

Fair Economics for Fair Integration:
The Need for Greater Access to Public Transportation Across the Peninsula

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Acknowledgements

In carrying out this project, we received the help and guidance of respected persons, who deserve our greatest gratitude. We would first and foremost like to thank our instructor Deland Chan, who has provided this unique opportunity for Stanford students to collaborate with government agencies and NGOs in the Bay Area to support their efforts towards creating sustainable, healthy, and equitable cities. Specifically, we would like to thank Adina Levin from Friends of Caltrain and Charisse Ma Lebron from Working Partnerships for offering guidance throughout this entire process and through numerous consultations. We would also like to expand our deepest gratitude to all those who helped directly or indirectly gather survey responses: Watercourse Way, Philz Coffee (Facebook & Middlefield Location), SJSU Transportation Solutions, Stanford Habla, Stanford Stepping Stones to Success Program, Working Partnerships, SEIU Local 521 and SIREN.

Of course, we would have not been able to analyze data if we did not have survey respondents willing to help our efforts. Thus, an immense gratitude towards all of our anonymous survey respondents who participated. We hope that our findings can help improve the public transportation system in our community.

I. Project Purpose

The objective of our Fair Economics for Fare Integration Project was to determine whether there exists a significant need for an integrated fare system for transit riders across the Peninsula. With some 27 different transit agencies serving the region, few of which have transfer and fare-sharing agreements in place, the Bay Area suffers from severe transit fragmentation. This current state of affairs undermines our region's goals around mobility and sustainable transportation, cleaner air, lower carbon emissions, and equitably providing economic opportunity for all. Potentially, one simple idea could go a long way towards addressing all of these challenges and make the commuting experience more convenient: a regional fare integration. For Silicon Valley in particular, now stands to be a particularly promising time to work on the issue, as MTC looks to update Clipper Card in the next few years; BART's extension to San Jose, now under construction, is likely to dramatically increase transit interchanges; and leading stakeholders in the region are publicly interested in transit improvements, possibly seeking to place a transit funding measure on the 2016 ballot.¹ Our goal as a team was to administer, collect, and analyze data in an attempt to determine the need for a pilot fare integration initiative.

Our main contact for this project was Adina Levin who is the Executive Director of our partnering organization, Friends of Caltrain. Friends of Caltrain is a 501(c)(3) nonprofit representing a grassroots coalition of neighborhood groups, employers, environmental groups, transit advocates, and transit riders advocating for the long-term viability of Caltrain's critical local and regional transit service. With a member base of over 3,500 Peninsula and San Francisco residents, the group advocates for a modern, connected transit network, and transit-supportive policies on the Caltrain corridor to increase social and environmental sustainability in our region. Founded in response to a sudden funding crisis for the vital rail system, the group has successfully organized in the past to stave off drastic cuts to Caltrain service, as well as to improve service and capacity.

Given that one of our target populations was the low to middle income working class, Adina enlisted the help of Charisse Ma Lebron from Working Partnerships. A self-dubbed "action-oriented think tank," Working Partnerships USA is a community-labor organization working to tackle inequality and foster more equitable growth through research, advocacy and organizing, civic engagement and leadership development, all with the aim of empowering workers and their communities -- especially those of color -- to lead and govern. Born and based in the heart of Silicon Valley, Working Partnerships "envisions our social change effort as an innovation laboratory for new policy and organizing ideas which can be exported and scaled... across the country." The group has campaigned successfully in the past for, among other things, access to quality healthcare for children in Santa Clara County; a \$10 an hour minimum wage, with annual cost of living adjustments, in San Jose; increasing funding for affordable housing in

¹ Gaurdino, Carl. "Carl Guardino: Silicon Valley and Region Want Caltrain to Achieve 'Market Share'" *San Jose Mercury News*. N.p., 13 Jan. 2015. Web. 02 Feb. 2015.

Santa Clara County; and registering, educating, and engaging over 14,000 young Vietnamese and Latino voters in the 2012 elections. Charisse in particular offers a wide knowledge of the political atmosphere and working organizations in the Valley.

Overall, this project aimed to provide data-grounded support for an integrated fare system across the Bay Area. An integrated fare system that spans this thriving and extremely diverse region would contribute hugely to achieving our goals for sustainability. Transportation is a hot topic for debate as soaring housing prices and increasing population density have caused gentrification, forcing lower income individuals to move elsewhere, pick up second jobs, and commute longer distances. An integrated fare system will help ease the financial burdens that come with commuting to work and potentially increase profits for the local public transit agencies. This cooperation amongst the region's transit agencies is just an initial step towards creating a better public transportation system for all demographics. An integrated fare may spark an integrated timetable, which may spark integrated communities, which sparks economic vitality for the entire region.

II. Literature Review

To inform our study of assessing the viability of a fare integration scheme for the San Francisco Bay Area, we collected a sample of cities who have embarked on implementation of a city-wide or regional fare integration scheme in the past. We did our best to make sure the cities we chose to incorporate in our review were comparable to the San Francisco Bay Area (regions with large populations spread out over a large land area) as this sociological geography deeply informs transit decisions in the Bay. A matrix comparing the cities we looked at in our case study can be found in Appendix A.

After conducting this review we found that there were four essential pieces to a successful implementation of fare integration:

- *Benefits for low-income users*
- *Cooperation between transit agencies*
- *Fare calculation*
- *Extra incentives*

Benefits for Low-Income Users

In most cities, citizens with lower incomes tend to be the main user base of public transportation. As such, a big push when attempting to integrate fares is to make transit more accessible, approachable, and comfortable for both new and existing users. In nearly all of the

case studies we considered, the majority of users benefitted from cheaper fares.^{2 3} However, as in the case of New York's fare integration pilot, while transit riders spent less at the farebox, this often results in minimal revenue reduction. In New York, this was found to be the result of a multitude of factors, including increased ridership, more transfers, and even a drop in farebox evasion.⁴ Other cities also had beneficial experiences using more targeted methods to help low-income transit riders.

