Understanding the Link Between Bicyclists and Light Rail

Survey Results from Bicycle Riders on MAX in Portland, Oregon

Matt Lasky

Field Area Paper
Master of Urban and Regional Planning Candidate
Portland State University

Readers:
Dr. Jennifer Dill
Dr. Robert Bertini

June 9, 2005

Acknowledgements:

Thank you to Dr. Jennifer Dill and Dr. Robert Bertini for being my MURP advisors and Field Area Paper readers. Additional appreciation to Dr. Thomas Kimpel and Dr. Irina Sharkova for various GIS assistance. This project would not have been possible without the support of Caleb Winter and the rest of TriMet's Marketing Information Department. Lastly, I thank my wife for being supportive during the "MURP years."

Table of Contents

Introduction

Portland, Oregon is a bicycle friendly city. In 1995 and 1998, *Bicycling Magazine* named Portland the best city for bicycling in the United States and in 2001 it named Portland the best bicycling city in North America (*Bicycling Magazine*, 2001). According to the 2000 U.S. Census, 1.8% of working residents in Portland bicycle to work. In comparison to the rest of the country, this is a large share; nationwide only 0.4% of workers ride a bicycle to work. There are many reasons for Portland's bicycling success; however, there are still opportunities for increasing the two-wheeled mode share.

One way to increase the number of bicyclists and the quality of life in Portland is by improving the connection between bicyclists and transit. Portland's transit service has a history of allowing bicycles on transit and currently permits the connection. However, there is still potential to increase the number of bicyclists making the multi-modal connection. This could help increase the bicycle commute share by reducing travel time and helping bicyclists avoid obstacles such as sloped terrain and roads without bicycle facilities. Bicycles are permitted on Portland's buses and light rail system (LRT) known as Metropolitan Area Express (MAX), but the region's transit agency, TriMet, has never studied these riders to learn how they can attract new and current bicyclists not making the connection. Section V of the Portland Bicycle Master Plan discusses the bicycle and transit connection and provides suggestions for improving it and increasing the number of bicycle-transit trips but does not establish any benchmarks for measuring success (City of Portland, 1998). The goal of this research is to understand more about bicyclists accessing transit and more specifically those that use MAX. Understanding more about the population of MAX riding bicyclists, why they make this transportation connection, and where they are going and coming from on their trip can lead to implementation of new policies and therefore increasing the number of bicycle riders. As a result, this could improve the bicycle mode share in Portland and also increase TriMet's LRT ridership.

This report gives a brief overview of the Portland Bicycle Master Plan and Section V relating to the bicycle-LRT connection. Then it discusses the MAX system and TriMet's history of allowing bicycles on LRT in Portland. A literature review follows the background information, leading into the experiment design and methodology of a Portland study. This study builds upon the previous bicycle-LRT research in the Literature Review with the use of bicyclists surveys conducted on MAX. Using results from the surveys, this paper discusses policies that could increase the bicycle mode share in Portland and increase MAX ridership.

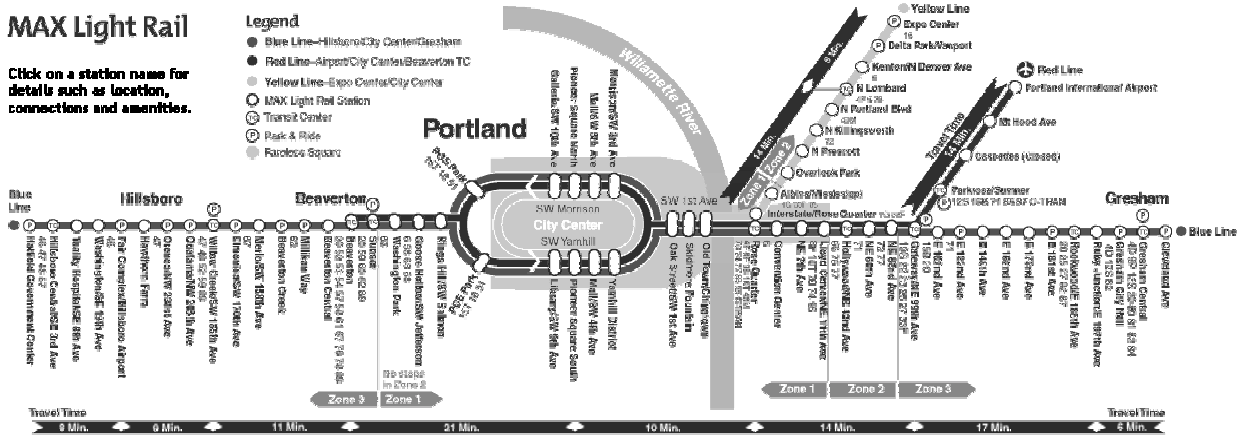
Portland Bicycle Master Plan, Section V

After two and half years and input from 2,000 residents at over 20 public meetings and 35 interest group presentations, the City of Portland adopted the Portland Bicycle Master Plan (PBMP) in 1996 (City of Portland, 1998). In the Plan, Section V is devoted to improving the link between bicycles and transit, designating the City of Portland and TriMet as the primary agencies responsible for these improvements. Included in the Plan are four components, two of them relate to this research, bicycle parking at transit stations and provisions for allowing bicycles on transit. The Plan states that the City should work with TriMet in providing and promoting bicycle lockers at transit stations and that TriMet will increase bicycle parking as demand rises. In terms of bicycles on transit, the PBMP states that TriMet has not developed a long-range bicycle/transit plan and discusses the permitting process as discussed later in this report in the History of Bicycles on MAX section.

Metropolitan Area Express

TriMet operates three LRT lines known as the blue, red, and yellow lines. A map of the 44-mile, 64-station regional LRT system is shown in Figure 1 (TriMet, 2004). The original blue line is the longest and the eastern half of the line, stretching from Portland to Gresham, is the oldest; it opened in 1986 and is 15 miles long. The western portion of the blue line opened in 1998, it is 18 miles long and extends from downtown Portland, through Beaverton, to Hillsboro (TriMet, 2004). The red line opened in 2001 and runs between Beaverton Transit Center on the west side of Portland and the Portland International Airport on the eastern end of the line. Between downtown Portland and Portland International Airport the MAX line is 5.5 miles. The newest MAX line, the yellow opened in 2004, extends from Pioneer Square 5.8 miles to the Expo Center station, and operates north and south (TriMet, 2004). MAX serves 97,000 trips per day; this is 31 percent of TriMet's daily ridership (TriMet, 2005). Currently, two further extensions are in the planning and design phases.

Figure 1 – TriMet's MAX Light Rail System Map



History of Bicycles on MAX

The first MAX line was completed in 1986. However, not until July 1992 were bicycles first allowed on trains. At the request of 7,500 petition signatures organized by the Bicycle Transportation Alliance (BTA), a bicycle advocacy group, TriMet initiated a bicycles-on-transit demonstration project allowing bicyclists to bring their bikes on MAX (Doolittle and Porter, 1994). Initially, persons with disabilities opposed the approach because bicycles were to be placed in the same location as wheelchairs. TriMet changed the system and created separate spaces for both users, turning the demonstration project into success. The demonstration project became a TriMet program. However, from the time of initiation in 1992, until 1999 (after the completion of the Westside blue line), MAX riders with bicycles could not board trains during the evening rush hour. It was believed that bicycles would lead to overcrowding during peak periods. Then starting in 1999 and continuing through today, MAX riders can board trains at any hour of the day on any line with their bicycles.

Beginning in 1992 when bikes were first permitted on MAX, bicyclists were required to purchase a permit in order to ride with their bicycle. Original permits cost bicyclists five dollars, expired after one year and were available at Portland bicycle shops and TriMet offices. The permits eventually decreased in price to one dollar and instead of necessary annual renewal, the permits were good for bicyclists' lifetimes. Throughout this time, when purchasing the permit, bicyclists had to watch a 6-minute video about safety and loading a bicycle on transit vehicles. At any time while riding MAX, fare inspectors could ask bicyclists for their permits and if they were not carrying a permit they could be fined. In 2003, the permitting program ended, now any bicyclist, at any time can board a MAX train with a bicycle.

The Portland Bicycle Master Plan (1998) states that during the fiscal year of 1994-1995, more than 35,400 people took their bicycle on MAX, this is equal to an average of 97 riders per day. Unfortunately, TriMet no longer keeps records for these ridership numbers because there is no longer a permitting process. To help demonstrate the popularity of the bicycles on transit program Table 1 shows the number of transit permits sold during the three fiscal years between 1992 and 1995.

Table 1 - Permit Sales for TriMet Bicycles on Transit (Portland Bicycle Master Plan, 1998)

Bicycles on TriMet Permits	1992/93	1993/94	1994/95
Number of Permits Sold	1,349	2,758	4,848*

Includes permit renewals*

Benefits of the Bicycle and Light Rail Connection

Increasing the number of commuters who access transit with bicycles has a number of benefits. First, for the individual, bicycling is a form of exercise and riding to a station can provide a day's necessary physical activity. This is especially important when a lack of physical activity and obesity is a growing public health problem in the U.S. Another benefit is that although bicycling is not as fast as driving, it is faster than walking. For transit riders without cars available to drive to stations, a bicycle is the fastest mode for the connection. Since bicyclists travel faster than pedestrians, they can travel further in the same amount of time. This provides transit stations with larger radius catchment areas, a benefit for transit agencies.

For bicyclists, transit also provides a refuge from poor riding conditions. For example, if a bicyclist rides to work in the morning and then during the day it snows, allowing bicycles on transit provides this bicyclist a way home with his or her bike. Also, where there are large hills or insufficient on-road bicycle facilities, transit may provide a safe alternative to riding.

Bicycling to light rail can provide a number of environmental and societal benefits as well. The environmental benefits include a reduction in energy use and air and noise pollution. The bicycle is practically nonpolluting in use and significantly less polluting in manufacture than motor vehicles (Wood, 1996). However, the degree that pollution benefits accrue is dependent on the number and length of vehicle trips that bicycles replace (Martens, 2004). In addition to these environmental benefits, if bicycles replace more vehicles accessing transit, less land would be necessary for park-and-ride lots near stations and could reduce congestion on some corridors that

access stations (Martens, 2004). Table 2 shows a comparison of park-and-ride facilities and bike-and-ride facilities. Bike-and-ride facilities are LRT stations with multiple and various bicycle parking options. Not only do bike-and-ride take considerably less land than park-and-ride lots; they are considerably cheaper for installation and operation.

