each at a cost of $2 gives a cost of $44,000.
		Community meetings	To get cut-through for the project there will be a comprehensive marketing program. Community meetings in Sumner, Bonney Lake, Enumclaw, Buckley, and possibly other locations will be one component. These will be arranged through local service groups. Allowance for ten meetings at $500 each.
	Cont-ingen-cies	Contingencies	Contingency sum for overs and unders and missed items in the above estimate. Prudence requires the line item. Experience suggests 15% is sufficient taken against all cost estimates related to setting up the service.
Ongoing Operating Costs		Management	0.25 FTE for a management level individual costing $80,000 per year. This is expected to be sufficient time managing such a small project. Cost estimate: $20,000 per year.
		Staff	0.5 FTE for a staff person costing $30,000 per year. Cost estimate $15,000 per year. The role of this person includes troubleshooting operations and enforcement of parking rules.
		Internet access	Allowance for operation of project website of $50 per month, $600 per year.
		Text messaging	Each time a member gets into another member's vehicle, the rider sends an SMS text message to the system. The system performs a look-up function and sends a confirming message to the driver. This line item is for the confirming messages, at $0.10 each. There are 46,000 passenger trips per year. Cost estimate: $4,600 per year.
		Access fees	Rental of parking spaces at Bonney Lake South PNR (100), and Sumner Station (50) estimated at $1 per space, 240 days of the year. Cost estimate $36,000 per year. This line item might be provided 'in kind' by Sound Transit and Pierce Transit.
		License fees	License fee for the flexible carpooling intellectual property, estimated at $0.20 per trip, 46,000 trips per year. Cost estimate $9,200 per year. This line item might be provided 'in kind' by Trip Convergence Ltd.
		Advertising	Even though it is hoped the 250 people who sign up pre-launch will continue to use the service, and replacements will be through word-of-mouth, it will still be important to use appropriate levels of 'reminder' advertising. Allowance of $20,000 per year.
		Public liability insurance	Estimate provided by an insurance company to cover the public liability risk, $6,000 per year.
		Guaranteed Ride Home	Provision for taxi or bus tickets for people who are delayed in the evening or have a daytime emergency.
		Miscellaneous overheads	To capture office space, communications, and other similar related cost of the project team. Allowance of $10,000 per year.
		Contingencies (15%)	Prudent allowance of 15% against all the above ongoing operating cost items.
Incen tives		Prize draw for registering	There needs to be a package of incentives to offset the 'newness' of the system and deal with the perceived risk felt by potential participants. The package will be finalized with the Steering Team,

Table 22 **Details of Costs Included in the Estimate for the Field Operating Trial**		
Line Item		**Description**
		and might have requirements or limitations due to sources of project funds. It is thought appropriate to allow for a prize draw that people enter by registering for the service. One entry per person. Only open to people in the project catchment area. Cost estimate $10,000.
	Prize draw for trial activity	As outlined above, except in this case a prize entry for each time the system is used. Cost estimate prize money for the first year of the trial: $25,000.
	Participation payments for trial	The purpose of this project is to establish an operating flexible carpooling system. The people participating will be pioneers. It is not likely that sufficient participants will join without a significant incentive. But payments should be made only for doing activity consistent with the goals of the project. Sharing rides is the key activity. It is proposed that incentives be paid per trip taken. Over time the incentives will reduce since the risk of the unknown will reduce. Cost estimate $138,000 based on $3 per trip for the first year. This could be an average with higher payments in the first weeks and lower in later weeks.
	Community grant for achieving project goals	The communities of Bonney Lake, Buckley, and Enumclaw will be asked to take an active role in helping the project to succeed. By doing so they will be helping reduce the congestion on regional roads. It is proposed that on reaching the target levels these communities be paid a grant to use as they see fit. It is proposed at $25,000 per community for a cost of $75,000, year 1 only.

The estimate has been analyzed into the cost components used by WSDOT for project proposals. The result is shown in Table 23.

