# The Tacoma Link Light Rail

## A Case Study of the Effectiveness of Rapid Tranist

Emma Abraham

March 2014

Senior thesis submitted in partial fulfillment
of the requirements for a
Bachelor of Arts (or Science) degree in Economics
at the University of Puget Sound

INTRODUCTION

The latter half of the 20th century has seen a significant trend away from city residency towards suburbanization. In 1950, approximately 65% of the urbanized population lived in central cities. By 1990, 65% were living in the suburbs (Nechyba, 2004). Population growth and rising incomes have played a key role in this trend, however declining transportation costs have also been a significant factor, making it easier for people to travel between suburban areas and cities.

In 1960, 64% of workers commuted by private vehicle. By 1970, this number jumped to 74% and, by 1980, 84% of commuters drove private vehicles to work (Nechyba, 2004). This trend has resulted in unfavorable externalities due to the high density of cars on the road such as traffic congestion and increased carbon dioxide and greenhouse gas emissions. Social costs due to the sprawl and segregation of certain demographics is also an issue, all of which might be mitigated by the implementation of public transportation. While public transportation aims to relieve many of these negative externalities, they often do not provide the intended relief or create negative externalities in and of themselves.

A significant example of the inefficiency of certain public transportation systems is the light rail which is currently touted as the fastest growing mode of public transportation. Even though the average number of trips taken per light rail has actually decreased in the past two decades – from 7.3 in 1995 to 5.2 in 2005 – new light rail systems are being implemented rapidly in cities across the United States (Nechyba, 2004). Tacoma's light rail project, the Tacoma Link, has been in operations since 2003 and is planned to expand in the upcoming years. While the city of Tacoma has clear goals and objectives in mind for its current operation and

expansion, it can be argued that the Link not only fails to meet these goals in its current state but will continue to neglect to meet these goals after the proposed expansion project.

## TACOMA LINK LIGHT RAIL: BACKGROUND AND PLANS FOR EXPANSION

The Tacoma Link light rail was part of Sound Transit's 1996 *Sound Move*, a ten year plan for the Sound region's transit system. The current Link, which began operation in 2003, is an $80.4 million, 1.6 mile long light rail system with six stations between the Theater District and the Tacoma Dome Station. These stations include the Theater District, South 11th and Commerce, the Convention Center, Union Station, the University of Washington Tacoma, and the Tacoma Dome[1]. The Tacoma Link has been free to all riders since the beginning of its operation in 2003. However, the fare will increase to $1.00 in September 2014 and $1.50 in September 2016.

Sound Transit's long range plan for the Tacoma Link was completed in 2005. The plan was a strategy to extend the link to other areas of Tacoma and in 2008 the Sound Transit Board adopted "Sound Transit 2": a resolution that included multiple extensions of the light rail with various possible corridors (TLEAAR, 2013).

According to the report, Sound Transit considered a multitude of possibilities for their expansion project. One such possibility was to connect the Tacoma Link with the Central Link which runs between SeaTac Airport and downtown Seattle. However, their studies concluded that ridership between Tacoma and SeaTac would not be sufficient to justify the project. In

[1] A map of the current Tacoma Link light rail route can be found at the end of this document.

addition, major revisions would have to be made to the current Tacoma Link in order to accommodate the multiple car operations that would be required for such a project.

They also discussed extending the Link west within Tacoma limits. Potential corridors included two 5.7 mile routes to Tacoma Community College, either by way of 6th Avenue to Pearl Street or by Sprague. Another possibility was a route to the college that would wind through the Proctor District by taking I Street from Division to Proctor. None of these options were advanced as they either did not provide service to an underserved population, reach a significant amount of mixed use centers, had little economic development potential, or faced construction challenges too burdensome to overcome.

They also considered expanding the Link eastward. The Puyallup Tribe of Indians voted to appropriate $41,000 to study expanding the Link from the Tacoma Dome to the Tribe's Casino complex which was currently under construction at the time of their Extension Feasibility Study (2004). Part of their conclusions showed concern over impeding heavy truck traffic on Portland Avenue and the expansion project eventually fell through. The City of Tacoma proposed to instead put streetcars on Portland Avenue, but that project never came into fruition either due to possible environmental and congestion impacts. Sound Transit issues with this possible corridor was the lack of information on potential ridership, the large cost that would be incurred ($38 to 71.5 million), and the need for larger stations and reconstructions than the tribe identified in their study.

