



Equity for Express Lanes

Project Report
UrbanSt 164: Sustainable Cities
Wednesday March 22, 2017
Victoria Mao, Alex Martel, Jacque Ramos, Amulya Yerrapotu

Acknowledgements:

Completion of this project is due in large part to the guidance and expertise of:

Adina Levin, Project Director, Friends of Caltrain

Chris Lepe, Silicon Valley Senior Community Planner, TransForm

Deland Chan, Lecturer, Dept. Urban Studies, Stanford University

Project Purpose

The Bay Area is notorious for its lengthy commutes. Traffic congestion can cause commute times to double near peak hours, and transportation demand is only expected to grow in the coming years.¹ One of the many proposed solutions to this problem is the institution of Express Lanes.



Figure 1: Map of San Mateo 101 Corridor²

**Table 1: Mode Choice, Existing Conditions
AM Peak Period, Average of Both Directions¹⁵**

Person or Vehicle Trips	Solo Occupant	2-Person Carpools	3+ Person Carpool	Bus	Vanpools	Motorcycles	Trucks	Total
% Vehicles	79.5%	15.5%	1.1%	0.4%	0.5%	0.5%	2.5%	
# Vehicles	20,700	4,040	290	100	130	130	650	26,040
% Persons	61.0%	23.8%	3.0%	6.6%	3.1%	0.5%	2.1%	
# Persons	20,700	8,070	1,000	2,230	1,040	150	730	33,920

Figure 2: Current San Mateo 101 Corridor Usage (ibid)

Express Lanes (otherwise known as High Occupancy Toll lanes, or HOT lanes) are specific freeway lanes that offer single occupancy vehicles the chance to use the lane for a fee, while giving high occupancy vehicles and green vehicles free access. In the Bay Area, the tolls from solo-drivers are collected using FasTrak passes— electronic passes that automatically charge the

¹"Bay Area's worst commutes: Highway 101 in South Bay at No. 3", Mercury News, 11 August 2016

²"Innovation Required: Moving More People with Less Traffic", TransForm, 2013

http://www.transformca.org/sites/default/files/final_hot_101_paper.12.16.2013-1_revised_acknowledgement_0.pdf

driver. Various counties around the Bay have plans to drastically expand the Bay Area's HOT network, with lanes already in effect on Hwy 237, I-580, I-680, and I-880. One of the upcoming Express Lanes projects aims to place an Express Lane on a stretch of Highway 101 resting between the end of the Santa Clara County Express Lanes to I-380 in northern San Mateo County.³ The exact implementation of the project, however, has yet to be determined. Numerous permutations are being considered and the shifting factors range from converting a lane or building a new one, to what to use the funds for.



Figure 3: Map of HOV and Express Lanes In Northern California from Caltrans

Our community partners, Friends of Caltrain and TransForm, have a preferred solution in mind. Founded in 1997, Transform is a transportation advocate that values walkable communities and great transportation options for people of all income levels. Transform believes that this, alongside carbon footprint reduction creates a better future for all. Friends of Caltrain is a grassroots group with over 3,000 members who support accessible and equitable public transportation options. The organization formed in 2010 in response to a proposed 50% cut in Caltrain funding. The two organizations hope that the Highway 101 Express Lanes project that moves forward involves converting, not widening, a lane to be a High Occupancy Toll lane, and using the funds generated to invest in transit options, as well as equity measures to ensure the project does not disproportionately benefit those who can afford to use the lanes.

In order to inform the ultimate decision about the project, Friends of Caltrain and TransForm have teamed up to conduct a survey to assess public opinion regarding Express Lanes. By learning more about commuter's needs and desires, the two organizations hope to learn what policies would be most beneficial for all stakeholders.

Our role was to pilot and fine-tune the survey and methodology in order to scale it up for a larger survey effort. Additionally, we analyzed our preliminary survey results to point out trends and

³ "Bay Area Express Lanes: How They Work", 511 Bay Area

patterns to keep an eye out for as the organizations move into the full survey. Though our project is primarily meant to model and test the overall larger study that will be presented to the City and County of San Mateo, our results gave us enough data to offer preliminary answers for our research questions. Our final list of deliverables is as follows:

- Complete paper survey
- Survey handout
- Map of survey respondent zipcodes with commute times:
https://qui44.carto.com/viz/4f91bc50-0948-11e7-8baa-0e8c56e2ffdb/public_map
- Survey report
 - Literature review on similar projects
 - Methodology + reflection and recommendations
 - Survey analysis + initial findings

Given the potential for any tolling policy to be regressive, this project is of the utmost importance in promoting the equity aspect of sustainability. Low income commuters would be forced to pay a larger proportion of their income to use the tolled lanes, or suffer through a longer commute. Express Lanes can have a positive or negative effect on equity depending on the pricing strategy, and what the toll revenues are used for.⁴ Thus, it is critical that the project contains contingencies— such as toll credits for low income commuters or improved bus service on the corridor— to offset any potentially regressive impacts. By understanding the transportation needs of various commuters throughout the Bay Area, we hope to figure out how to best implement Express Lanes on Highway 101 to serve the community. Furthermore, a well-designed Express Lane can produce environmental benefits. The lower traffic congestion means less pollution, and investing in alternative transportation— buses, trains, vanpool, etc.— pulls cars off of the road as well. All of these benefits, however, hinge on how well the project matches the needs of the community. Thus, the data gathered from the survey is crucial to its success.