TABLE 23 Cost by Component

Cost Category	Direct Operating	Contracted Services	Adminis-trative	Capital	Total
Costs of setting up the service	$ 141,450	$ 34,500	$ 84,525	$ 109,250	$ 369,725
Ongoing Operating Costs	$ 98,210	$ -	$ 23,000	$ -	$ 121,210
Incentives	$ 248,000	$ -	$ -	$ -	$ 248,000
Contingencies to enable iteration	$ 20,700	$ 11,500	$ 14,375	$ -	$ 46,575
Total Estimated Costs	$ 508,360	$ 46,000	$ 121,900	$ 109,250	$ 785,510

The estimate has been analyzed by the tasks in the project plan as detailed in Appendix 2. The result is shown in Table 24.

TABLE 24 Cost by Task

Cost Category	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Total
Costs of setting up the service	$ 23,000	$ 172,126	$ 151,599	$ 5,750	$ -	$ 17,250	$ 369,725
Ongoing Operating Costs	$ -	$ -	$ -	$ -	$ 121,210	$ -	$ 121,210
Incentives	$ -	$ -	$ 10,000	$ -	$ 238,000	$ -	$ 248,000
Contingencies to enable iterations	$ -	$ 16,819	$ 9,056	$ -	$ 20,700	$ -	$ 46,575
Total Estimated Costs	$ 23,000	$ 188,945	$ 170,655	$ 5,750	$ 379,910	$ 17,250	$ 785,510

Appendix 4. MOCK-UP OF MEMBERSHIP CARD AND CAR CARD

Member card - front

Raspberry Express

Member No. 1234567

USERNAME. paul

Member card - back

This card belongs to Raspberry Express. If found please return to 17/130 Great South Road, Epsom, Auckland 1051.

If taking a ride as a passenger, upon getting in to the car please create a text message and send it to 021 666 414. The message should show just the username of the driver.

If you are travelling on a route that is not your default route, please also add the route ID after the driver's username, with a space in between.

Car card

Raspberry Express

Member No. 1234567

USERNAME. paul

If paul is your driver, please text paul to 021 666 414. This message can be generated automatically on an enabled internet phone by taking a picture of the above QR code.

If you are travelling on a route that is not your default route, please add the route ID after the driver's username, with a space in between.

If no confirming text message is received by the driver, please complete a manual claim form for the trip.

Appendix 5. SELECTED TRANSPORTATION STORIES

The following are excerpts from the on-line surveys. They are all people from the Bonney Lake Catchment. In the survey, in addition to the many other questions, respondents were asked to tell their transportation story. While there were 37 responses from the catchment, the following 22 gave an answer to this question.

To put the transportation story in context, the origin, destination, distance travelled, main mode, response to the question about spontaneous carpooling, number of patterns, most used pattern, overall trip rating, and the transport benefits they receive are also shown.

These are the voices of potential users of the Bonney Lake South PNR to Sumner Station Flexible Carpooling Route.

Origin	Bonney Lake	Destination	Renton
How recruited	Flyer handed out	Distance to work (miles each way)	30
Main mode	Share	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	2	Overall Trip Rating (out of ten where ten is excellent)	6
Most used pattern	Not given	Transport benefits received	Pre-tax payment of transit, vanpool, or cycling costs
Transportation Story *car pool with coworker both ways to work and home*			

Origin	Bonney Lake	Destination	Tacoma
How recruited	handout from person at sumner park and ride	Distance to work (miles each way)	24
Main mode	Public Transport	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	2
Most used pattern	Drive alone+Bus+Bus	Transport benefits received	Transit tickets they pay for in full
Transportation Story *I take two buses to get to work (496 Pierce Transit and 578 Sound Transit) and they DO NOT work together to ensure that these schedules work together. The single bus that used to exist until Sound Transit removed it was perfect. Now it is a terrible commute.*			

Origin	Bonney Lake	Destination	Seattle
How recruited	Co-Worker	Distance to work (miles each way)	42
Main mode	Public Transport	Response to Spontaneous	Possibly, if it saved me