Table 2 - Park-and-Ride and Bike-and-Ride Facility Comparison (Replogle and Parcells, 1992)

Characteristic	Park-and-Ride	Bike-and-Ride
Land Requirement (ft2)	330	1-2
Installation Cost per Space	$10,000-$12,000	$140-$800
Operating Cost per Space (year)	$110	$0-$30

Literature Review

There are many benefits to increasing the number of bicycles on LRT including for individuals and for regions. This study examines why this connection is important to individuals in Portland and generalizes those factors for developing possible policies to increase the number of bicyclists making the connection. Bicyclists were surveyed on MAX to gain this information. The survey was created after considering previous research on the subject.

A substantial amount of past research of the bicycle-light rail connection is from European experiences. This is most likely due to the higher percentage of bicyclists riding to work compared to in the U.S. If Portland wants to continue its bicycling success, it must implement some of these models for testing multimodal access.

Martens (2004) researches the combination of bikes and public transportation in three different countries: the Netherlands, Germany, and the United Kingdom. In the research, he studies all public transit modes including regional rail, suburban rail, express bus, city bus, and light rail. Only the Netherlands and Munich (Germany) have light rail and are therefore the most applicable to the Portland research. He finds that for slower modes of transportation, including light rail, there are fewer bicyclists who ride their bicycle to a station in comparison to faster modes of transportation such as heavy rail. Martens research pertains to distances bicyclists travel for access and egress trips to public transportation. He also finds that for slower modes of transportation, bicyclists are not willing to travel as far to access it compared to faster modes of transportation. More specifically, the majority of bicyclists are not willing to travel further than 2 or 3 kilometers when accessing slower modes. Another relevant finding from Martens research is that bicyclists are four to nine times less likely to ride a bicycle on an egress trip than an access

trip. The Netherlands is unique because there is a large bicycling population, plus, there are unique bicycling facilities, for example free bicycle rentals. Although a very different bicycling "culture," the research in this paper regarding Portland will determine the distance bicyclists are traveling on access and egress trips.

Since many trips are not made on one mode of transport and require multimodal choices, there are different costs and times involved. This makes connectivity between modes an important element for successful multimodal transportation. Gorter, et al. (2000) studies traveler satisfaction of trip chains at two central Dutch railway stations. The study focuses on chaining between private modes of transportation, such as by vehicle or bicycle, and a public mode of transportation, rail. The three areas of interest for the Gorter et al. research are accessibility, parking facilities, and time coordination between modes. They found that no matter the private mode choice in the chain, bicycle or vehicle, the longer passengers wait for public transit, the less satisfied they are with its services. More importantly for the Portland example, the researchers found that people who go to work or school are significantly less pleased with the bicycle parking facilities than others. This demonstrates that regular users of the transit system are less pleased with its amenities. For example, 38 percent of respondents stated they would ride a bike to the rail station more often if bicycle lockers at the stations were cheaper.

Gorter et al. comes from a Dutch example. It is important to note that 30 percent of commuters ride their bike to work in the Netherlands compared to only less than two percent in Portland (2000 U.S. Census). One shortcoming of the Gorter et al. research is the lack of a balanced sample. Of the two rail stations sampled, 85 percent of results came from one station and only 15 percent of results came from another station. The authors do not state the reason for this imbalance. In the Portland research, the survey's administration occurred on board MAX trains to collect the most data possible, therefore controlling for stations was difficult. However, like Gorter, et al., in the Portland research, frequency of use is compared to feelings about available services at stations.

Taylor and Mahmassani's research (1996) is the result of a survey conducted in Austin, Texas. The researchers focus on factors that may affect people's decisions of intermodal bicycle-transit trips and three policy variables to increase these multi-modal trips: on-street bicycle facility type, bicycle parking facility type, and bicycle access distance to transit. The most relevant policy variable in the Austin research is the parking facility question. The results found that bicycle lockers are about 2.5 times more of an incentive than lockable/covered parking for

bike-and-ride trips because they are perceived as providing more protection from vandalism than simple lockable parking. In the Austin research, the sampled respondents were skewed to mostly avid male bicyclists; this could be due to the population being all members of a Texas bicycling advocacy group. All members of the advocacy group were mailed a survey with 814 responses (48 percent response rate).

Bracher's research (2000) is from the Berlin and the Brandenburg region of Germany. The study focuses on suburban and regional trains but there are recommendations applicable to LRT research as well. The study includes a survey of riders and finds that most bicyclists who take their bicycles on trains during weekdays are regular users and often come from households without vehicles. However, during weekends, the number of occasional train riders in comparison to regular riders is substantially greater. Respondents stated that the greatest advantage of taking a bicycle on the train was that it helps cover long distances.

Wood (1996) makes a case for bicycling as an environmentally friendly mode of transportation. He states that bicycling is the most energy-efficient form of transportation and that it is well suited for short journeys. He calls for guidelines of best practice for planners integrating bicycles and light rail and in his paper he exemplifies good practice. Some of Wood's research comes from Copenhagen, Denmark. Due to the high number of commuters in the city, it was realized that bicycle parking facilities should safeguard bicycles from damage, be easy to use, protect bicycles from weather, be conveniently located, and close to the station. These policies were adopted by the rail agency in Denmark. Security of parking can be important when bicyclists are determining whether to leave their bicycle at a station or ride with it on LRT.

In most cases, Tri-Met locates bicycle parking close to transit stops and often more closely than vehicle parking. This reduces the distances bicyclists must travel when accessing MAX. TriMet does not have a bicycle parking policy at MAX stations. As the research in this report demonstrates, the Portland region could benefit from more comprehensive long-term bicycle parking policies for MAX stations.

Bracher develops several guidelines for German bike-and-ride improvements pertinent to Portland's modal link. He recommends publicity campaigns for the bicycle to transit link for increasing ridership and as a result, foresees future overcrowding on trains. To assist in preventing this, he calls for reducing the demand for bikes-on-trains during weekdays through attractive alternative offers, such as high-quality bicycle parking facilities. If bicyclists know that

there is a safe place for storing their bicycles, this will reduce the number of riders taking them on trains.

Once again most of the previous research comes from Europe where the bicycling mode share in many places is greater than Portland and the rest of the U.S. However, the strategies that Bracher suggests for increasing bicycle use in Germany are applicable to Portland. For example, marketing this as a fast and easy transportation mode would benefit TriMet and the Portland region by likely increasing ridership. Also, increasing the amount of premium bicycle parking could attract a latent demand of bicyclists. Perhaps, there are bicyclists who do not currently access MAX on their bicycle because they do not want to leave it at a station due to security concerns.

Brunsing (1997) gives a general overview of bicycle and public transportation integration in Germany. He notes that the largest group of users for the transportation link is commuters and students. In the Portland research, the survey considers this by integrating demographic questions and will look into the specifics of the survey's sample.

Doolittle and Porter (1994) present a report on the *Integration of Bicycles on Transit*. This report includes information for all forms of transit including bus and light rail and is primarily aimed at the integration in U.S. cities. The report describes characteristics of various bicycle-transit programs and documents experiences from various transit agencies (including TriMet) that are successfully integrating the two transportation modes (Doolittle and Porter, 1994). In the Doolittle and Porter report, Portland and TriMet are viewed as leaders in the bicycles on transit movement. They attribute this to strong local bicycle advocacy and the willingness of TriMet to listen to users. Portland is also a leader in this intermodal link because it is used to support a regional mobility plan (Doolittle and Porter, 1994). The City of Portland and other jurisdictions in the region make an effort to connect on-road facilities, such as bicycle lanes, to MAX stations.

The report also describes three classes of available bicycle parking equipment near transit; this is shown in Table 3. This is important for Portland because there are currently Class II and III parking readily available for bicyclists at MAX stations but there is a smaller supply of Class I. The potential use of Class I bicycle parking is a focus in this research. The research in this report hopes to pick-up where the Doolittle and Porter paper leaves off, that further research into customer characteristics and customers' likes and dislikes of existing programs are needed (Doolittle and Porter, 1994).

Table 3 – Advantages and Disadvantages of Bicycle Parking Equipment (Doolittle and Porter, 1994)

Type	Advantages	Disadvantages
Class I: Lockers  http://www.metrocouncil.org	Greater security from theft and vandalism Greater protection from weather and debris Guaranteed availability	Requires advance reservation and lease Administration of leases and keys Maintenance of locks and enclosure Monitoring for unintended uses
Class II: Racks  http://www.translink.co.uk	Protection of lock from tampering Security to bicycle frame and wheels Available on first come, first serve basis Simple Installation	Exposure to weather, unless covered shelter is provided Bicycle accessories are exposed to theft and vandalism Not as easy to use as Class III
Class III: Racks such as inverted U and ribbon-racks  http://www.denvergov.org	Easy to use Low cost Widest selection of designs and sizes Small space requirements for siting Available on first come, first serve basis Simple installation	Bicycle accessories are exposed to theft and vandalism Exposure to weather, unless covered shelter is provided Not all designs provide a sufficient amount of security

Research Question

The goal of the Portland research in this paper is to better understand bicyclists on MAX. As previously mentioned, contrary to their discussion in the PBMP, there is little information on these transit riders. Therefore, this analysis serves as a baseline for the Portland region, gaining information about who these transit riders are, why they are using MAX with their bicycles, and their origins and destinations. With a better understanding of bicyclists riding MAX, TriMet and the Portland region can appeal more to these riders and as a result, increase ridership and the bicycle mode share.

Methodology

To better understand behavior of bicyclists accessing MAX in Portland, a short, five-minute survey was designed and then conducted onboard trains. Copies of the survey were available in both English and Spanish versions, the English version is shown in Figure 2 and the

Spanish version is in Appendix A. The survey was administered on randomized MAX trains in both directions, from 7 to 10 am, during the morning commuting hours. Surveys were administered on April 11-13, 20, 22, 28, and May 2 2005 onboard MAX trains. One survey administrator wearing an orange TriMet Customer Service vest rode designated MAX trains, watched for bicyclists boarding the cars, and attempted to survey all bicyclists boarding. If necessary to survey bicyclists on trains with two cars, administrators moved cars at stations. Survey administrators approached bicyclists and asked if they were "willing to fill-out a five minute bicycle survey." A large majority of surveys were completed when received by bicyclists onboard and few were returned by mail. Surveying was conducted on trains rather than at stations because it was believed that this would capture the largest sample size in the shortest amount of time.