In January of 2008, Haifa, Israel's third largest city, implemented a fare integration scheme which reduced its previous count of distinct "fare zones" from 19 to just 5. With this simplicity, the zone with the lowest socioeconomic status was also given a lower-inner zone fare, meaning that anyone travelling within this impoverished part of the city paid nearly half that which citizens would normally pay in the other four zones. Again this reform saw minimal effects on revenue and resulted in a 7.7% increase in passenger trips and an 18.6% increase in boarding.⁵ Many of the other case study cities reported similar findings when lowering fares, proving that providing benefits aimed at lower-income residents can lower fares and increase ridership while keeping revenues from dropping significantly.

Fare Calculation

A large piece of the puzzle in implementing fare integration is understanding exactly how fares will be recalculated following integration. Each city in our list of case studies moved to completely different methods of calculating fares. For example, in the Emilia-Romagna region of Italy, fare calculation went from being zone-based with extra payments for transfers, to being purely based on the amount of kilometers traveled, regardless of the number or type of modes used during the commute.⁶ This is in almost exact opposition to New York's fare calculations at the implementation of MetroCard: distance became irrelevant, commuters paid a flat fare every time they transferred, regardless of how far they need to go.⁷ Ultimately, what proved to be most important was the ease of understanding how fares were calculated. All of the cities studied aimed to reform their previous transit calculation methods that were seen as too confusing by commuters. It appeared that as long as the new integrated fares were calculated in a manner that was easily understood, they proved to be beneficial.

² Sharaby, Nir, and Yoram Shiftan. "The Impact of Fare Integration on Travel Behavior and Transit Ridership." *Transport Policy* 21 (2012): 63-70.

³ Maike Puhe, Markus Edelman, Max Reichenbach. "'Integrated Urban E-ticketing for Public Transport and Touristic Sites'" *Science and Technology Options Assessment* (2014):. European Parliamentary Research Service, Jan. 2014.

⁴ Schaller, Bruce. "Lessons From MetroCard Fare Initiatives." Fall/Winter 1998

⁵ Sharaby, Nir, and Yoram Shiftan. "The Impact of Fare Integration on Travel Behavior and Transit Ridership." *Transport Policy* 21 (2012): 63-70.

⁶ Maike Puhe, Markus Edelman, Max Reichenbach. "'Integrated Urban E-ticketing for Public Transport and Touristic Sites'" *Science and Technology Options Assessment* (2014):. European Parliamentary Research Service, Jan. 2014.

⁷ Schaller, Bruce. "Lessons From MetroCard Fare Initiatives." Fall/Winter 1998

Cooperation Between Agencies

The most complicated and politically difficult piece of fare integration seemed unilaterally to surround exactly how the multiple transit agencies would cooperate to provide an integrated fare approach. In the majority of the case studies outside of the United States, integration was attained by establishing a private holdings corporation designed to oversee fare collection and its necessary technological infrastructure. For example in the case of Seoul, South Korea, the Korean Smart Card Corporation was established as a joint venture between the Seoul Metropolitan Government (managers of the transit infrastructure), LG Electronics (supplier of the fare collection technology), and local credit card issuers (managers of the card's ePurse qualities). This same type of public-private cooperation was found in Hong Kong and London, with the newly established company acting privately but typically on behalf of the government.

This type of cooperation has proven extremely difficult in the United States as public transit has been almost completely public owned and operated since the second half of the 20th century. Chicago has been aiming to develop integrated fares for its three transit operators (Metra, Pace, and CTA) for some time; however, cooperation efforts have been the main pressure point, stalling the project for many years. Currently, the plan is to have fare collection services be provided by Cubic transportation, a 3rd party corporation operating completely independent of the city's transit operators. The new system, dubbed Ventra, began in July of 2014.⁸

Extra Incentives

Many of these fare integration systems also involved extra incentives to entice transit users and other populations such as tourists and avid shoppers to join the new programs offered. The Mi Nuovo card in the Emilia-Romagna region of Italy can be used not only on public transit but also at Electric Vehicle charging stations and bike sharing to entice people to use more sustainable modes of transportation outside of the typical gasoline-powered automobile.

The "I Amsterdam City Card" was developed specifically for tourism use. The city of Amsterdam had already possessed an integrated fare system when it introduced this tourist-focused card. The card can be bought at various tourist locations and museums across the city and allowed unlimited transit use for a limited period of time and provided access to over 38 tourist destinations across the city. This increased use of public transit as tourists could now simply hop on public transit anywhere in the city without having to speak the local language or understand how fares were calculated.

A growing alternate use for the cards provided by fare integration systems is the ability to use the transit card as an ePurse at local businesses much like a pre-paid debit card. Users can top the card up with cash that can be used in the normal fashion at a transit turnstile or to buy lunch at a local convenience store. This method has proven tremendously successful when area businesses cooperate with the new system. The city known for the best implementation of this system is Hong Kong with its Octopus card. The Octopus card is known as the first contactless,

⁸ "CTA - About Ventra." Transit Chicago.

integrated ticketing system in the world implemented in 1994, and after only ten years of use, the card attained 95% market penetration with nearly twelve million daily transactions.⁹ While understanding the intricacies of this ePurse system is out of the scope of our project, with similar uses for transit cards being employed in London, Seoul, Chicago and other cities across the world, it has proven that this incentive both increases transit ridership and provides an additional source of revenue for future projects.