Another plan that did not involve the Tacoma Link was the possibility of streetcars serving the Martin Luther King Jr. Way neighborhood area. The conceptual design was to involve a loop system that would travel clockwise on MLK Way to 6th Street, J Street, and South 20th. The city did not move forward with these plans for unspecified reasons.

.

## THE PROPOSED CORRIDOR

In 2003, the city proposed its preferred corridor for the Link expansion: a 1.6 mile line that would expand the link north up Stadium Way to Division Avenue, west to MLK, and south to South 19th Street[2]. This project is suspected to cost $150 million dollars in local revenue contributions, federal funding, and partner funding.

The city stated possible benefits as having a great potential to attract riders due to the Link's existing ridership, giving faster service to Downtown and the Tacoma Dome, serving areas with high ethnic and economic diversity, and having a high viability for funding from local sources. The stated disadvantages include building through an area with a low amount of developable land, a high number of noise sensitive areas, and having the potential to affect historic or park resources. Outlined below from the Tacoma Link Expansion Alternatives Analysis Report are the specific goals and needs that Sound Transit hopes will be met by the expansion project.

- The need to meet the rapidly growing connectivity needs of the corridor and the region's future residents and workers.
- The need to link downtown with other growth centers in the City and encourage economic development within those areas.
- The need to serve increasing commute trips to the downtown core via transit.

[2] A map of the proposed corridor can be found at the end of this document.

- The need to support the planning goals of the South Downtown Subarea Plan, the MLK Subarea Plan and the other Growth and Employment centers.
- The need to reduce greenhouse gas emissions within the City of Tacoma.
- The need to support economic development in Downtown Tacoma.
- The need to serve underserved communities and neighborhoods within the city of Tacoma.

Based on the current literature regarding light rail, urban sprawl, and public transportation in general, it is arguable that these goals will not be met by the expansion project, just as they are failed to be met by the current Link.

## THE NEED TO REDUCE GREENHOUSE GASES

In order for light rail systems to be safe, they are often heavy and require steel whose production uses a vast amount of energy and emit large amounts of carbon dioxide. The only way for any type of rail system to be truly efficient is to have a sufficient passenger load to offset these costs. However, rail transit is so costly that increased fares have actually reduced ridership. A comparison of the cost of rail transit systems with the benefits provided by those systems found that every rail transit system in the U.S. actually reduces social welfare with the exception of BART in San Francisco (O'Toole, 2008).

In the studies conducted so far, the amount of energy consumed and carbon dioxide emitted by construction alone is never repaid by the service the rail provides. The environmental impact statement for Portland's North Interstate light rail estimated that it would save roughly 23

billion BTUs per years. However, it would cost 3.9 trillion BTUs during its construction. At such a rate, it would take 172 years for the savings from the operation of the light rail to repay the cost of its construction. Likewise, the North Link light rail line in Seattle is estimated to use 17.4 trillion BTUs but only save 200 billion by 2030. Even if we assume that savings are constant throughout the lifespan of a rail line, it will most likely need remodeling or rebuilding long before it repays its original energy consumption debt. Thus, it would create a larger debt to repay and so on.

The Tacoma Link averages 20,000 boardings per week; roughly one million per year. A 2013 survey aimed to conclude how current Link riders would respond in the case of increased fares from zero dollars per ride to one dollar, one dollar and fifty cents, or two dollars per ride. Of those polled, 44% said they would reduce the frequency in which they rode the Link if the fare rose to $1 while 33% said they would discontinue riding the Link altogether. 28% said they would ride less frequently with a fare increase to $1.50, while 61% said they would discontinue their use of the Link altogether. The inevitable decrease in ridership from a fare increase would necessarily mean less passengers per mile, causing the Link to become less energy efficient than it would be if it continued to provide free service. Therefore, the expansion would have to induce an increase in the amount of ridership lost due to the fare increase. However, the fact that Sound Transit plans to expand service to an economically disadvantaged area of town leads one to believe that this will not be the case, especially due to the fact that they are already in near proximity to the majority of the Link stations.

The projections of the energy efficiency of rail transit does not and cannot take into consideration the growing energy efficiency of automobiles. Because it can take a minimum of 10 years to plan and construct a railway system that might last for 30 to 40 years, that railway

system must be more efficient than the average automobile decades from the date of its conception for any future savings to be incurred.

Automobiles have become more fuel efficient since the conception of the Link in 1996 and again since its commencement in 2003. Automobiles may become even more fuel efficient by the time of the expansion project's completion. Ceteris paribas, this will cause light rail to become increasingly less fuel efficient compared to automobiles. Taking into consideration the impending fare increase and, consequently, a possible deduction in ridership, the problem is twofold.