Figure 2 – English Bicyclists' Survey

TRIMET irection:

Date:

Time:

Please fill out this survey about the trip you are making now.

1. From what street address, cross streets or landmark did you start this trip?
   N • S • E • W • NE • SE • NW • SW • (circle one)
   Street Address:_____

   Nearest Cross Street: _____

   City: _____ Zip Code: _____

2. What is your final destination's street address, cross streets, or landmark for this trip?
   N • S • E • W • NE • SE • NW • SW • (circle one)
   Street Address: _____

   Nearest Cross Street: _____

   City: _____ Zip Code: _____

3. At what station did you first board MAX?

   _____

4. Did you ride your bike to the MAX station where you boarded? a. Yes b. No

5. At what station are you getting off MAX?

   _____

6. Will you ride your bike to your destination after you get off MAX on this trip? a. Yes b. No

7. If you will bring your bike on another vehicle this trip, please indicate (circle all that apply):
   a. Another TriMet MAX train
   b. TriMet bus
   c. Portland Streetcar
   d. Private automobile
   e. None

8. Where are you going on this trip? (circle <u>one</u>)
   a. Home d. Recreation
   b. Work e. Shopping
   c. School f. Other
   _____

9. Does the MAX station where you boarded have nearby bike lockers or racks for MAX riders?
   a. Yes b. No c. Don't know

10. Did you have an automobile available today to make this trip?
    a. Yes b. No

11. Generally, indicate how important the following factors are in your decision to take your bike on MAX. Use the scale below, where 1 = not important and 4 = very important.

	Not Important			Very Important
To avoid bad weather	1	2	3	4
To avoid busy traffic	1	2	3	4
To save time	1	2	3	4
To avoid hills	1	2	3	4
To avoid parking my bike at this MAX station	1	2	3	4
To avoid roads without bike lanes	1	2	3	4

12. Please rate how secure you think your bike would be, where 1 = not very secure and 4 = very secure.

	Not Very Secure			Very Secure
In a bike locker	1	2	3	4
At a bike rack	1	2	3	4
Locked to a nearby signpost or other item	1	2	3	4

13. If there were free bike lockers available for your use at all MAX stations, how often would you use them during an average week? ___ days per week

14. During an average week, how many days do you bring your bike on MAX? ___ days per week

15. Aside from riding to/from MAX with your bike, how often do you ride your bike for other purposes during an average week? ___ days per week

16. In the last two weeks have you(circle all that apply):
    a. Missed MAX because bike spaces were full
    b. Boarded MAX with a bike and found no spaces
    c. Had no problems finding a bike space

17. What is your gender? a. Male b. Female

18. What is your age? _____ years

19. Are you currently (circle all that apply):
    a. Employed d. Unemployed
    b. A student e. A homemaker
    c. Retired f. Other _____

20. Do you have any other comments you wish to share about traveling by bike and MAX together?

    _____

    _____

A random sample of trains was chosen for conducting the survey. To randomly sample, the total number of trains reaching each destination in the morning commute was totaled. The destinations for the three lines are shown in Table 4. Depending on the line and the direction, 16 to 20 percent of the trains in the morning commute were used for conducting bicyclist surveys. For example, there are twelve eastbound red line trains reaching its final destination, Portland International Airport, between 7 and 10 am on any weekday. Therefore, for this study, two trains (16 percent of the total number of trains reaching the Airport on a weekday during the morning commute) were randomly chosen for administration of the survey. This methodology was used for the two directions of the red, blue, and yellow lines. Table 5 shows the number of trains for each line that surveys were administered and the percent of trains this is in the morning commute. Researchers were only able to conduct surveys on 16 to 20 percent of trains due to time restraints of the project.

Table 4 – MAX Trains and Destinations

Line	**Red**		**Blue**		**Yellow**	
Direction	East	West	East	West	North	South
Destination	Portland International Airport	Beaverton Transit Center	Cleveland Avenue	Hatfield Government Center	Expo Center	Pioneer Square North

Table 5 – Percent of Total Trains that Surveys were administered

Line	Red		Blue		Yellow	
Direction	East	West	East	West	North	South
Number of Surveys Administered	5	6	13	18	3	4
Percent Administered	16.7% (12)	16.7% (12)	16.0% (25)	16.7% (18)	21.4% (14)	20.0% (15)
Projected Morning Commute Bicyclists	30	36	81	108	14	20

Total number of trains between 7 and 10am in parenthesis

Data

The total number of returned surveys included in the analysis is 49. Of the total number of surveys, only three were mailed to TriMet using the business reply; this means that 46 of the total, or 94 percent, were completed at the point of administration. Including the five surveys taken by the bicyclists to return by mail and did not, only 15 bicyclists were asked to take the

survey and refused. This makes a response rate of 77 percent. It is believed that the response rate is high because respondents had an easy chance to complete the survey in person, and that generally bicyclists want to improve their environment on public transportation. Some respondents did not answer all the questions on the survey; the analyses only uses questions answered and do not include any unanswered questions. Based on the number of bicyclists surveyed on each line and the number of trains on all lines during the morning commute, the projected estimate of total morning commuting bicyclists is 289.

Results

Survey Respondents

Thirty-six survey respondents (73 percent) were male. The average age of all users was 35 years old with the youngest respondent being 19 and the oldest respondent being 58 years old (all survey data is shown in Appendix B). In addition to gender and age, respondents were also asked if they had a vehicle available to make their trip as opposed to using a bicycle and transit. Twenty-four respondents did have a vehicle available (52 percent) while 23 respondents did not have a vehicle available for the trip (48 percent). Except for only four people, all the respondents were either employed or a student at the time of taking the survey. This is most likely due to the survey's administration time occurring during the morning commute hours.

Respondents were asked several questions regarding their bicycle use, such as how often they bring their bicycle on MAX per week and the number of days per week that they ride a bicycle for other purposes other than riding to and from MAX. Table 6 shows the summary statistics for these two variables. As shown, the average respondent brings their bicycle on MAX 4 to 5 days in an average week and then rides there bicycle 4 to 5 days per week excluding their access and egress from MAX. This demonstrates that the respondents of the survey make the bicycle transit link often and that they are experienced bicyclists. These results are similar to Martens (2004) findings at a light rail station in Germany where almost 80 percent of the bicycling population making the bicycle-transit link do so more than four times a week

Table 6 – Respondents' Weekly Bicycle Use

	Bring Bike on MAX (days)	Bike for Other Purposes (days)
Mean	4.5	4.6
Median	5.0	5.0
Minimum	0.0	0.0
Maximum	7.0	15.0
Standard Deviation	1.7	3.5

As a result of the survey sample, it is assumed that the bicyclists who are riding MAX with their bicycles are primarily expert male bicyclists. These conclusions reflect other research, including Taylor and Mahmassani's (1996) research sample in Austin, Texas. Their survey's sample came from a population consisting of Texas Bicycle Coalition members. In their survey, the sample was skewed to 90 percent avid bicyclists, or bicyclists that ride more than once per week and had 54 percent more men than women (Taylor and Mahmassani, 1996).

Connections

Survey respondents were asked if they rode their bicycle to the boarding MAX station and if they were planning to ride their bicycle after they reached their alighting station. All but three respondents rode their bicycles to their boarding stations and all respondents except for two rode their bicycles to their final destination after completing their trips in vehicles. Including the two respondents who did not ride to their destinations, three respondents transferred to another MAX train after completing the survey, five transferred to buses, and one respondent transferred to a private vehicle in order to reach their final destination. The percent of bicyclists making this connection compared to their destinations is shown in Table 7. These connections demonstrate that the bicycle to MAX link is important but so is the bicycle to MAX to another vehicle link. The overwhelming majority of final destinations for all the respondents was work and this is also shown in Table 7. This is most likely due to the survey time occurring during the morning commute times on weekdays.

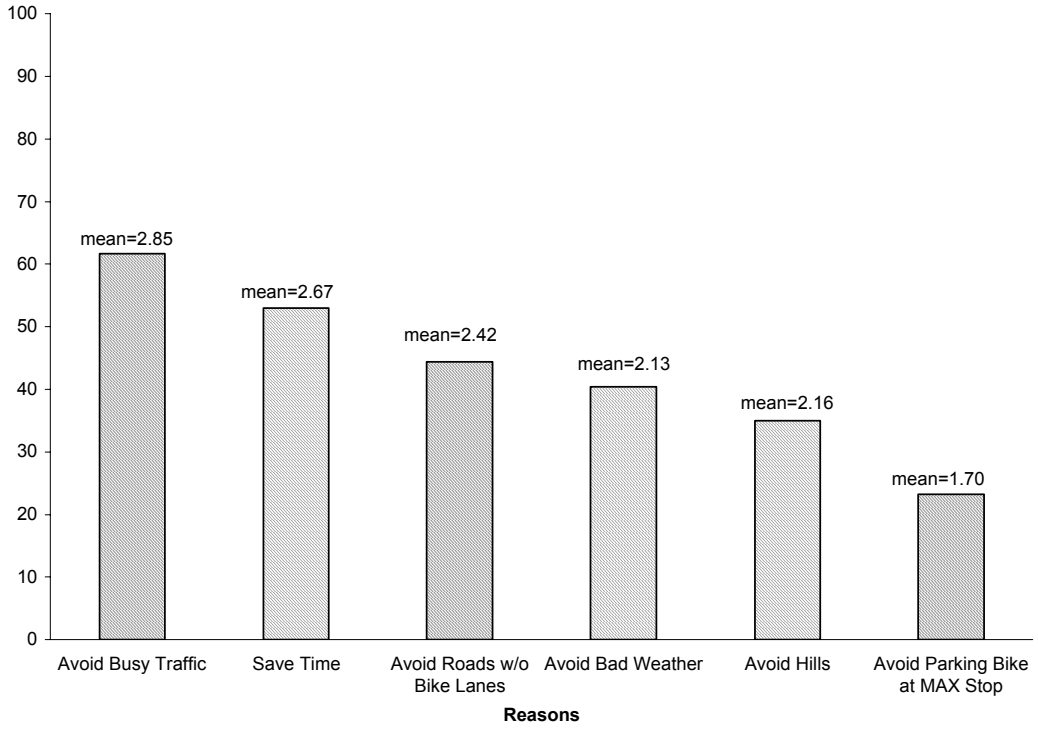
Table 7 – Destinations of Bicycle Survey Respondents