Relevancy to the Bay Area

Reviewing these case studies has proven to be beneficial in better understanding the necessary work involved in creating an integrated fare system and the possible challenges faced with this work. What proves to be the most difficult aspect for the San Francisco area is cooperation between local transit agencies. With 27 different agencies, each with their own locationally-based constituency, it is extremely difficult to entice these agencies to work together. Since a great majority of them are also public managed by local governments, coordination is essential yet difficult. In a similar study done by Sara Barz and Eleanor Leshner from UC Berkeley, researching the current state of fare collection in the Bay Area, stakeholders and interviewees in their project noted the need for a regional agency to oversee a fare integration endeavor. Once and if this difficult coordination is attained, the next hurdle is often gathering funding to implement the plan.

The funding necessary for such an implementation still remains somewhat of a mystery. Many of the case studies did not report how much was spent to implement these new plans and the ones that did varied greatly, from \$36 million in Italy to nearly \$500 million in Chicago (although this high cost is most likely due to several years of bureaucratic delay).¹⁰ Barz and Leshner also cite the need for new sources of funding to cover these potentially high costs, as the current status quo of transit funding sources would not be enough to support the implementation of a new system.¹¹ However, what is proven is that when implemented correctly, commuters flock towards public transit. After implementation, cities have reported large user bases of 7 million users in London, 10 million in Hong Kong and 18 million in Seoul.¹² As mentioned above, nearly all of the case studies noted substantial increases in ridership helping offset revenue reductions as a result of lower fares. Barz and Leshner also cite the need of new sources of funding to cover these possibly high costs, as the current status quo of transit funding sources would not be enough to support the implementation of a new system.

⁹ Maike Puhe, Markus Edelman, Max Reichenbach. "Integrated Urban E-ticketing for Public Transport and Touristic Sites" Science and Technology Options Assessment (2014):. European Parliamentary Research Service, Jan. 2014.

¹⁰ Ibid.

¹¹ Leshner, Eleanor, and Sara Barz. "Understanding Barriers to Providing Seamless Regional Fare Payment in the San Francisco Bay Area." University California: Berkley College of Environmental Design

¹² Maike Puhe, Markus Edelman, Max Reichenbach. "Integrated Urban E-ticketing for Public Transport and Touristic Sites" Science and Technology Options Assessment (2014):. European Parliamentary Research Service, Jan. 2014.

Reading these case studies has proven to us that while fare integration is a large and difficult project to coordinate and plan, its benefits are often worthwhile to both cities and their citizens in the end. In the Bay Area specifically, stakeholders are in favor of seamless fare payment and agree that operators should do more work to focus on the transit rider. However, there is still a lack of understanding in the effect fare integration will have on revenues, therefore more research still needs to be done to better quantify how an integrated fare system can benefit both transit operators and its riders.¹³

III. Methodology

Given our limited time span and the intricate political nature of public transportation, we decided to forego an attempt to hash out the policy specifics of an integrated fare system and focus on providing tangible data for our partners to present to potential supporters of a pilot program moving forward. In order to get these figures we decided to conduct a survey to see if there was enough interest in the community to warrant a trial initiative. We particularly, though not exclusively, sought to target the lower to middle income working class who may be priced out of using public transportation because of the economic strain of multiple transfers. We wanted to observe if this economic disconnect played a significant role in whether these individuals chose to use public transportation to commute.

We were not able to find any existing data regarding the effects of transfer pricing on public transportation use in the Bay area, so we decided to conduct a survey of our own. We believed surveys provided the most useful data for our project, because they allowed us to gather a lot of information in a short period of time and look at the results with a larger lens. Our three to five minute survey asked questions in regards to people's daily commuting habits and factors that influence their commuting choices (see Appendix B for the full text of the survey itself). We also asked basic demographic questions and geographic questions to mark transportation routes. Our survey was translated into Spanish to capture more of our target population. With survey information we were able to see trends between demographic information and individual habits.

Our survey population consisted of Stanford service workers, union members, others affiliated with labor groups, employees in select Palo Alto retailers, and transit riders. Specifically, we enlisted the expertise and guidance of our partners in identifying where and who to survey. Working Partnerships was able to conduct a tremendous amount of surveys with their partners at SIREN and SEIU Local 521. Both SIREN (Service, Immigrant Rights & Education Network) and SEIU Local 521 (Service Employees International Union) work with populations that this project is trying to serve. Additionally, we surveyed service workers at Stanford who commute in from various locations around the region. Adina was able to secure approval to send our online survey to employees of Watercourse Way, a spa in Palo Alto, and of Philz Coffee's

¹³ Leshner, Eleanor, and Sara Barz. "Understanding Barriers to Providing Seamless Regional Fare Payment in the San Francisco Bay Area." University California: Berkley College of Environmental Design

Menlo Park and Facebook locations. This provided us with more sample populations who can greatly benefit from an integrated fare system. Lastly, we surveyed actual transit riders, largely at the Palo Alto Caltrain station and the bus stops adjacent to San Jose Diridon Station, to garner their perspectives on a unified system of public transportation and identify factors that they take into consideration when choosing to ride public transit.

A full discussion of the specific challenges and limitations of our survey can be found in “Improving the Survey,” at the conclusion of the following section. For now, it suffices to note one overarching constraint. In an ideal world, given much more time, our sample size of 191 surveys collected would not have amounted to the entirety of our data gathering. Rather, these 191 responses would have served merely as a first iteration for the survey, after which our data collection methodology — the questions themselves — could have been thoroughly overhauled and refined, followed by a dramatic expansion in survey dissemination and thus a large increase in sample size. However, we were of course operating within the constraints of a ten-week quarter, of which only about two to three weeks could be dedicated to survey collection and fieldwork, and so we were limited to this first pass at gathering data. We hope that our community partners, perhaps in collaboration with some interested San Jose State University students, are able to continue our efforts moving forward, in order to realize at least some of that iterative process we had envisioned.