Another reality for Tacoma is that the majority of those boarding the Link drive private vehicles downtown in order to access the Link. According to the Origins and Destination Study (2013), 50% of those who started their trips to the Downtown area from home drove in order to board the Link. Current Downtown parking options include paid meters and paid lots. However, the Tacoma Dome situated at the southern end of the Link's current route offers free parking. The results of which are that 87% of those who drive alone in order to board the link drive to the Tacoma Dome and board the Link into Downtown. The Link does not reduce congestion by a large margin because many are driving their cars to a close proximity of their final destination regardless. The Texas Transportation Institute estimated that more than 2.9 billion gallons of fuel are wasted on congested traffic each year (O'Toole, 2008). Taking measures to reduce congestion will do far more than increasing rail transit, especially since a significant number of Tacoma's Link users drive private vehicles in order to access the Link.

Not only does the Link fail to reduce congestion in that regard, but it also creates congestion Downtown due to poor synchronization with traffic signals. Expanding to Division Avenue would be successful at ameliorating traffic flow on yet another busy street in Tacoma—

one which transports a large amount of drivers from the I-5 to the north end of Tacoma and beyond. Currently, Tacoma does not have the infrastructure to coordinate its traffic signals, but it might be best served in order to appropriate the money it would use to expand the Link to do so. A study of 75 U.S. urban cities found that an increase in commuting costs from congestion to be about $520 per person per year. Roughly 85% of that cost is time costs while the remaining is the cost of increased fuel consumption due to congestion (Nechyba, 2004). San Jose coordinated 223 traffic signals in their most congestion areas. In doing so, they saved an estimated 471,000 gallons of gasoline each year, translated to a reduction of 9.2 million pounds of carbon dioxide emissions (O'Toole, 2008).

## THE NEED TO MEET CONNECTIVITY NEEDS AND SUPPORT COMMUTE TRIPS

Public transportation is hailed for providing access to areas that people might otherwise not be able to travel. Improved light rail service, however, may lead to reduced bus coverage due to the transferring of funds. Such has been the case in Tacoma. In 2012, the average annual Downtown bus boarding was 2.6 million as opposed to the Link's one million. Although Downtown bus ridership is more than double that of the Link's, Sound Transit has cut many of its bus routes and stops in the past years yet plans to barely expand the Link's routes instead.

Sound Transit's origin and destination study (2013) found that, in 2012, only 19% of total Link riders are dependent on public transportation, 10% of which are commuters. This means that, in order to access the light rail, they walk, bicycle, or take another form of public transportation in order to reach their access point to the Link. It was also found that commuters in general are significantly more affluent than those riding for other reasons—$43,867 compared

to $16,212 respectively. Given these facts and that the current Link is no more than a 1.6 miles route, it stands to reason that it is not a necessary mode of transportation even to those who have no other option but public transportation. And, most of those who are not dependent riders utilize it for the convenience of parking for free at the Tacoma Dome. Bus routes are significantly more extensive than the Link and the proposed Link expansion, being more useful to those who do not have access to private transportation, yet those are the modes that have been cut. The 150 million dollars being appropriated to the Link expansion project might have been better served keeping Sound Transit buses in operation.

Expanding the link by less than one mile north and west of the pre-existing route could have a small effect on ridership, ceteris paribus. Baum-Snow (1998) defines potential "walk and ride" participants to be those living within two kilometers of a transit line and calculates that if a commuter is now two kilometers closer to transit, walking at three miles an hour, with an hourly wage of $15, his time price of public commuting will fall by $625. Baum-Snow predicts that it causes residents of those tracts who were previously out of work to enter the work force given easier access to and from jobs. This does lend a hand as evidence to support Sound Transit's goal of increasing access for commuters Downtown. However, it is worthwhile to consider whether an expansion by less than one mile will have such a substantial effect on ridership. The Link is being expanded into a more economically disadvantaged area which would be served by public transportation, but the imminent fare hike would most likely cause potential riders to choose to walk the short distant instead of paying to ride the Link, as indicated by the survey performed on current Link users.

# THE NEED TO SERVE UNDERSERVED COMMUTIES AND SUPPORT ECONOMIC ACTIVITY

Baum-Snow found statistical evidence that transit is an amenity. He calculated that a 1% decrease in transit distance increased rents by .024% and housing values by .034%. This is quite small, but at the very least it shows that transit does not have a negative impact on real estate. However, the density of crime and retail does influence real estate values and tends to fluctuate with the proximity of public transportation. Transit can increase crime and retail, thus negatively affecting real estate prices indirectly.