Destination	Number of Responses	Percent of Total	Number of Respondents using mode other Mode	Percent of Respondents' by Destination using other Mode on Trip
Work	40	85.1%	6	15.0%
Home	3	6.4%	1	33.3%
School	2	4.3%	1	50.0%
Recreation	1	2.1%	0	0.0%
Other	1	2.1%	1	100.0%

Factors to take MAX

There are many factors that persuade bicyclists to take MAX. The survey tested six of these possible reasons. They included: avoiding busy traffic, avoiding hills, avoiding bicycle parking at a MAX station, avoiding roads without bicycle lanes, avoiding bad weather, and to save time. Respondents rated each of these factors on a Likert-scale of one to four, one as least important and four as the most important. The means for each factor on this scale are shown in Figure 3. After consolidating the one and two ratings and determining these as not important and consolidating the three and four ratings and deeming them as important, 62 percent of bicyclists on MAX found that avoiding busy traffic as the most important. This and the importance of the other factors are shown in Figure 3. A majority, or 53 percent of respondents, said riding MAX with a bicycle to save time was important. The majority of respondents stated that the remaining four factors, avoiding roads without bicycle lanes, avoiding bad weather, avoiding hills, and avoiding parking a bicycle at a MAX station, were not important.

Figure 3 – Importance of Six Factors for Bicyclists to take MAX



The correlation analysis between these six factors and bicycling frequency is shown in Table 8. The results show two significant correlations at the 0.05 level. The first is that expert users, or individuals who take their bicycles on MAX more often are more likely to do so to avoid parking their bicycle at MAX stations. While the majority of respondents, as shown in Figure 3, stated that this factor was the least important, the bicyclists making this connection the most often find it important. This could be due to a number of factors; perhaps these cyclists have the most expensive bicycles and therefore are more concerned for their bicycles' security. It could also be due to these users having a more realistic notion of what MAX station bicycle parking resembles due to their more frequent use.

Table 8 – Correlations of Six Factors for Bicyclists to take MAX and Use Variables

		Bring Bike on MAX	Bike for Other Purposes
Avoid Busy Traffic	Correlation	-.026	-.132
	Significance	.863	.388
	n	47	45
Save Time	Correlation	.058	-.142
	Significance	.703	.365
	n	45	43
Avoid Roads w/o Bike lanes	Correlation	.047	**-.339***
	Significance	.760	**.025**
	n	45	**44**
Avoid Bad Weather	Correlation	.104	-.046
	Significance	.488	.764
	n	47	45
Avoid Hills	Correlation	.110	-.056
	Significance	.472	.721
	n	45	43
Avoid Parking bike at MAX Stop	Correlation	**.326***	.125
	Significance	**.033**	.431
	N	**43**	42

*Correlation significant at the 0.05 level

The other significant correlation shows that the bicyclists who use their bicycles the most often for other purposes than riding to and from MAX are the least likely to avoid roads without bicycle lanes. Once again, this explains a characteristic of a more advanced bicycle riding population. These individuals do not need to ride MAX to avoid riding conditions because they are comfortable on roads without bicycle lanes.

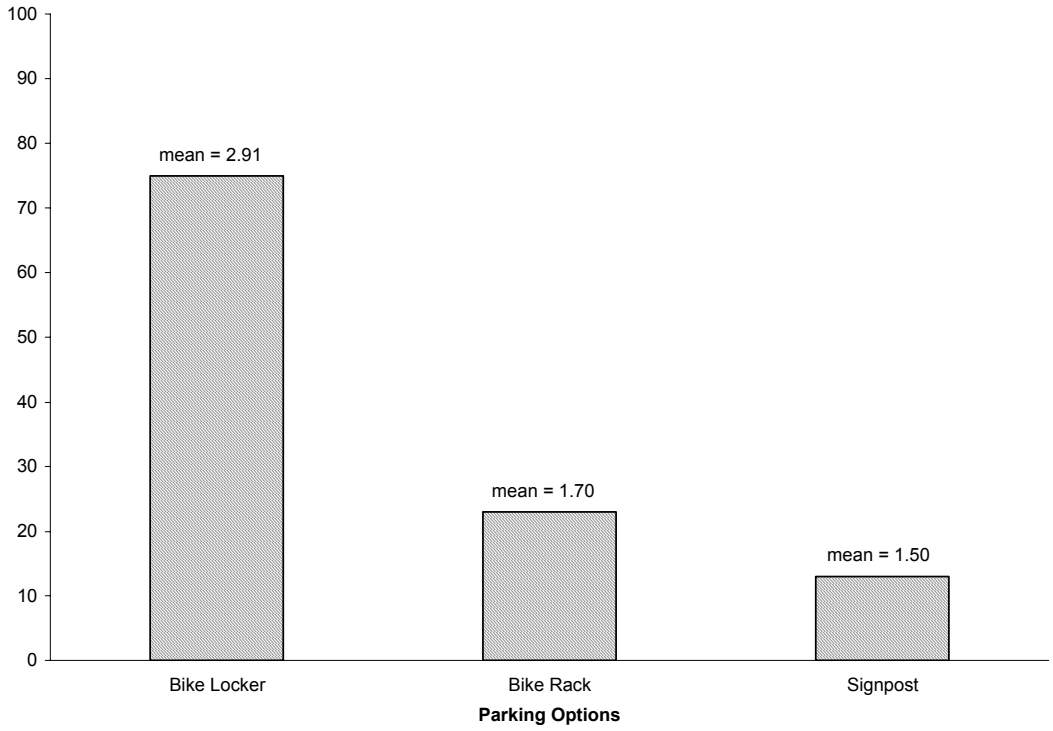
Although the most important factor to ride MAX for the whole population was to avoid busy traffic as shown in Figure 3, it was not significantly correlated with the amount of use or the amount of bicycling for other purposes. Although not significant, Table 8 shows that this factor is negatively correlated with use variables. This demonstrates that the more experienced riders think that this is not as important as some of the other factors.

Bicycle Parking

The survey asked respondents to indicate their perceptions of bicycle parking security at MAX stations. Like the six factors above, this was asked on a Likert-scale of one to four. For security, the scale ranged from one, a location that is not very secure, to four, a very secure

location. Respondents were asked their opinions about three different locations: in a bike locker, at a bike rack, and locked to a nearby signpost or other item. Means for the different parking options are shown in Figure 4. For classifying the three options, if a respondent scored a locking location as a one or two this is considered not secure in the results and if a respondent scored one of the three options a three or four this is considered a secure location in the results. Figure 4 shows the bicycle security results at the three locations included in the survey. As shown, 74 percent of respondents stated that bicycle lockers are secure. The other two options, parking at a bike rack or at a signpost were considered not secure by over a majority of respondents; 31 percent agreed that a bike rack is secure and only 13 percent said that a signpost is a secure bicycle parking location.

Figure 4 – Security of Bicycle Parking Options



The correlation analysis between the three bicycle parking options and the frequency of free bicycle locker use and bicycling frequency is shown in Table 9. The correlation between those respondents who bring their bicycles on MAX most often and the perception that bicycle lockers are secure is significant at the 0.01 level. This demonstrates that the population of expert users, or those who take their bicycle on MAX more often, find bicycle lockers to be a safe bicycle parking option. This same population of more frequent users is also correlated with using

free bicycle lockers more often if they were available. This is significant at the 0.05 level. This shows that the bicyclists who board MAX with their bicycles would use bicycle lockers if they were available partly due to their perceptions as a safe bicycle parking option. In the opposite sense, this also demonstrates a need to inform the novice bicycle/MAX user of the safety of bicycle lockers.

Table 9 – Correlations Between Bicycle Parking Options and Use of Bicycle Lockers with MAX and Bicycle Use

		Number of Days bring Bike on MAX	Number of Days Bike for Other Purposes
Bicycle Locker	Correlation	**.416****	-.139
	Significance	**.004**	.356
	n	**47**	46
Bike Rack	Correlation	-.002	-.114
	Significance	.989	.450
	n	47	46
Signpost	Correlation	-.084	-.016
	Significance	.586	.921
	n	44	43
Use Bike Lockers	Correlation	**.360***	.210
	Significance	**.014**	.166
	n	**46**	45

*Correlation is significant at 0.05 level
**Correlations is significant at 0.01 level

The results reveal that the bicyclists who ride MAX most often with their bicycles may find it important not to leave their bicycles parked at a MAX station. This implies that these individuals are dissatisfied with the parking facilities at MAX stations because they are not secure. This is similar to a finding by Gorter, et al. (2000) in the Netherlands. They found that regular users, those most commonly traveling to work and school (like the sample in the Portland research), are significantly less pleased with transit's amenities and more specifically are dissatisfied with bicycle parking amenities.