IV. Deliverables

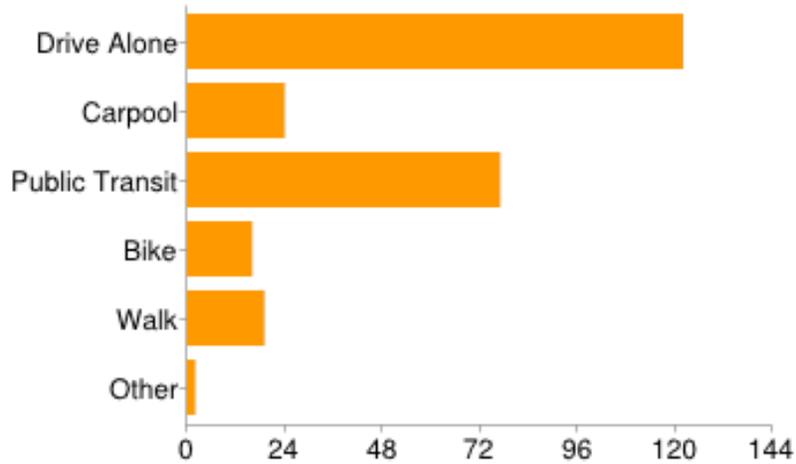
What did we find in the data? It should first be said that, unfortunately, we didn’t find strong evidence when it comes to the question of whether reduced transfer costs would yield a large increase in ridership, largely owing to the weakness of our survey’s design on that point, although it would have been a very difficult question to effectively target and answer in any event. We did, however, uncover several other compelling findings.

To begin, let’s overview the demographics of our survey population. Out of 191 total respondents, 76 (40%) included transit among their response(s) to “How do you get to work/school? Choose more than one, if applicable,” while 115 (60%) did not include transit.¹⁴ We will employ this basic disjuncture throughout our analysis, referring to those who commute by transit (even occasionally — the survey didn’t specify frequency but rather asked for any mode by which they commute) as “transit riders” and those who do not as “non-transit riders.” As we conducted roughly a third of our surveys on site at transit stops, this proportion of transit ridership is of course far higher than a broader, more representative sample of Santa Clara

¹⁴ Somewhat misleadingly, this latter group includes 5 who only bike or walk to commute — active modes of transportation we should promote alongside transit usage. While shifting them into the transit-riding group may have been slightly more accurate, it would not have materially changed hardly any of the numbers detailed throughout here, even as it significantly complicated the analytical process. For simplicity’s sake, then, we left them in this larger group.

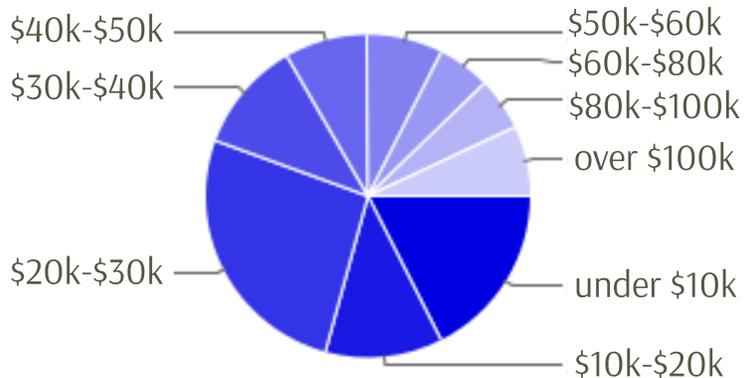
County workers and residents, where by one recent county report’s measure, only 3% of the population commute by transit.¹⁵ Figure 1 below depicts the overall results for this question.

Figure 1. “How do you get to work/school? Choose more than one, if applicable.”



Similarly, having intentionally targeted the working class population that fare integration would likely boost most, our respondents were disproportionately lower and middle income, especially relative to the county median of \$93,500, the highest in the nation.¹⁶ 90% (172 respondents) of survey takers answered the question,¹⁷ “What is your annual income bracket?”, placing themselves into the subdivisions indicated in Figure 2 below. Of those who answered the question, 75% (129) earn less than \$50,000 annually, and 56% (96) make less than \$30,000 a year.

Figure 2. “What is your annual income bracket?”



¹⁵ “Community Health Existing Conditions Report.” May 2013. http://www.sccgov.org/sites/planning/PlansPrograms/GeneralPlan/Health/Documents/SCC_Existing_Health_Conditions_FINAL_May_2013.pdf

¹⁶ Avalos, George. “Santa Clara County has highest median household income in nation, but wealth gap widens.” *San Jose Mercury News*. August 11, 2014. http://www.mercurynews.com/business/ci_26312024/santa-clara-county-has-highest-median-household-income

¹⁷ The 19 respondents who didn’t answer the income question were a fairly representative subsample of all survey takers, for instance riding transit at similar rates (37% vs. 40% overall) and citing cost as an issue at the same rate (47%), although they were disproportionately Latino and had slightly longer commute times than the overall sample.

Our first major finding was that out of all possible factors, time matters most to commuters. This preference was the simple result of a question at the heart of the survey, “What is most important to you when you choose how you get to work/school?”, for which respondents could select up to three answers from among the options displayed in Figure 3 below. Responses are broken down by transit riders and non-transit riders, making clear another interesting result: that what the two groups value generally align remarkably closely and consistently. The exceptions to that phenomenon are in part unsurprising — non-transit riders, overwhelmingly drivers,¹⁸ value their ability to make stops more, while transit riders place more emphasis on environmental concerns — but one less predictable discrepancy did emerge. Namely, whereas only 20% of transit riders cited safety as a leading concern for them in choosing their commute, 35% of drivers did so. Correcting this perceived disparity, which research shows is simply wrong — by risk of fatality to the user, one recent study found riding commuter rail to be about 20 times safer than driving, riding metro or light rail about 30 times safer, and riding the bus about 60 times safer¹⁹ — could be one point of leverage for those seeking to effect mode shift away from single-occupancy vehicle (SOV) trips towards mass transit.

Figure 3. “What is most important to you when you choose how you get to work/school?”