		Carpooling	enough time or money
# of patterns	3	Overall Trip Rating (out of ten where ten is excellent)	9
Most used pattern	Drive alone+Train+Walk >100 meters	Transport benefits received	Pre-tax payment of transit, vanpool, or cycling costs

Transportation Story

Up until the last "shake up" in Pierce County I was only driving 1 mile to the park n ride to catch the shuttle bus to the train station in Sumner which was awesome, however, now that more cuts have been implemented I'm having to drive to Sumner station because the afternoon shuttle bus isn't as dependable and I've got to get back up the hill fast! I love the morning commute as I'm able to relax and sometimes cat nap on my way into Seattle on the train, the people are nice and the train is clean and best of all I'm not ready for a straight jacket when I get to work or come home at night from traffic related issues. It would be nice to have reliable alternatives througout the day, ie the train running all day rather than just commute hours, there have been a few times when I've needed to go home before the 1st train and I have spend over 3 hours on buses trying to get as close to home as possible - that does stress me out!!

Origin	Bonney Lake	Destination	Renton
How recruited	Co-Worker	Distance to work (miles each way)	33
Main mode	Drive	Response to Spontaneous Carpooling	Possibly, if it saved me enough time or money
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	5
Most used pattern	Drive alone	Transport benefits received	I receive no transport related discounts or benefits,

Transportation Story

Drive alone thru BOnney Lake's traffic nghtmare, on to HWY 410 which is a parking lot at the SR-167 interchange. Alone all the way from Puyallup to downtown Renton in SR-167 traffic, bumper to bumper.

Origin	Bonney Lake	Destination	Tukwila
How recruited	hand bill at Summer's Sounder station	Distance to work (miles each way)	30
Main mode	Public Transport	Response to Spontaneous Carpooling	would not work unless 167 had a carpool lane to 410/512 junction
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	8
Most used pattern	Drive alone+Bus+Train+Drive alone	Transport benefits received	Pre-tax payment of transit, vanpool, or cycling costs,,,,Other free parking at destination,Free parking at park-and-ride

Transportation Story

Its faster for me to drive in the morning as it reduces my travel time in half (30 minutes). But because of traffic on 167 going home my travel double to 1 hour. Driving to the Park & Ride, taking the bus to the train station, having a 2nd car at the destination train station and then driving to work and back to the train station is about the same as driving home (1 hour) in my car but with less stress. Costs are about the same.

Origin	Enumclaw	Destination	Renton
How recruited	Company Trip Reduction Coordinator	Distance to work (miles each way)	27
Main mode	Share	Response to Spontaneous Carpooling	I would definitely try it.
# of patterns	2	Overall Trip Rating (out of ten where ten is excellent)	Excellent
Most used pattern	Vanpool as driver+Vanpool as rider	Transport benefits received	Transit pass they pay for in full,,,,,Free parking from your employer
Transportation Story			
I am a member of a metro Van Pool and Ride my motorcycle in good weather. I wish I lived closer to work but love where I live and not willing to relocate.			

Origin	Bonney Lake	Destination	Seattle
How recruited	Handout at train station	Distance to work (miles each way)	35
Main mode	Public Transport	Response to Spontaneous Carpooling	Possibly, if I was convinced it was safe
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	Excellent
Most used pattern	Drive alone+Train+Bus	Transport benefits received	Transit tickets they pay for in full
Transportation Story			
I take the Sounder train and love it. Would like to see a bus that can get me to the Sumner station easily if the train is not running.			

Origin	Lake Tapps	Destination	Auburn
How recruited	CTR Admin	Distance to work (miles each way)	10
Main mode	Drive	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	8
Most used pattern	Drive alone	Transport benefits received	No answer
Transportation Story			
Leave from Lakeland Hills area of Lake Tapps, drop off son at daycare on the way to work which takes about 5 minutes. Drive back roads to work and the commute always takes about the same amount of time (25 minutes). Same route to go home, picking son up from daycare on the way. Takes about 25 minutes.			