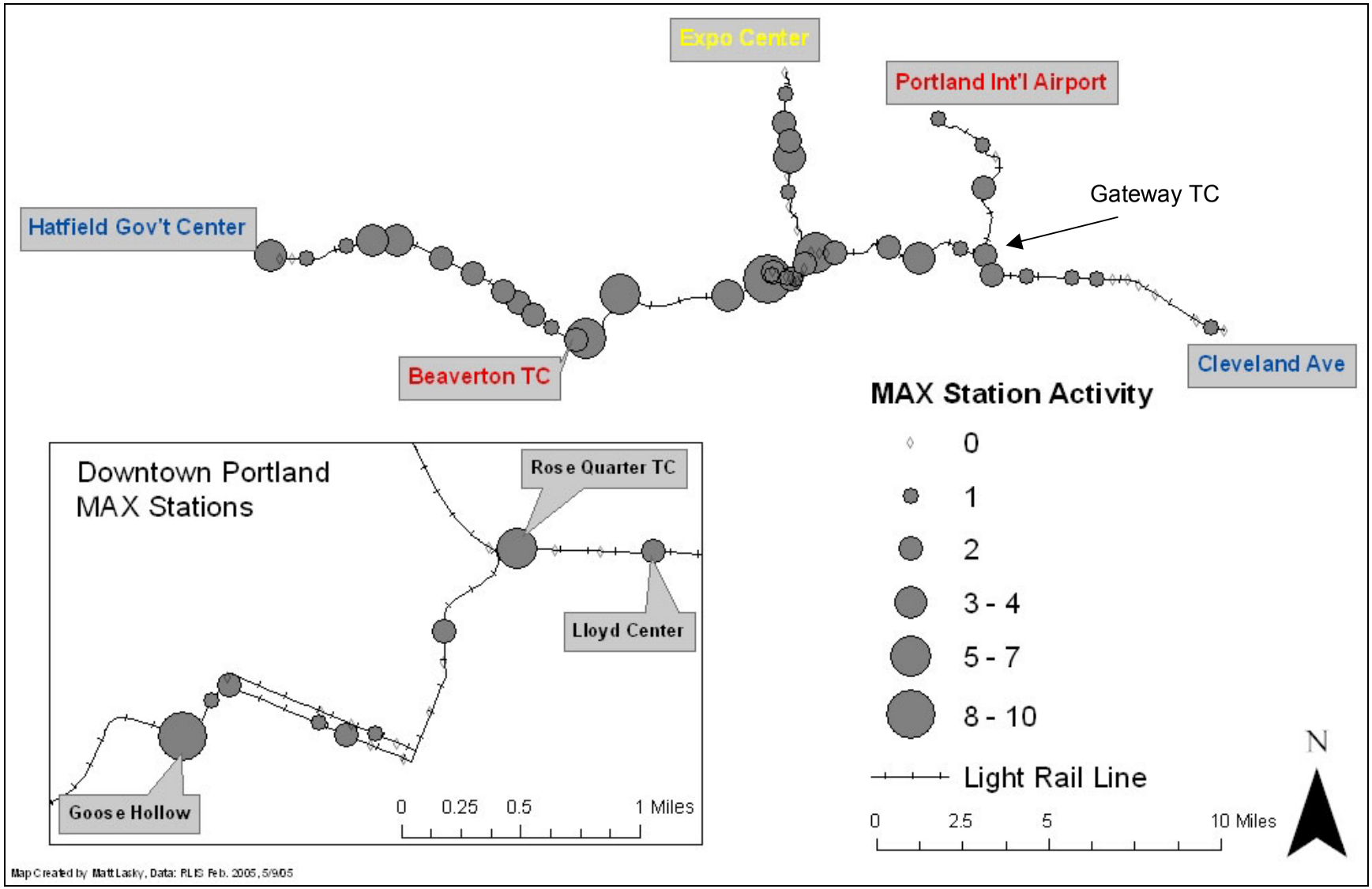
Although the average of all respondents using free bicycle lockers if available is 1.78 days per week, from the significant, positive correlation shown in Table 9, this research also shows that the bicyclists who take their bicycle on MAX more frequently would use free bicycle lockers if they were available. This is because this population also thinks that bicycle lockers are

secure. These findings are also similar to the Netherlands example where the most respondents, 38 percent, would travel by bike if bicycle lockers were cheaper. Although these are different populations, one is already riding to transit (in Portland) and the other would travel more often (the Netherlands) if free or cheaper bicycle lockers were available. Both of these examples demonstrate the importance of an easily accessible resource for bicyclists at transit stations.

Station Activity

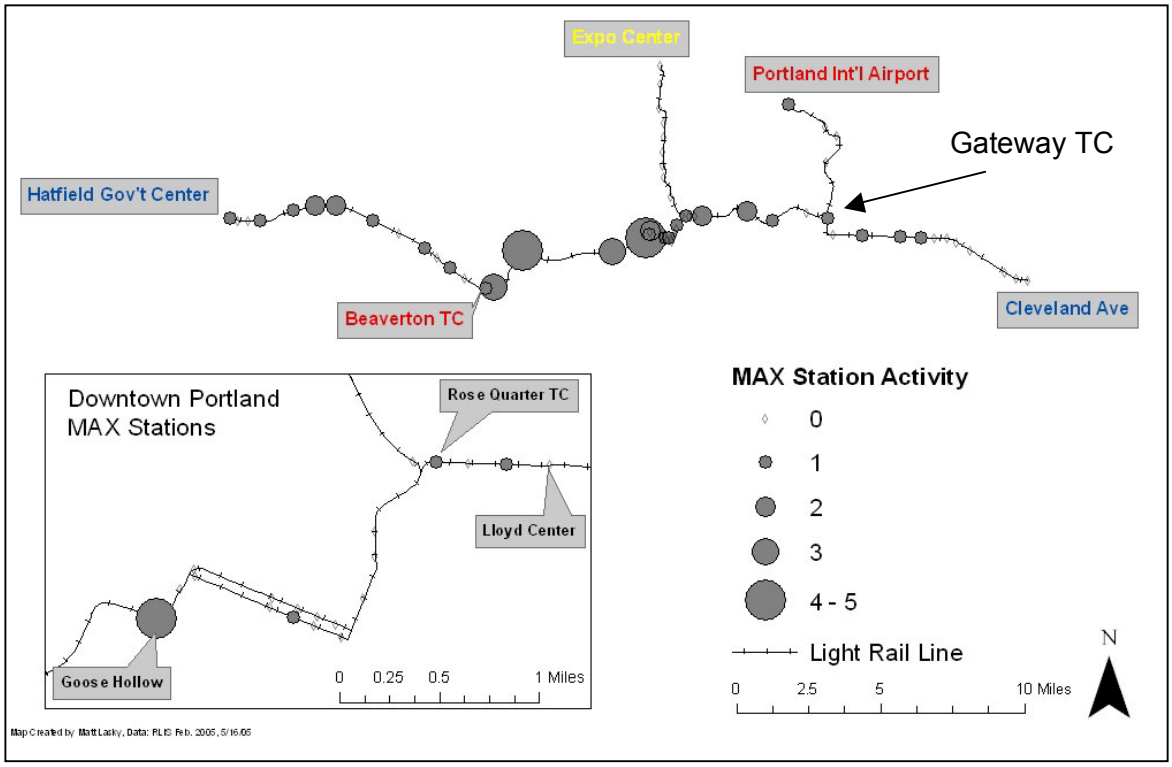
The survey asked respondents to name the station where they first boarded MAX on their trip and the station where they were intending to alight MAX. Station activity refers to the number of boardings and deboardings by survey respondents. These boardings and deboardings were combined into one value due to the small sample size. There are 64 MAX stations and as shown in Figure 5, activity occurred at many stations on all three lines during the survey collection. Figure 5 shows the results from all lines and all directions. On the map, the larger the circles are stations with more activity. The station with the most activity is Goose Hollow Station with ten total boardings and deboardings and then Rose Quarter and Sunset Stations, each with seven. The map also shows that there is activity throughout the MAX system, however there is less activity east of Gateway Transit Center on both the red and blue lines.

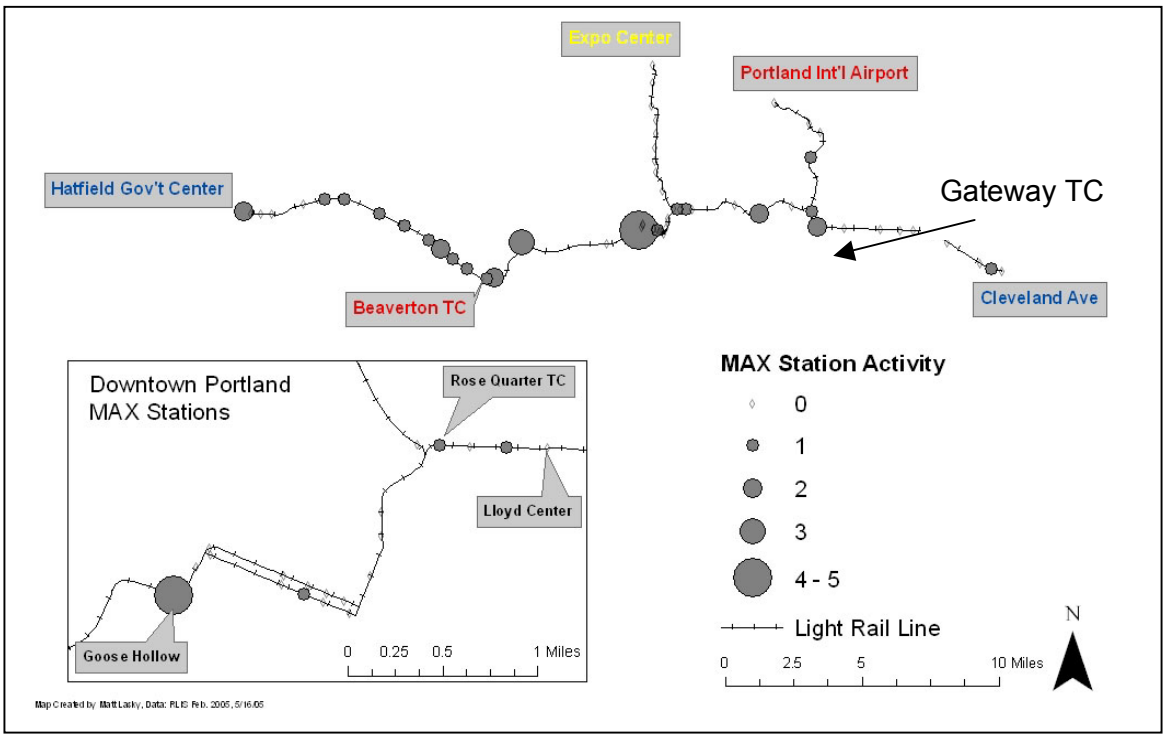
Figure 5 – MAX Station Bicycle Activity



Survey responses came from riders traveling in all directions. There are 24 responses from bicyclists riding MAX westbound, 18 from bicyclists riding eastbound, four from southbound and three from northbound. Eastbound and westbound riders were riding the red and blue and northbound and southbound riders were riding the yellow lines. Perhaps more survey responses came from the west and east directions because there are more stations on the red and blue lines and they are also longer routes. When comparing the westbound and eastbound station activity there is not a large amount of variation. Figure 6 shows the activity for westbound and eastbound MAX lines, so only the red and blue lines. For both directions, Sunset and Goose Hollow Stations have the most activity. Westbound, Goose Hollow and Sunset have five total boardings and alighting and eastbound Goose Hollow has five and Sunset has three total boardings and alightings. Also, as in Figure 6, there is less activity on the east side of the lines, especially past Gateway Transit Center.