If time is most important to commuters, then how do commute times break down between transit riders and non-transit riders? Figures 4 and 5 below have the data, which reveal a large, significant difference. Under a third of transit commuters reach their destination each day in under a half hour, and about half of them have commutes longer than 45 minutes. By contrast, two-thirds of drivers have commutes less than 30 minutes long! This major finding poses a

¹⁸ This analysis will, indeed, occasionally refer to the non-transit riding group simply as “drivers.”

¹⁹ Schmitt, Angie. “Here’s How Much Safer Transit Is Compared to Driving.” *Streetsblog USA*. December 19, 2014. <http://usa.streetsblog.org/2014/12/19/heres-how-much-safer-transit-is-compared-to-driving/>

serious obstacle to facilitating mode shift in the Santa Clara Valley, especially in light of sprawl, as commuters, who most prioritize time in choosing how they commute, will likely be unwilling to get out of their cars in favor of taking transit, which is both statistically and geographically (given land use patterns and transit coverage) probable to be a longer (time-wise) trip.

Figure 4. Commute times, transit riders

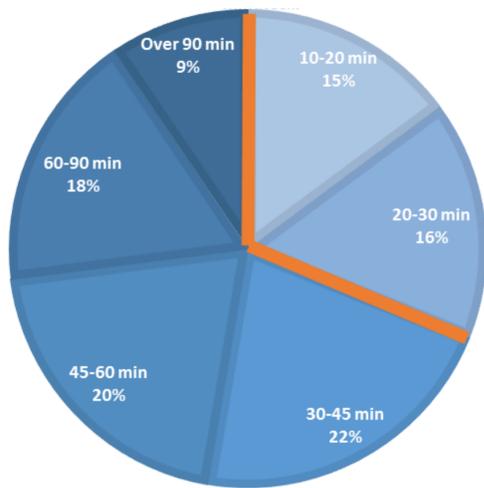
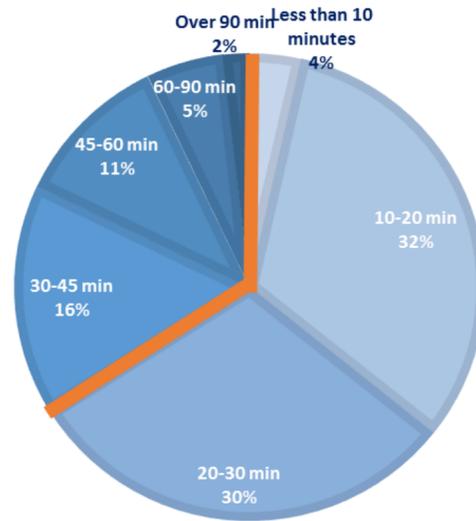


Figure 5. Commute times, non-transit riders



Next, we break down the data on commuters’ annual incomes, dividing the survey population as usual by whether they ride transit, as depicted in Figures 6 and 7 below.²⁰

Figure 6. Annual income of transit riders

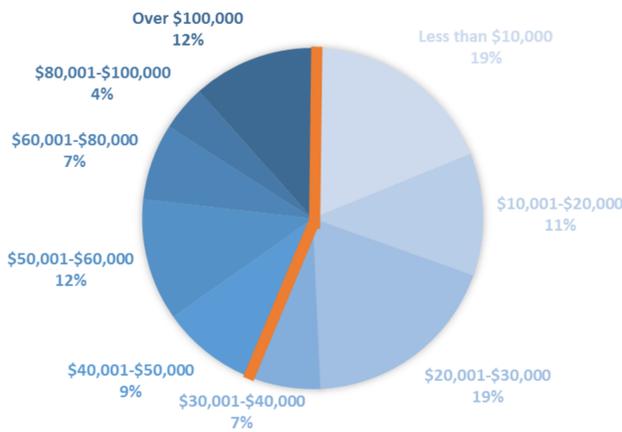
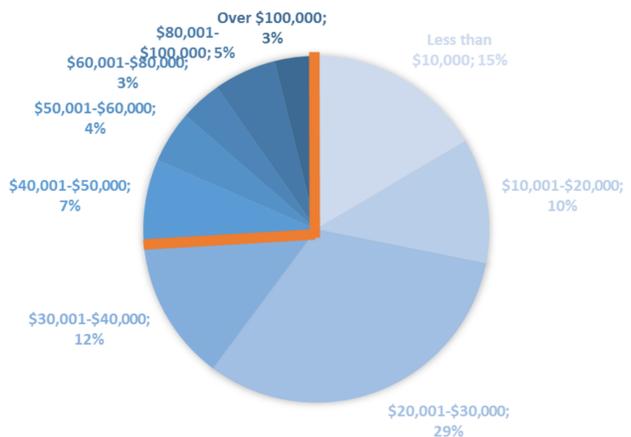


Figure 7. Annual income of non-transit riders



²⁰ Be warned: these numbers are a little strange. Percentages shown in the figures sum to about 90, reflecting the number of respondents who answered the income question. However, the figures’ visual proportions reflect the relative ratios within that 90%, so that, for example, while the number of non-transit riders earning less than \$40,000 a year sums to 66% based on the spelled-out numbers in the graphic, that *proportionately* and thus *visually* accounts for exactly 75% of a set of percentages which together total 88, not 100. Since this latter measurement is more representative, the numbers cited below operate on the same proportionality logic, creating some discrepancies with the graphics’ listed percentages. In future analysis, these numbers and graphics should be pre-adjusted accordingly.

Conventionally, one might expect transit riders to be comparatively lower-income, but in this region where the average Caltrain rider earns \$117,000 a year,²¹ we found the opposite. Specifically, as visualized by the orange dividing lines in Figures 6 and 7, 75% of non-transit riders make less than \$40,000 a year, while only 56% of transit riders do. Unsurprisingly in view of the aforementioned Caltrain ridership statistic, a sizable group of transit riders, some 13% of them, make over \$100,000 a year. Importantly, since the non-transit riders are a bigger pool of respondents, these results also signify that low income commuters are even more likely to not take transit than these pie charts would at first suggest.