Bowes and Ihlanfeldt (2001) found that properties within one quarter mile of rail stations sell for 19% less than those three miles away. However, those within one and three miles were valued higher than those further away. This would lead one to assume that the negative externalities of being in very close proximity to a railway station are not overcome by the benefits incurred by being somewhat close.

They also showed that people are willing to pay higher prices for housing closer to transit in wealthier neighborhoods and that people are willing to pay more to live closer to transit stations that are further from the central business district that it serves. The community to which the expansion project intends to extend the Link is neither affluent nor far from the central business district that is Downtown Tacoma. Therefore, the positive effects on real estate in those areas are not projected to be seen.

The conclusion that moving MLK District and Hillside residents Downtown in order to boost economic activity is unfounded. Bowes' basic model showed that there is no statistically significant evidence that station proximity variables have a positive effect on retail activity and –

considering the economic position of those resident – that stands to reason. Similarly, the MLK District will most likely not see a large increase in economic activity due to the Link expansion either. Retail might boom for a short amount of time until the effects of gaining little patronization shut them down. Bowes' model showed that there is a statistically significant, positive effect on retail due to transit stations as they moved further away from the central business district, but Sound Transit does not have any near future intentions to expand the Link much further from Downtown.

According to the Origins and Destination Study (2013), 81% of Link riders have drivers licenses and access to private vehicles, 37% of riders utilize the Link in order to commute between classes at the University of Washington Tacoma or the School of the Arts, and, ultimately, only 19% of all riders are dependent on public transportation at all. The data shows that the vast amount of the population that the Link serves are not "need based."

## WHY WE CONTINUE TO BUILD RAPID TRANSIT AND WHAT CAN BE DONE INSTEAD

Rail transit is costly and has little impact on commuter behavior, yet systems continue to be built. Costs are great and borne mostly by the federal government and taxpayers, many of whom not themselves utilize the transit themselves. However, because it is so heavily subsidized, there is often little backlash from local communities when they are built.

Much of the reason come down to politics. Urban rail will be touted as able to support underserved areas and reduce greenhouse gases and congestion, even though it does not. Light rails are prestigious and technologically advanced compared to other modes of urban

transportation such as buses, even if buses are more useful and effective to cities and their surrounding areas. Ultimately, light rail is more of an attraction than an amenity.

Greenhouse gas and carbon dioxide emissions can only be effectively reduced through the use of alternate fuel sources and technologies and by increasing ridership (O'Toole, 2008). Ridership can be increased by increasing the frequency of trips or by cutting fares. The Link cannot increase the number of trips it makes unless an additional car was put into operation. Only one city has been able to increase rail transit's share of commuting by more than 1% and it only achieved said increase by cutting fares (O'Toole, 2008). The Link is not cutting fares, but raising them.

Hybrid buses and buses that use biodiesel are more costly than regular buses, but they are significantly more cost effective at reducing greenhouse emissions than light rail. A study conducted in Minneapolis-St. Paul demonstrated the tradeoffs between light rail and hybrid buses that use biodiesel. O'Toole calculated that their purchase of hybrid electric buses was 3.5 times more cost efficient than light rail. At the time of his study, 300 hybrid electric buses could have been purchased by the city of Tacoma for the $150 million that they plan to appropriate for the Link light rail expansion. Not only would these buses be more fuel efficient than the light rail, but they would accommodate more routes and do so without needing to build monetarily and time costly infrastructure. Long term jobs would be created through the hiring of drivers, rather than the relatively short term jobs created to construct the rail. Ultimately, buses would serve the underserved to a greater degree than the Link.