Figure 6 – Westbound and Eastbound MAX Station Activity



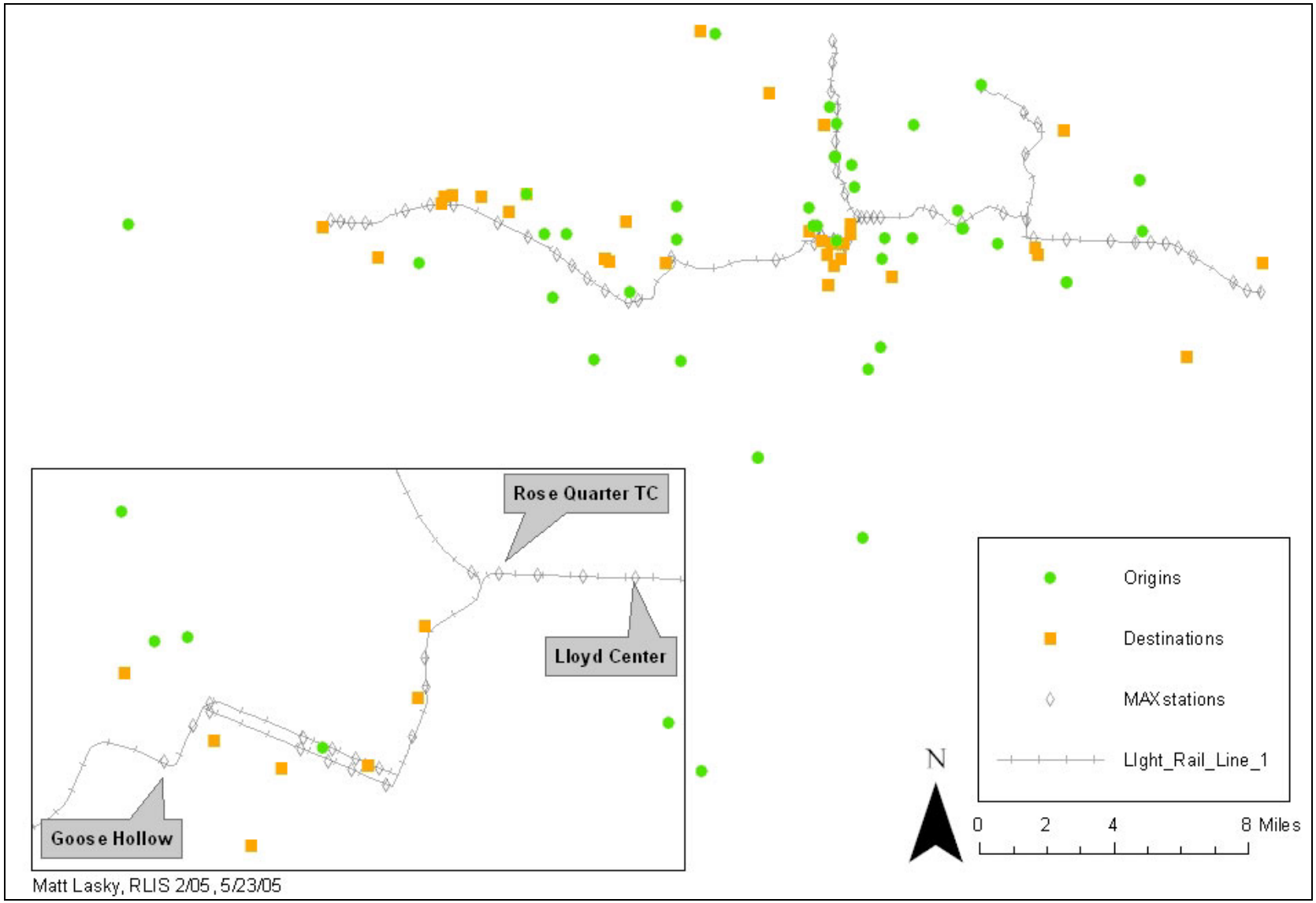


The station activity shows that there are bicycle boardings and alightings throughout most MAX lines. However, there are some holes where there is less use, most noticeably east of Portland, past Gateway Transit Center. The data also shows the most activity occurring just west of Portland's city center at the Goose Hollow and Sunset Stations. This is most likely due to Portland's West Hills in the same area. This research assumes that bicyclists board and alight MAX more frequently here to avoid hills. While this was not a factor deemed important by the majority of survey respondents, it does seem as though it is important for a subset of the sample. These are the most active stations and they are situated directly east and west of the hills.

Origins and Destinations

Respondents were asked their origins and destinations on the survey. Respondents provided exact addresses, cross street locations, or landmarks nearby. These responses were geocoded using ArcMap 8.0 and plotted on a map with the MAX line; this is shown in Figure 7. As shown, bicyclists' origins and destinations are spread out throughout the region with some clustering of destinations in the central city and on the west side of Portland. This is most likely due to a higher concentration of jobs being in these areas

Figure 7 – Origins and Destinations of Bicyclists on MAX



To determine how far bicyclists are traveling on their access trip to MAX stations and on their egress trip from MAX stations to their destinations, ArcView 3.3's Fast Network Path Extension was used for the analyses. First, in ArcView, all origins, destinations, and MAX stations were snapped to streets in a file that excluded Portland highways using the XY Tools Extension. Then, using the Fastest Network Path Extension, the route and destination distances were calculated for all points. The bicyclists that did not bicycle to their boarding MAX station or did not ride their bicycle when they alighted were removed from the data sets. A map of the fastest network path for bicyclists accessing MAX is shown in Figure 8. Many of the origins shown are outside of the central city. In other words, most respondents access MAX in the suburbs. Figure 9 shows the fastest network path for bicyclists' egress trip from MAX to their destination. These distances are shorter than the access trip and are more concentrated in areas. The concentrated areas are in the central city and at several locations on the west side of downtown