Two other minor but clear results regarding time and income are worth noting briefly. Firstly, plotting time of commute against income yielded an almost exactly flat graph, indicating there was no correlation whatsoever between those two variables. Secondly, two variables that did, unsurprisingly, correlate were transfers and time of commute. Roughly 15% of those with commutes shorter than a half hour reported that their journey includes at least one transfer,²² compared to 24% of those commuting for 30-45 minutes, 30% of commuters en route for 45-60 minutes, 61% of those traveling for 60-90 minutes, and at the top end, 89% of those with commutes over 90 minutes.

Our final major finding, and possibly our most compelling, emerged from a question we had initially included for a reason totally different from its eventual significance. We asked commuters, “Does your work/school subsidize your commute?” and if so, how much, intending to help contextualize their sensitivity to and choices regarding cost. While our efforts to study cost largely produced results which were nebulous at best, our inquiry about subsidies, or commuter benefits, which a quarter of our respondents receive, inadvertently proved highly illustrative. Namely, we discovered that 67% of those who received benefits ride transit, a figure significantly higher than the 40% clip of the entire group of respondents, or the 30% rate of those not subsidized. Breaking it down by the usual two groups, 43% of transit riders receive subsidies, while only 14% of non-transit riders do. In a county in which a very small share of commuters overall ride transit, this result constitutes a noteworthy opportunity, suggesting a possibly powerful source of leverage to help encourage commuters towards more sustainable modes.

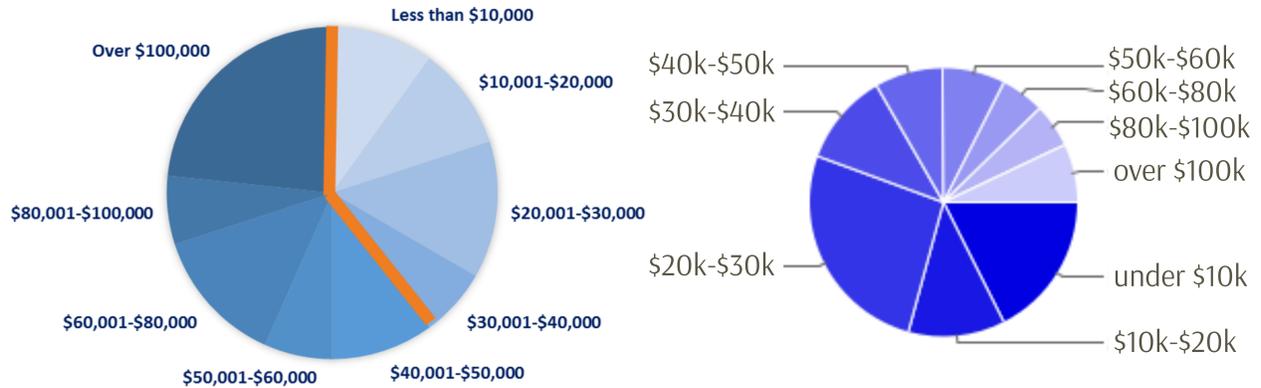
Investigating the group of transit-riding subsidy recipients further yielded a fascinating subplot evident in Figure 8 below: those receiving commuter benefits and taking transit were decidedly higher income than the overall sample. Among all respondents (Figure 2, reprinted below), 55% make less than \$30,000 annually, yet in this group only about a third do. Most

²¹ Donato-Weinstein, Nathan. “Younger and wealthier, Caltrain riders opt out of traffic.” *Silicon Valley Business Journal*. May 29, 2014. <http://www.bizjournals.com/sanjose/news/2014/05/28/younger-and-wealthier-caltrain-riders-opt-out-of.html?page=all>

²² Thanks to our poor survey design (see Appendix B, question 10), “transfer” here only includes transfers from one agency to another, and excludes intra-agency transfers, like from one VTA bus to another. See the discussion in “Improving the Survey” for further information.

notably, while only 7% of the entire sample earn over \$100,000 a year, nearly a quarter of benefit-receiving transit riders do.

Figure 8. Income of subsidized transit riders | Figure 2, again. Income of all respondents



Why is this the case? Our community partner Adina Levin suggested that this may reflect an increased ability on the part of larger employers, with better-paid employees, to provide commuter benefits. This possibility again points to a substantial opportunity for action, discussed in section V below.

To summarize our major findings:

- *Time is the most important factor for commuters.* As transit commutes take notably longer on average than non-transit commutes, this poses a significant challenge for creating mode shift towards transit.
- *Lower income commuters are more likely to drive than take transit, relative to higher income commuters.*
- *Subsidies appear to have great influence on transit usage.* Those receiving commuter benefits ride transit at a far higher rate than the average respondent. However, these subsidies flow largely to higher-income employees.

Improving the Survey

As we administered the survey instrument we had designed ourselves, and especially as we analyzed the data it produced, various flaws in our survey became increasingly apparent. Here are a few of the most prominent ones:

- For a project about fare integration, we ironically did a particularly poor job of targeting information about transfers. When we designed the survey, we were seeking to draw out one particular scenario, that of the commuter who would benefit from a reduced cost of transferring from one agency to another. In pursuit of clarifying the potential for policy change on that score, we defined “transfer” to exclude intra-agency transfers such as from

VTA bus to VTA bus. (See Appendix B, question 10.) In so doing, we complicated the survey for ourselves and for the respondents, and moreover made the answers a less reliable illustration of commuters' choices and circumstances as a result. For example, consider the correlation, mentioned above, between commute times and transfers — how much did our counterintuitive mechanism undermine the data's ability to accurately reflect the relationship between those two variables in commuters' real experiences? Furthermore, our choice eliminated the opportunity to look at transfers more holistically, and address a broader challenge of costly transfers for commuters. To put it another way, why is the expense incurred in going from one VTA bus to another a *different* problem than the cost of switching between VTA and Caltrain?