Origin	Enumclaw	Destination	Des Moines
How recruited	City sent link	Distance to work (miles each way)	30
Main mode	Drive	Response to Spontaneous	I work for a small city as a police officer. Others do

		Carpooling	not travel at the same time as me or from the same area.
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	5
Most used pattern	Drive alone	Transport benefits received	Take home car during my work week

Transportation Story

I have a problem with semi trucks that do not stay in the slow lanes.

Origin	Bonney Lake	Destination	Tukwila
How recruited	Person at the Bonney Lake Park & Ride	Distance to work (miles each way)	24
Main mode	Public Transport	Response to Spontaneous Carpooling	Possibly, if I was convinced it was safe
# of patterns	3	Overall Trip Rating (out of ten where ten is excellent)	7
Most used pattern	Drive alone+Bus+Train+Walk >100 meters	Transport benefits received	I receive no transport related discounts or benefits,

Transportation Story

I took a job in Tukwila only because the Sounder Train was close enough to be able to walk from the station to my office. I've been doing this commute for over 5 years and I am a bit disappointed that the Tukwila Sounder station hasn't been completed yet.

Origin	Bonney Lake	Destination	Tacoma
How recruited	representative from Pierce Transit	Distance to work (miles each way)	25
Main mode	Public Transport	Response to Spontaneous Carpooling	Possibly, if it saved me enough time or money
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	4
Most used pattern	Drive alone+Bus+Bus	Transport benefits received	Transit pass they pay part of

Transportation Story

I used to love my commute, one bus from park and ride to work. However, they took away the route and now I must catch two buses (Pierce Transit and Sound Transit). This is very inconvenient and now takes me over 30 to 60 minutes longer each day for the round trip. The biggest issue I have is when the ST bus is late, which happens quite often, I then miss the PT bus and have to wait outside for an extra 30 minutes. ST needs to change the route which is comes as one route from Seattle and leaves as another route. Since traffic is bad in Seattle, this usually results in the route leaving Tacoma being late and missing the connection in Sumner. These two agencies need to coordinate their schedules better knowing that most folks rely on both bus systems. The train routes only cater to those going to Seattle and bus that transports for the train always waits for the train but not connecting buses. We have been told it will only get worse with budget cuts. I believe more people would ride if they felt they could depend on a commute that wasn't extended for the reasons mentioned above.

Origin	Bonney Lake	Destination	Kent
How recruited	Enclosure in mail	Distance to work (miles each way)	19
Main mode	Public Transport	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	3	Overall Trip Rating (out of ten where ten is excellent)	6
Most used pattern	Carpool as rider+Train+Walk >100 meters	Transport benefits received	Transit pass they pay part of

Transportation Story

I work a compressed work week, 4 ten hour days. On some shifts, public transportation is not available. I choose my work shifts in order to use public transit because it costs less money. I get a ride to the train station, ride the train, then walk to work. I have to leave earlier than I like because of the train schedule and my scheduled start time. I end up arriving at work 45 minutes before my shift starts, which is disappointing. I do find the train ride very relaxing and much less stressful than driving in heavy traffic on the freeway. The train ride takes less time.

Origin	Bonney Lake	Destination	Seattle
How recruited	Handout at Bonney Lake park and Ride	Distance to work (miles each way)	38
Main mode	Public Transport	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	9
Most used pattern	Drive alone+Bus+Train+Bus	Transport benefits received	Free parking at park-and-ride,Free shuttle or bus service

Transportation Story

My transportation story is simple and only include one pattern easily discernable from the answers already provided earlier in the survey. The only thing I'd like to see changed is an alternative to tapping on/off the train. It's easy to forget to tap before boarding the train - and with only one warning allowed before issuing a $124 fine - it seems a bit severe and puts the onus on the rider, when it seems SOUND transit should automate a way to ensure all riders are paying their fare.