Figure 8 – Fastest Network Path for Bicyclists Accessing MAX

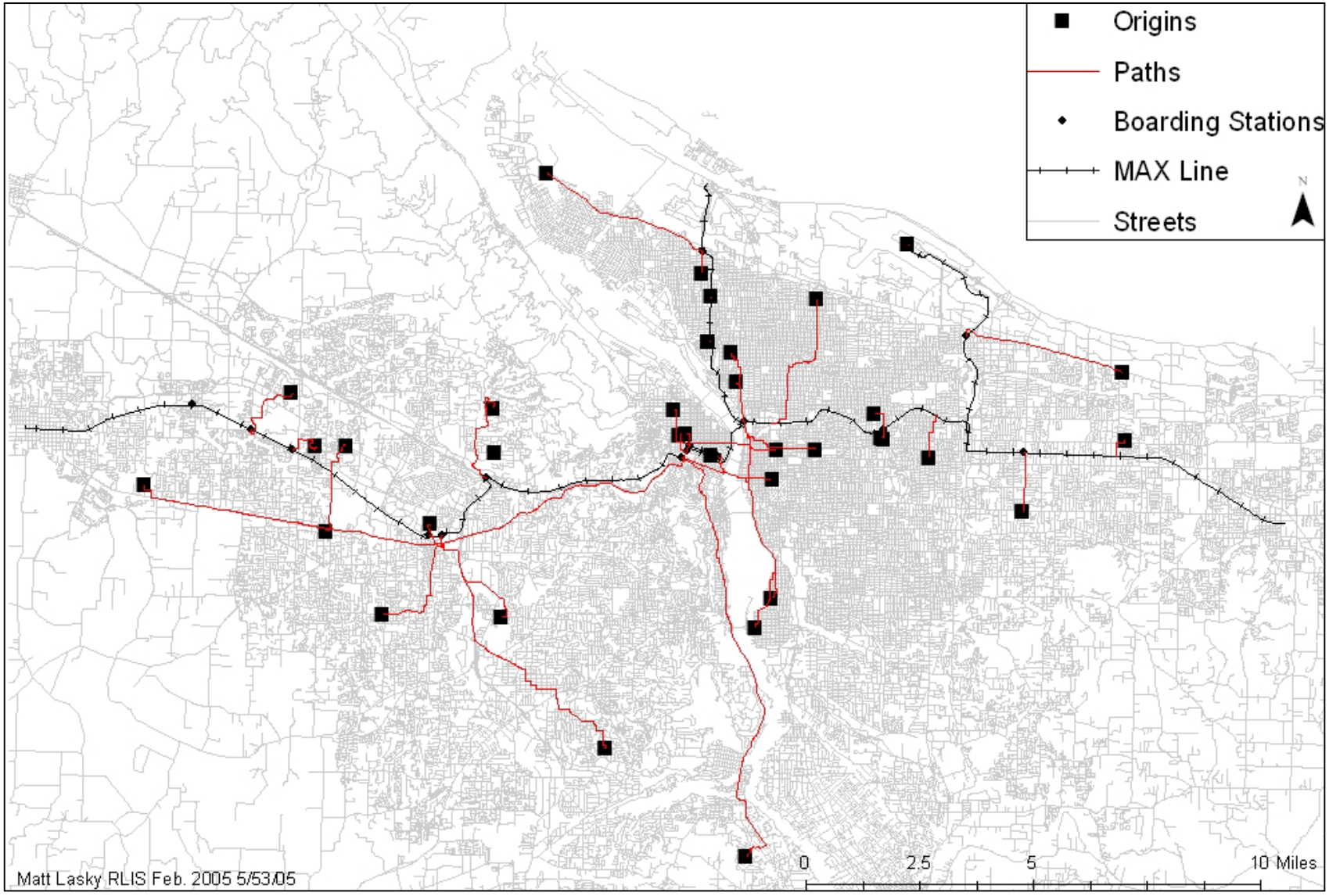
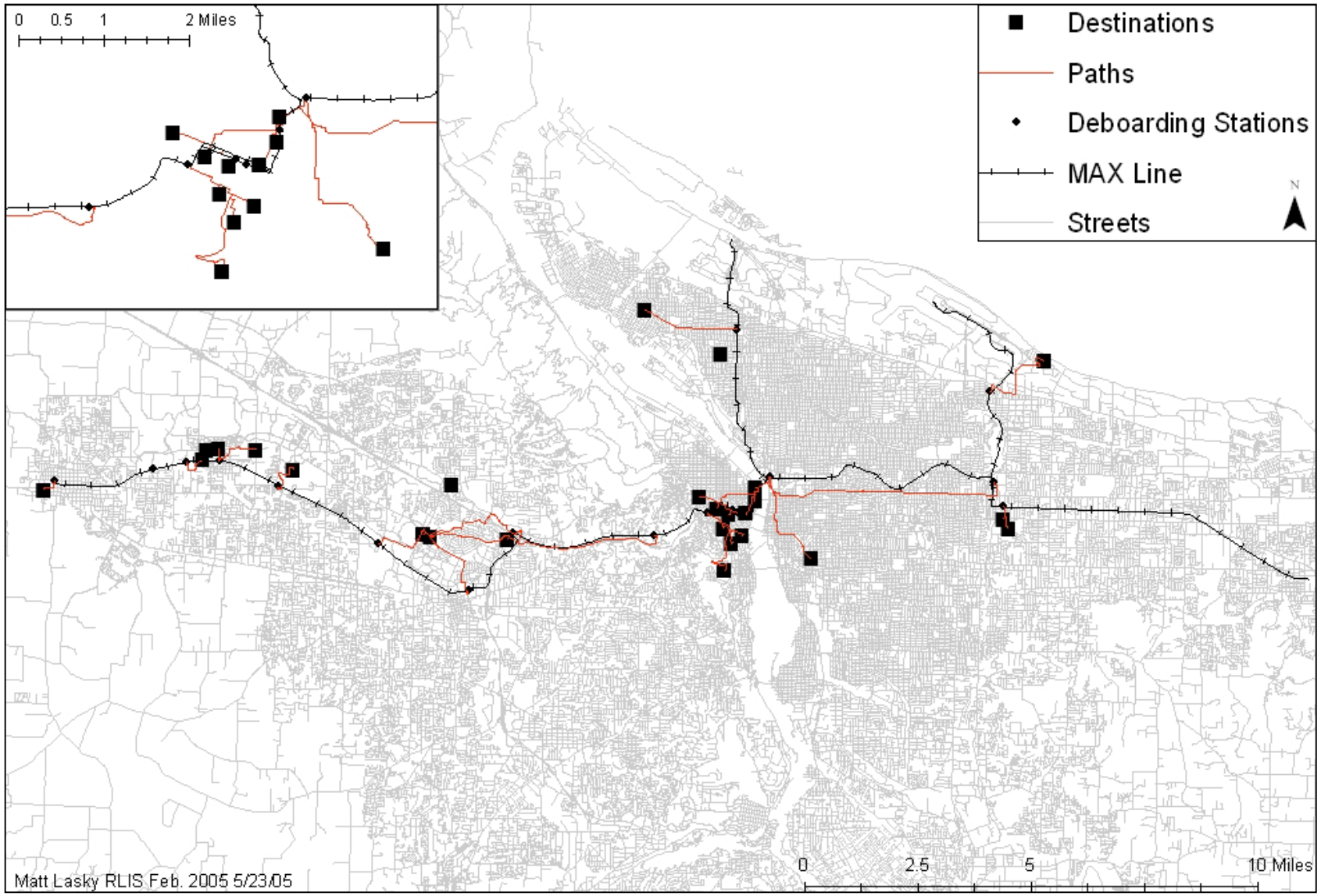


Figure 9 – Fastest Network Path for Bicyclists' Egress from MAX



Based on the information presented in Figures 8 and 9, the access and egress distances are comparable and shown in Table 10. The *n* values, or number of surveys with origin and destination information differ in this analysis from the others because not all survey respondents answered the origin and destination address questions on the survey, or more importantly, some respondents did not ride their bicycle to the boarding station and/or they did not ride their bicycle to reach their final destination. These, as well as the respondents who transferred to another form of transportation after MAX, are excluded from the analysis.

Table 10 – Comparison of Access and Egress Distances in Miles

	Origin to MAX	MAX to Destination		
N	36	29		
Minimum	0.02	0.14		
Maximum	13.15*	5.91		
Median	1.32	1.05		
Mean	2.36	1.58	*Sig.*	.332

*to Goose Hollow

The results in Table 10 show that when bicyclists access MAX they travel farther than on their egress trip to their destination. The median access trip is 1.32 miles compared to 1.05 miles for egress trips and although in an independent *t*-test the means are not significantly different, average access trips are 2.36 miles compared to 1.58 miles for egress trips. The access mean is over one mile longer than the median compared to a difference of half a mile on egress trips. This is because there are two considerably longer access trips. The longest trips are both accessing MAX, these are 13.13 miles and 10.4 miles and they are both accessing Goose Hollow station.

This research shows that bicyclists using MAX during the weekday morning commute times travel farther on their access trips than on their egress trips. Most of these bicyclists are accessing MAX from their homes and traveling to their places of employment when they egress. In most cases housing development is more spread out compared to employment that is more concentrated. These areas include the central city, where several survey respondents were traveling on their trips. Other destination areas include business parks, such as Nike, Inc. in Beaverton. Martins (2004) found that bicyclists in Netherlands, Germany, and the U.K. are more likely to ride a bicycle on their access trip to light rail then on their egress trip to their

destination. This research also implies that the bicyclists are traveling farther on access versus egress trips.

Discussion

The major findings from the results are:

- Bicyclists on MAX are predominately men
- Bicyclists on MAX are predominately more experienced bicyclists
- More experienced bicyclists deem bicycle lockers as secure
- More experienced bicyclists would use free bicycle lockers if they were more readily available
- There is less eastside MAX station activity
- Bicyclists travel farther for access trips than for egress trips

The link between bicycles and transit is important because it has many potential benefits for jurisdictions, transit agencies, and bicyclists. As explained in the Literature Review, there has been little study of this in the U.S. This is most likely due to the small number of bicyclists making this connection in the U.S. in comparison to bicyclists in European countries. This is a direct result of the number of bicyclists and the number of cities with rail transit in both places. In the U.S., the population using a bicycle as a primary mode of transportation is considerably smaller than in Europe. Also, in the U.S., it seems as though jurisdictions are concerned more about increasing the number of individuals taking transit *or* riding bicycles and less interested in increasing the population of people that use both forms of transportation as a multimodal link. However, this research shows that with specific policies aimed towards specific populations and some additional amenities near stations, more people would make the bicycle-transit connection. These policies hold the potential to increase transit ridership with existing as well as new bicycle commuters. These policies also hold potential to increase the appeal of the bicycle-transit connection to new bicycle commuters and increase the bicycle mode share in a region.

Since the sample in this research shows an overwhelmingly large population of male bicyclists, the bicycle-transit link needs marketing towards women. However, before this can occur, there is a need for understanding women's bicycling behavior in contrast to men, for example, why do they not bicycle as often as men? In order to make marketing the bicycle-transit connection to women successful, it is important to understand their bicycling beliefs and how to improve their bicycling needs. An early hypothesis is that women are less motivated to

take their bicycle on MAX because of the bicycle hooks. While on MAX, bicyclists place bicycles vertically on hooks; this requires bicyclists to lift bicycles. This can be awkward and could detract from the connection's benefits for some bicyclists, including women.

This study also suggests that expert bicycle riders tend to take their bicycles on MAX more than less experienced bicycle riders. This is implied from the average number of days the sample boards MAX with their bicycles and the average number of days they ride their bicycles not including access and egress from MAX. Therefore, public agencies need to market the connection to novice and recreational bicycle riders, informing them of the possibility and the ease of use. Perhaps this could start with the help of local bicycle retail stores and advocacy groups including a commuting information packet with new bicycle purchases.

The last population not found as often in the sample is east side bicyclists. As shown in the station activity analysis, there is a lack of bicyclists on MAX east of Gateway Transit Center on the red and blue Lines. Once again, marketing the bicycle-MAX connection to populations in these areas could benefit MAX ridership as well as the bicycling mode share in Portland and Gresham. In terms of access to MAX, many of these locations of stations are at street level. This makes it easy for bicyclists to ride directly to trains stopped at these stations. TriMet and the City agencies could go to neighborhoods in these areas and talk with residents about the ease of multimodal links and the benefits.

Based on the results from the surveys, there is also a need to further evaluate bicycle locker availability and need. There are bicycle lockers at or near 54 of the 64 MAX stations and are currently operated and maintained by three different parties: the BTA, the City of Portland, and TriMet. The BTA is responsible for lockers outside of Portland's central city at MAX stations, the City of Portland is responsible for bicycle lockers that are spread throughout downtown Portland, and TriMet is responsible for bicycle lockers on the yellow MAX line. TriMet's lockers are self-service, first come first serve; this means these lockers do not include a lock and that bicyclists must use their own. The other bicycle lockers have a key-lock on them. At the time of the study, the availability of these lockers was unclear. This is because the BTA requires a $50 deposit for the locker keys and bicyclists have a tendency not to return keys when they are done with the lockers (Bicycle Transportation Alliance, 2005). As a result, it is unknown whether lockers are available for other bicyclists. This is unfortunate because at some stations there is even a waiting list for bicycle lockers. There is a priority need for evaluating the lockers'

availability in the Portland region to decrease the sizes of waiting lists and for learning the availability of existing lockers.

The results of the survey demonstrate that the bicyclists more likely to use bicycle lockers are more experienced bicyclists. Therefore, once an inventory occurs, there is a benefit in marketing these towards novice bicyclists. Bicycle lockers serve as incentives for bicyclists because they are a secure place to park. As shown in the results, experts understand this, however, there is also a need to inform bicycle novices of the lockers' security. This incentive could help increase the bicycle population making the multimodal link.