- Even more crucially perhaps, we bungled wholly our attempt to seize on that one hypothetical scenario, that of a commuter who would benefit from lowered transfer costs between agencies. Unsure of how to elicit and zoom in on that particular obstacle (and faced in part by the prospect that those currently not commuting by transit *wouldn't even know* that they stand to benefit from such a reduction in transfer cost), we inserted an answer so broad as to be meaningless, thereby comically (and ineptly!) sabotaging our own ability to draw any conclusions about an issue we had deemed so crucial. Specifically, among the options to question 8 of the survey — “If you do not use public transit, what would encourage you to use public transit for commute?” — we included “Easier/less expensive connections between other transit options,” making the answer so catchall in a foolish and ungainly effort to goad survey takers into lobbing that response at us. (We did come into this project with a preexisting attitude towards fare integration, after all.) Resolving this issue in a far better way is a key challenge for those designing the survey's next iteration. One option would be to break down the current, consolidated answer into two separate options for respondents to select. Alternatively, this answer could be limited to the cost of transferring, and “Help navigating/understanding system” could be understood to include the complication of transfers.
- Despite extensive efforts to analyze cost sensitivity and cost barriers, we were unable to turn up much clear-cut on that front. In part, this owed to survey design, where we gave respondents multiple opportunities to cite cost as an issue in another misguided attempt to encourage the answers we hoped to hear,²³ but it also just turned out to be a generally difficult thing to pin down. Careful thinking about how to better approach the issue of cost within the survey mechanism, after studying our data analysis notes and largely fruitless attempts to infer consequential results on this central topic, would greatly behoove anyone who takes up the project from here.

Several questions' wording could have improved, too:

²³ Note to anyone taking up this project moving forward: ignore that impulse, the urge to design your survey in such a way that (you think) will help produce your hoped-for outcomes. That inclination will be strong and tempting, but it is not only (obviously) bad research practice; it will also ultimately undermine your ability to collect and interpret data in the most lucid and effective way, including seemingly unrelated segments and features of your sample.

- “If you take public transit, what agencies do you take?” could easily be read as “*when* you take public transit, what agencies do you take?” Indeed, 36 people who didn’t list transit as a mode by which they commute told us what agencies they use, suggesting that that reading was an issue. One fix could be “If you included transit among your answers to question 2...,” but that may also inadvertently limit other interesting information, like discovering as we did that several of those who do not typically commute by transit still clearly use public transportation occasionally.
- “Does your work/school subsidize your commute?” doesn’t clarify whether we’re asking “are subsidies *available* to you?” or “are you *currently using* benefits to pay for your commute?”? Better distinguishing between access to and use of benefits would ameliorate a possible misreading that may have even falsely generated our findings about subsidies (although they’re strong enough that they likely hold up in any case): did the patterns we purportedly found reflect only that transit riders were just using the benefits whereas non-transit riders were not, and in fact rates of access to subsidies were not so different?

Finally, we could and should have done a better job of tracking exactly how and where we conducted each survey. We were able to retroactively note where each response had originated (live interview at transit, online, from SIREN, etc.), but moving forward the survey should be amended to gather this information specifically. While collection information on the location of survey gathering (Palo Alto Caltrain? San Jose Diridon? SEIU 521?) would be useful and important, even more crucial would be recording how the survey was conducted, and in particular whether the respondent filled out the form on their own or the surveyor walked them through and explained each question methodically. Collecting that data would sharply improve our methodological feedback loop, and bolster future efforts to iterate and improve on survey design and delivery.

Website

Check out our presentation of all of this data online at <http://integratedfares.weebly.com!>

V. Conclusion

Moving forward, more analysis is required on several fronts. Firstly, while we were able to collect very good data about respondents’ home zip codes, and fairly good data about their place of work, we did not have the bandwidth to begin to conduct a geographical analysis, which would address several lynchpin questions. Specifically, in examining respondents’ commute routes, are people whose journeys lie along a convenient bus or rail corridor but are commuting by car potentially priced out of transit? In particular, are drivers and/or bus riders priced out of faster but expensive options by Caltrain? The data is already there to analyze, so an initial effort to answer these questions would not even require further surveying.

Secondly, future surveys should attempt to capture data on at least two new key issues unaddressed by our first iteration. One concerns time: how much do longer (time-wise) transit commutes reflect time required to transfer? Of course, this possibility speaks directly to transit integration, as better aligning schedules across agencies, precisely to minimize time spent waiting to transfer, is a key component of integration. The data themselves suggest this question is worth addressing, as less than a third of transit riders with commutes less than 45 minutes transfer, while two-thirds of transit riders with commutes over 45 minutes transfer. The other speaks to employment opportunities: the survey should ask in some form if respondents would consider better or more jobs with affordable, fast (likely rail) access to them by transit.

Thirdly, our findings around subsidies point to a substantial and exciting opportunity. Should the hypothesis about larger employers being more able to disburse commuter benefits be confirmed by further research, Friends of Caltrain and others may seek to work with Transportation Management Associations (TMAs), and other transit-facilitating entities, to enable smaller businesses to pool resources in order to provide benefits to their employees as well. If, again, the likelihood of riding transit increases with the provision of subsidies by as much as our research suggests, this effort could be a powerful force for shifting workers across the Santa Clara Valley towards far more sustainable modes of transportation. Efforts could and should also be made towards identifying attributes other than size which make employers more or less likely to provide commuter benefits for their employees: are their patterns by industry, for instance?