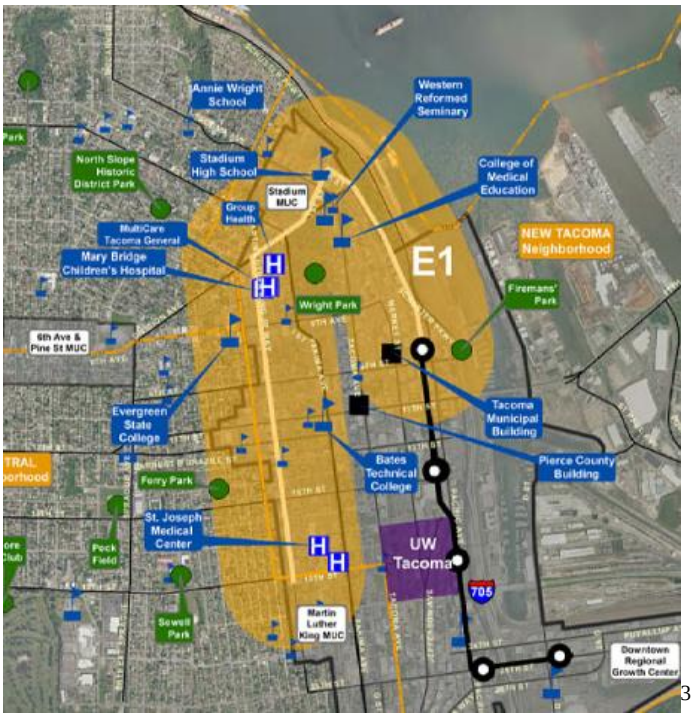
If Tacoma elected to purchase buses instead of expanding the Link, they could further the efficiency of those buses by increasing the frequency of routes where ridership is highest by taking into account which areas and at what time of day it would best serve its riders. The Link

cannot change its routes nor the frequency with which it stops at each station and is thusly not as effective as buses in this way either. As it is, buses already serve all of the areas that the Link currently serves and plans to serve after the expansion.

## CONCLUSION

Tacoma is not efficiently serviced by its current light rail nor will it serve its intended purpose after the proposed expansion. The Link does not relieve congestion or reduce greenhouse gases as it is purported, nor does it serve the underserved in the communities it is intended to reach. It will not expand into areas that might support economic activity Downtown but will, instead, push the Link into an area populated by residents who will not pay the fares to utilize it. It does not significantly relieve congestion, as a majority of riders drive in order to access the Link. It creates congestion on the busiest streets Downtown by impeding traffic due to its confliction with traffic signals and will create more congestion after its expansion. Ultimately, it seems to be a project to increase Tacoma's perceived prestige without doing much to provide the city with significant benefits.

Tacoma would be better served by coordinating its traffic signals along the Link's current route and adopting hybrid electric buses with the funds currently intended to pay for the Link's expansion. Adopting one or both of those measures would reduce congestion and greenhouse gas emissions. Doing so would also serve a wider range of communities, reaching both the underserved and those that could promote economic development Downtown.

[3]

[3] Both images from the Tacoma Link Expansion Alternatives Analysis Report and SEPA Addendum.

SOURCES

Baum-Snow, Nathaniel, and Matthew E. Kahn. "The Effects of New Urban Rail Transit: Evidence from Five Cities." (1998): Accessed , 2013.

Bowes, David R., and Keith R. Ihlanfeldt. "Identifying the Impacts of Rail Transit Stations on Residential Property Values." Journal of Urban Economics 50 (2001): Accessed October, 2013.

Downtown on the Go. "Tacoma at a Glance." Accessed January, 2014

EMC Research. "Sound Transit Tacoma Link Origin and Destination Study Final Report." Sound Transit. Last modified July, 2013.

Nechyba, Thomas J., and Randall P. Walsh. "Urban Sprawl." The Journal of Economic Perspectives 18, no. 4 (2004): 177-200. Accessed October, 2013.

O-Toole, Randal. "Does Rail Transit Save Energy or Reduce Greenhouse Gas Emissions?"Policy Analysis 615 (2008): Accessed October, 2013.

Sound Transit. “2013 Tacoma Link Fare Proposal Summary of Public Involvement: Attachment B” (2013).

Sound Transit. "Expanding Tacoma Link: Fact Sheet." Last modified July, 2013. http://www.soundtransit.org/Documents/pdf/projects/link/Tacoma/Tacoma%20Link%20Expansion/201307_FACT_TacomaLink.pdf.

Sound Transit. "Quarterly Ridership Report Archive." Last modified 2014. http://www.soundtransit.org/Rider-Community/Rider-news/Quarterly-Ridership-Report/Quarterly-ridership-archive..

Sound Transit. "Tacoma Extension Feasibility Study." Last modified March, 2004. http://www.soundtransit.org/Documents/pdf/projects/link/Tacoma/Tacoma%20Link%20Expansion/Tacoma%20Extension%20Feasibility%20Study.pdf.

Sound Transit. "Tacoma Link Expansion Alternatives Analysis Report and SEPA Addendum." Last modified May, 2013. http://www.soundtransit.org/Documents/pdf/projects/link/Tacoma/Tacoma%20Link%20Expansion/ExpansionAlternativesAnalysisRpt_and_SEPAAddendum/201305_TLE_AAReptandSEPAAddendum_Main.pdf.