Conclusion

This report has explored the population using bicycles on LRT in Portland, Oregon. This was to demonstrate the importance of a multimodal transportation link that is often ignored in the U.S. The PBMP calls for improving this link and understanding this ridership in Portland. Unfortunately up until now, neither Portland nor TriMet has established any standards or benchmarks for serving this population. Hopefully this research will serve as a first step in understanding this population in Portland and lead to further research for improving their needs. More importantly, for TriMet and the Portland region's benefit, understanding this population and improving facilities will potentially increase MAX ridership and the number of commuting bicyclists.

Sources

Bicycle Transportation Alliance. Various Interviews, Portland, Oregon, 2005

Bracher, T., 2000. *Demand Characteristics & Co-operation Strategies for the Bicycle & Railway Transport*. World Transport Policy and Practice, 6 (4), 18-24.

Brunsing, Jurgen, 1997. *Public Transport and cycling: Experience of Modal Integration in Germany,* 357-370. In Tolley, Rodney, The Greening of Urban Transport:
planning for walking and cycling in Western cities. John Wiley and Sons, Chichester.

Bicycling Magazine. *The Cycling Cities: Meet 10 urban places that do cycling right-population, sprawl and congestion be damned!* Rodale Press. November 2001.

Doolittle J., Porter, E.K. *TCRP Synthesis 4, Integration of Bicycles and Transit*. Transit Cooperative Research Program, Transportation Research Board 1994.

Gorter, C., Nijkamp, P., and Vork, R., 2000. *Analysis of Travellers' Satisfaction on Transport Chains*. Transportation Planning and Technology. 23, 237-258.

Martens, K., 2004. *The bicycle as a feedering mode: experiences from three European countries*. Transportation Research Part D 9. 281-294.

Replogle, M., Purcells, H. *Linking Bicycle/Pedestrian Facilities with Transit*. National Bicycle and Walking Study, Case Study No. 9, FHWA 1992.

Taylor, D., Mahmassani, H., 1996. *Analysis of stated preferences for intermodal bicycle-transit interfaces*. Transportation Research Record 1556, Transportation Research Board, Washington, DC, 87–95.

TriMet. Facts about TriMet. September 2004.

TriMet. TriMet Ridership Statistics & Demographics, 2005. Viewed on 5/30/05 at http://www.trimet.org/inside/ridership.htm

US Census Bureau. Data Sets: Census 2000 Summary File 3 – Sample Data.

Wood, C. *Integrating Cycling and Public Transport*. TransPlan Occasional Paper No. 1, September, 19.

Appendix A – Spanish Bicyclists' Survey TRIMET

Por favor complete esta encuesta sobre el viaje que está realizando.

1. ¿En qué dirección, esquina o punto de referencia comenzó este viaje?
   N • S • E • O • NE • SE • NO • SO • (marque uno)
   Dirección:_____
   Esquina más cercana: _____
   Ciudad: _____ Código postal: _____

2. ¿Cuál es la dirección, esquina o punto de referencia final de su viaje?
   N • S • E • O • NE • SE • NO • SO • (marque uno)
   Dirección: _____
   Esquina más cercana: _____
   Ciudad: _____ Código postal: _____

3. ¿En qué estación abordó MAX por primera vez?
   _____

4. ¿Fue en bicicleta hasta la estación donde abordó MAX?
   a. Sí b. No

5. ¿En qué estación se baja de MAX?
   _____

6. ¿Irá en bicicleta hasta su destino luego de bajarse de MAX en este viaje? a. Sí b. No

7. Indique si traerá su bicicleta en otro vehículo en este viaje (marque todas las opciones que correspondan):
   a. Otro tren MAX TriMet <<Portland Street Car>>
   b. Autobús TriMet
   c. Tranvía de Portland
   d. Automóvil particular
   e. Ninguno

8. ¿Adónde va en este viaje? (marque uno)
   a. Casa d. Entretenimiento
   b. Trabajo e. De Compras
   c. Escuela f. Otro
   _____

9. ¿La estación MAX donde abordó tiene caja segura o otro estacionamiento para bicis de viajeros en MAX?
   a. Sí b. No c. No lo sé

10. ¿Tuvo un automóvil disponible para hacer este viaje?
    a. Sí b. No

11. Indique en forma general la importancia de los siguientes factores en su decisión de llevar su bicicleta en MAX. Use la siguiente escala, en la que 1 = no importante y 4 = muy importante.

	Muy importante			No importante
Para evitar el mal tiempo	1	2	3	4
Para evitar el tráfico	1	2	3	4
Para ahorrar tiempo	1	2	3	4
Para no subir colinas	1	2	3	4
Para evitar dejar mi bicicleta en esta estación de MAX	1	2	3	4
Para evitar las rutas sin sendas para bicicleta	1	2	3	4

12. Evalúe qué tan segura cree que estará su bicicleta; 1 = no muy segura y 4 = muy segura.

	No muy segura			Muy segura
Caja segura para bicicletas	1	2	3	4
Estacionamiento de bicis Atada a un poste cercano o a otro objeto	1	2	3	4

13. Si hubiera cajas seguras para bicicletas gratis en todas las estaciones MAX, ¿con qué frecuencia las usaría en una semana promedio?
    ____días a la semana

14. En una semana promedio, ¿cuántos días lleva su bicicleta en MAX?
    ____días a la semana

15. Además de sus viajes de ida y vuelta a MAX en bicicleta, ¿con qué frecuencia va en bicicleta con otros fines en una semana promedio?
    ____días a la semana

16. En las dos últimas semanas (marque todas las opciones que correspondan)
    a. Perdió el MAX porque todos los espacios para bicicletas estaban ocupados
    b. Abordó MAX con su bicicleta y no encontró espacios
    c. No tuvo problemas para encontrar espacios

17. ¿A qué sexo pertenece? a. Masculino b. Femenino

18. ¿Qué edad tiene? _____ años

19. En la actualidad es (marque todas las opciones que correspondan):
    a. Empleado d. Desempleado
    b. Estudiante e. Amo/a de casa
    c. Jubilado f. Otros _____

20. ¿Tiene otros comentarios acerca de viajar combinando la bicicleta y MAX? _____

GRACIAS *3/05*

TRIMET

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 596 PORTLAND OR
POSTAGE WILL BE PAID BY THE ADDRESSEE

MARKET RESEARCH–MI2
TRIMET
4012 SE 17TH AVENUE
PORTLAND OR 97202-9911

Appendix B – Survey Results

Questions 1 & 2 - Comparison of Access and Egress Distances

	Origin to MAX	MAX to Destination
N	36	29
Min	0.02	0.14
Max	13.15*	5.91
Median	1.32	1.05
Mean	2.36	1.58

*to Goose Hollow

Question 3 – Boarding Station

Station	Boardings
Beaverton Central	2
Beaverton Creek	2
Beaverton TC	2
E. 122nd	1
E. 148th	1
E. 162nd	1
Elmonica	2
Goose Hollow/SW Jefferson St	4
Hatfield Government	2
Hollywood/NE 42nd Ave TC	2
Kenton/N Denver Ave & Interstate	2
Kings Hill	1
Lloyd Center/NE 11th Ave	1
Mall/SW 5th Ave	1
N. Prescott	1
NE 60th Ave	3
NE 82nd Ave	1
Orenco	1
Parkrose/Sumner TC	1
PGE Park	2
Portland Blvd	2
Portland Int'l Airport	1
Quatama/NW 205th Ave	1
Rose Quarter TC	4
Sunset TC	3
Willow Creek/SW 185th Ave TC	2
Grand Total	46

Question 4 – Ride to Boarding Station

Yes	44
No	2
Total	46

Question 5 – Alighting Station

Station	Deboardings
102nd	1
Beaverton TC	3
Delta Park	1
E. 102nd	1
Fair Complex	1
Gateway	2
Goose Hollow/SW Jefferson St	6
Gresham Central	1
Hatfield Government	1
Hawthorne Farm	3
Library	1
Lloyd Center/NE 11th Ave	1
Lombard	2
Merlo	2
Milikan Way	1
Mt. Hood	1
N. Portland Blvd	1
Old Town	2
Orenco	2
Parkrose/Sumner TC	1
PSQ South	2
Quatama/NW 205th Ave	1
Rose Quarter TC	2
Sunset TC	4
Washington/SE 12th	1
Zoo	3
Total	47

Question 6 – Ride to Destination

Yes	43

No	3
Total	46

Question 7 – Bring your Bike on another Vehicle

Another MAX train	3
TriMet bus	5
Private Automobile	1
None	33
Total	42

Question 8 – Destination

Home	3
Work	40
School	2
Recreation	1
Other	1
Total	47

Question 9 – Boarding Station bike lockers or racks

Yes	21
No	7
Don't Know	19
Total	47

Question 10 – Automobile Availability

Yes	24
No	23
Total	47

Question 11 – Importance of Six Factors to take bike on MAX

Factor	Mean	Median	Mode
To Avoid Bad Weather	2.13	2	1
To Avoid Busy Traffic	2.85	4	4
To Save Time	2.67	3	4
To Avoid Hills	2.16	2	1
To Avoid Parking bike at MAX Station	1.70	1	1
To Avoid Roads without Bike Lanes	2.42	1	1

Question 12 – Security of Three Bicycle Parking options

Location	Mean	Median	Mode
Bike Locker	2.91	3	3
Bike Rack	1.70	1	1
Signpost	1.50	1	1

Question 13 – If free bike lockers were available, how often would you use them?

Statistic	Days Per Week
Mean	1.8
Median	0.0
Min	0.0
Max	7.0
St. Dev.	2.4

Question 14 – How many days do you bring your bike on MAX?

Statistic	Days Per Week
Mean	4.5

Median	5.0
Min	0.0
Max	7.0
St. Dev.	1.7

Question 15 – Ride bike for other purposes other than to/from MAX

Statistic	Days Per Week
Mean	4.6
Median	5.0
Min	0.0
Max	15.0
St. Dev.	3.1

Question 17 – Gender of respondent

Male	36
Female	13
Total	49

Question 18 – Age

Statistic	Age
Mean	34.8
Median	33.0
Min	19.0
Max	58.0
St. Dev.	9.9

Question 19 – Occupation

Employed	44
Student	2
Retired	0
Unemployed	2
Homemaker	0
Total	48