Lastly, any efforts to shape a 2016 county-wide transportation ballot measure towards including a pilot fare integration program should of course heed the lessons of our literature review. The region would stand to gain substantially as a result.

Though our project did not uncover the decisive data, pointing towards the urgency of fare integration, that we had initially hoped for, we still feel we were able to meaningfully advance the conversation about better transit in the Santa Clara Valley. We hope sincerely that Friends of Caltrain, in partnership with other groups of students or additional advocacy organizations, can take the baton from here to extend our work — and take the train with it!

Appendix A: Systems Matrix

	Transport Modes						Use for retail purchases?	Users	Managers of Fare Collection	Notable System Features
	Railways?	Local Public Transit?	Taxi?	Bike Sharing?	Car Sharing?					
Oyster Card London, UK	yes		-	-	-	no	7 million	Managed by Transys (tech supplier) on behalf of Transport for London (transit operator) and the Department of Transport (government agency).	Card calculates best possible fare for journeys across all modes.	
Mi Muovo Emilia Romagna, Italy	yes	yes	-	yes	yes	no	200,000	Managed by transit operators (which are managed directly by various local governments.)	Price depends on distance traveled through zones, not based on operators or modes of transit.	
Octopus Card Hong Kong, China	yes	yes	yes	-	-	yes	10 million	Joint company managed by city's five major transit operators, largest stakeholder is Government of Hong Kong.	95% market penetration Tourism features World's first integrated ticket system	
T-Money Seoul, South Korea	yes	yes	yes	-	-	yes	18 million	Joint venture managed by Seoul Metropolitan Government, LG Electronics, and various credit card issuers.	Modeled after octopus card, Most users of such a system in the world	
Ventra Chicago, USA	yes	yes	-	-	-	yes	Unknown (began in July 2014)	Managed by 3rd party tech supplier, Cubic Transportation	Not managed by transit operators	

Appendix B: English Survey

FARE ECONOMICS FOR FAIR INTEGRATION - SURVEY

Hello! We are a group of Stanford students studying how to improve our transportation networks here on the Peninsula, and especially how to remove barriers to mobility for underserved Bay Area residents, students, and workers. In pursuit of that goal, we are interviewing workers and students about how they commute each day. Please note: if you don't commute regularly to work or school, please do not take the survey, as it is specifically targeted towards those who make those trips regularly.

We are looking to survey people who LIVE OR WORK in SANTA CLARA VALLEY, so please only take this survey if that describes you.

This brief survey will ask a few questions about how you commute. All answers will be fully anonymous, and your personal information will not be shared with anyone. We hope to use the results of this survey to advocate for better, simpler, and more connected transportation options on the Peninsula, and your answers make that possible -- so please fully answer each question to the best of your ability! Thank you so much for participating in our study!

1-How many times a week do you commute to work and/or school? (Count each roundtrip as once.)

- 1-2 times
- 3-4 times
- 5-6 times
- 7+ times

2-How do you get to work/school? Check more than one, if applicable.

- drive alone
- carpool
- public transit
- bike
- walk
- other(s): _____

3-If you take public transit, which transit agencies do you take?

4a-Does your work/school subsidize your commute?

- Yes
- No
- Other: _____

b-How much does your work/school subsidize your commute per month or per year?

5-Approximately how many minutes does it usually take for you to get to work/school?

- less than 10
- 10-20
- 20-30
- 30-45
- 45-60
- 60-90
- over 90

6-What is most important to you when you choose how you get to work/school?

Select up to 3 choices.

- Travel time
- Cost
- Convenience/flexibility
- Reliability
- Safety
- Comfort
- Reducing pollution, conserving energy
- Ability to make stops on the way to work or home
- Stress
- Other: _____

7-If you do not commute by public transit, why don't you?

Select up to 2 choices.

- I currently commute by public transit
- It's too expensive
- Service doesn't match my schedule
- Either my work or home is not accessible by transit
- I need to make some stops on the way to work (for childcare, errands, or other reasons)
- I use my car as a part of my job
- I prefer to drive my own car
- Flexibility for emergencies
- The transit network is too complicated
- other: _____

8-If you do not use public transit, what would encourage you to use public transit for commute?

Select up to 3 choices.

- I currently commute by public transit
- Help navigating/understanding system
- Service that matches my schedule
- More convenient stops
- Better security/safety
- More comfortable services
- Easier/less expensive connections between other transit options
- More affordable prices
- Guaranteed ride home in case of emergencies
- Transit passes sold at work
- Better bike/walk access

9-If you take public transit, what kind of pass do you use?

- I don't take public transit
- I purchase tickets for single rides
- Daily pass
- Monthly pass
- Other: _____

10-If you take public transit, how many times do you transfer between agencies on each commute?

If you take two busses that are both provided by VTA, for instance, your answer would be "none."

- I don't take public transit
- None
- 1
- 2
- 3 or more

In order to best study how current policies impact our community, we ask the following questions to best understand who can benefit from future policy changes. Your individual responses will be kept strictly confidential.

11a-What is your home ZIP code?

11b-Where do you work?

Please be as specific as you can be: if you know the address, great! - then please write that below. If you only know the approximate street intersection, please let us know that. If you know only the name of the company and the city in which it is located, then that's fine.

12-How old are you?

- less than 18
- 18-29
- 30-44
- 45-60
- 60 and over

13-What is your gender?

- Male
- Female
- Other: _____

14-What is your race or ethnic identity?

- American Indian or other Native American
- Asian, Asian American or Pacific Islander
- Black or African American
- White (non Hispanic)
- Hispanic or Latino
- Multiracial
- Other
- I prefer not to respond

15-What is your annual income bracket?

- Less than \$10,000
- \$10,001-\$20,000
- \$20,000-\$30,000
- \$30,001-\$40,000
- \$40,001-\$50,000
- \$50,001-\$60,000
- \$60,001-\$80,000
- \$80,001-\$100,000
- Over \$100,000