Origin	Bonney Lake	Destination	Fremont
How recruited	someone at train station was passing out info	Distance to work (miles each way)	40
Main mode	Public Transport	Response to Spontaneous Carpooling	Possibly, if I was convinced it was safe
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	8
Most used pattern	Drive alone+Train+Shuttle	Transport benefits received	Transit pass they pay part of,Free shuttle or bus service

Transportation Story

I have been riding the train since the first month it began. We based the decision on where to buy a house partly on the train location. I drive from my house to the train station, it is a quick & easy route. Parking at the Sumner train station is

very difficult. There is no parking after the second train leaves. The train is a great way to commute. It is sometimes crowded in the evening, but most everyone is polite. I ride a shuttle from the Seattle train station to Fremont. The shuttle is paid for by several companies in the Fremont area. The shuttle trips is only 10-15 minutes. If I had to take the bus it would be >30 minutes. I could not continue to work in Fremont if I had to take the bus, the commute would be too long.

Origin	Buckley	Destination	Seattle
How recruited	solicitation at the Sumner Sounder station	Distance to work (miles each way)	30
Main mode	Public Transport	Response to Spontaneous Carpooling	Possibly, if I was convinced it was safe
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	9
Most used pattern	Drive alone+Bus+Train+Bus	Transport benefits received	Transit pass they pay part of,Pre-tax payment of transit, vanpool, or cycling costs

Transportation Story

Generally my transportation story is the same. I am a creature of habit so I like things to be the same all of the time. Even though I can manage unexpected change I don't particularly care for having to mange change.

Origin	Enumclaw	Destination	South Boeing Field
How recruited	Tweet from @PierceTransit	Distance to work (miles each way)	32
Main mode	Drive	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	3
Most used pattern	Drive alone	Transport benefits received	I receive no transport related discounts or benefits,

Transportation Story

I would love to use public transportation. I would be willing to pay fees or taxes for this. We need to get cars off the road and out of cities. But, it's nearly impossible to use! It would take me 5 or 6 hours a day to commute to work, which now takes 1-1/2 to 2 hours by car (round trip). I can't arrive at or leave destinations when I want to, which can vary from day to day. Making stops and/or side trips on the way to and from work is a frequent requirement, as are trips to and from my workplace during the day.

Origin	Buckley	Destination	Seattle
How recruited	flyer handed to me by trip convergence staff	Distance to work (miles each way)	43
Main mode	Public Transport	Response to Spontaneous Carpooling	I carpool to the park and ride from time to time. Generally, this isn't viable as our schedules conflict leaving the non-driver stranded.
# of patterns	1	Overall Trip Rating (out of ten where ten is	8

		excellent)	
Most used pattern	Walk >100 meters+Drive alone+Bus+Train+Walk >100 meters	Transport benefits received	Transit pass they pay for in full,Free parking at park-and-ride

Transportation Story

I find taking public transportation the best way to commute. Other than my drive to the park and ride, I have free time to do work. My only complaint is that when the train runs into delays, I am not given accurate information in terms of when it will be moving. The announcer mainly repeats "we'll be moving in approximately 10 minutes". These delays are often 30 to 45 minutes long. Knowing about the length of the delay will help me ensure I'm not missing important meetings without notice to the other attendees.

Origin	Buckley	Destination	Not given
How recruited	Handout at the Sumner Train Station this morning.	Distance to work (miles each way)	50
Main mode	PTDriveWalk	Response to Spontaneous Carpooling	Possibly, if it saved me enough time or money
# of patterns	3	Overall Trip Rating (out of ten where ten is excellent)	Excellent
Most used pattern	Not given	Transport benefits received	Transit pass they pay for in full

Transportation Story

I enjoy riding the train to and from work because it is faster than driving or taking the bus; and it is reliable.

Origin	Bonney Lake	Destination	Seattle
How recruited	Building email from ETC Coordinator	Distance to work (miles each way)	46
Main mode	Public Transport	Response to Spontaneous Carpooling	Possibly, if it saved me enough time or money
# of patterns	2	Overall Trip Rating (out of ten where ten is excellent)	9
Most used pattern	Drive alone+Train+Walk >100 meters	Transport benefits received	Transit pass they pay for in full,,,,,Free parking from your employer

Transportation Story

I love taking the train but hate that I have to get to the Sumner station 40 minutes before my train comes just to find a place to park. I also believe there should be ORCA machines at both ends of the platform as it is cumbersome to walk two car lengths backward in order to tap the car. I find the train very satisfying as far as comfort. There are plenty of seats and lots of leg room. I like that the conductor announces the stops and, for Sumner and Puyallup, which side we will depart from.

Origin	Bonney Lake	Destination	Not given
How recruited	Hand out at the train station	Distance to work (miles each way)	40
Main mode	Public Transport	Response to Spontaneous Carpooling	I would definitely try

			it.
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	9
Most used pattern	Drive alone+Train+Walk >100 meters	Transport benefits received	Transit pass they pay part of

Transportation Story

I take the Sounder train from the Sumner station and arrive at the King Street Station. I walk approximately 8 blocks to work from there. I enjoy the relaxing atmosphere of the train and appreciate the times the train leaves as it works into my schedule perfectly

Origin	Bonney Lake	Destination	Seattle
How recruited	Email from work	Distance to work (miles each way)	35
Main mode	Drive	Response to Spontaneous Carpooling	Possibly, if I was convinced it was safe
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	5
Most used pattern	Drive alone	Transport benefits received	I receive no transport related discounts or benefits,

Transportation Story

let see i works nights. i drive every night to work. i leave at 8pm jump on 410 to 167 to 405 to i-5. the from i-5 i take to james/dearborn st exit. then take the james st exit all the way up to 18th st try to find parking then go in to work. then when i get off around 5:30-6ish i do it all over again.

Origin	Bonney Lake	Destination	Mercer Island
How recruited	Email from friend	Distance to work (miles each way)	42
Main mode	Drive	Response to Spontaneous Carpooling	Never, I cannot see myself doing something like that
# of patterns	1	Overall Trip Rating (out of ten where ten is excellent)	5
Most used pattern	Drive alone	Transport benefits received	I receive no transport related discounts or benefits

Transportation Story

I drive approximately 86 miles round-trip daily. From where I live, I cannot use public transportation due to my schedule and lack of services. I drive a diesel car and it is relatively inexpensive for me to commute.

Appendix 6. Seattle Area Organizations who's staff participated

Over 80 Seattle-area organizations' staff participated in the web-based survey. The list below is inevitably a partial list, because not all respondents listed their employer, though most heard about the survey through their employer. The researchers thank all who participated, including their organizations.

Seattle Area Organizations Who's Staff Participated and Noted Company Name		
ADESA	DOC	Pierce Transit
ADP	Dorsey & Whitney	Ply Gem Windows
Alaska Airlines	FDA	Precor
Attachmate	Federal Home Loan Bank of Seattle	PSRC
Battelle	FHLB Seattle	Puget Sound Energy
Cardiac Science	First Choice Health	R4 CA
Cascade Designs Inc.	Foster Pepper PLLC	Regence BlueShield
Cascadia Community College	Guy Carpenter and Company, LLC	Safeway Inc.
Cascadia Facilities Services	Highline Community College	Seattle Biomed
Casey Family	HomeStreet Bank	Seattle Century Square
Century Square	Horizon Air	Seattle Community College District
CH2M Hill	Intellectual Ventures	Seattle Parks and Recreation
Chamber of Commerce	Kibble & Prentice	South Seattle CC
Chateau Ste. Michelle Winery	King County	State of Washington
Children's Administration, Region 4	King County Metro	Sur La Table
Children's Hospital	Labcorp/Dynacare	Tetra Tech EC
Cisco Systems	LMN Architects	Travelers Insurance
City of Burien	Mithun Architects	U.S. Bank
City of Mercer Island	North Seattle Community College	Unified Grocers
City of Renton	Northwest Administrators	United Way of King County
City of Shoreline	OHMC	UW Bothell
City University of Seattle	Oracle Corporation	Virginia Mason
CMC/ICOS Biologics	Overlake Hospital	Washington State Bar Association
CommTrans	Pacific Science Center	Watermark Credit Union
Cutter & Buck	Philips	Wells Fargo Insurance
DDD	Philips Bothell	Williams Kastner
Dept. of Social and Health Services	Philips Healthcare	Woodland Park Zoo