It is clear that the Bay Area needs smart transportation strategies to truly become a sustainable city. While many of the problems are structural— the mismatch between housing and jobs being the root of the area's transportation problems— it is important that even seemingly minor solutions like this examine all aspects of sustainability. In this case, a solution designed to take cars off the road benefits environmental quality, but must also keep equity concerns in mind in order to truly be sustainable.

⁴ "Income-Based Equity Impacts of Congestion Pricing", U.S. Department of Transportation Federal Highway Administration, <https://ops.fhwa.dot.gov/publications/fhwahop08040/fhwahop08040.pdf>

Literature Review

MetroLA Express Lanes Project

The institution of Express Lanes on I-110 and I-10 in Los Angeles serves as an ideal model for the Highway 101 Express Lanes Project. The Los Angeles Project converted 25 miles of existing HOV lanes to toll lanes, using the funds to improve alternate transit options. Single Occupancy Vehicles (SOVs) are allowed to use the lanes after paying a toll, while carpools, vanpools, transit, motorcycles, and low emission vehicles travel for free. All vehicles that use the lanes must have a Transponder (which has a \$1 monthly maintenance fee), regardless of how many occupants there are. The tolls typically ranged from \$.25 - \$1.40 per mile, depending on congestion levels that day. Tolls were adjusted to try and keep speeds in the Express Lanes at 45 miles per hour.⁵



Figure 4: FasTrak Program in LA from the Transit Coalition

Overall, 461,121 Transponders were issued for the program, including 7,991 accounts that use the program's Equity Plan. The Equity Plan allows low income commuters to access the Express Lanes for a lower toll. 54% of vehicles in the lane were HOV2+, driving for free, and 44% were SOV, choosing to pay the toll. Under State Law, the program's revenue was designated for use in maintenance, administration, operations, toll collection, and enforcement. All additional revenue has to be invested back into the corridor it was generated in. In this particular project, additional funds were parcelled out as follows:

- Set Aside funds for Transit Operating Subsidy (Metro Silver Line, Foothill, Gardena, and Torrance Transit)
- 3-5% of funds set aside as reserve funds
- Remaining funds granted on competitive basis (Net Toll Grant Program)
 - 40% Transit System Improvements
 - 40% System Connectivity/Active Transportation
 - 20% Highway System Improvements⁵

⁵Philbert Wong, "Metro Expresslanes Net Toll Revenue Reinvestment" (report presented at 2015 ITS California Annual Meeting September 2, 2015) <http://www.itscalifornia.org/Content/AnnualMeetings/2015/Presentations/TS11-4-MTA-NetTollRevenueReinvestment.pdf>

Table 4-1. Changes in Travel Time After CRD Improvements (in mins).

Facility	Peak Period (Direction)	Express Lanes	General Purpose Lanes
I-10	Morning (WB)	-2.19	-1.89
	Afternoon (EB)	-2.00	4.31
I-110	Morning (NB)	1.89	-0.02
	Afternoon (SB)	0.11	1.67

Source: Caltrans

The actual implementation of the project proved to have generally beneficial impacts on the community. There was an increase in travel times during the initial deployment of the lanes on I-10 and I-110, as is the case with most HOT conversion projects. However, as time went on, travel time decreased and speed increased. The increases and decreases in travel were rather small, with no change being larger than 5 minutes.

Transit investments were some of the most effective portion of the project. Perhaps the most important came through investment in the Metro Silver Line freeway Bus Rapid Transit, which operates on the same corridors as the Express Lanes. After one full year of Express Lanes, ridership on the Silver Line rose 52 percent.⁶ A third of new riders said they drove alone prior to the increased Silver Line service, and 48% of riders said that the Express Lanes project had indeed improved their commute (and 34% were neutral). Bus travel times improved by about 1.5 minutes on both Interstates, a small change that did not particularly impact riders.⁷

There were several other indicators of project success. 259,000 drivers purchased transponders to use for the Express Lanes— exceeding the program goal of 100,000. Revenue from the lanes totaled to \$19 million, outstripping projections of \$8-10 million.⁶

The project's results in regards to equity are more mixed. A little over half of those surveyed stated that tolls were unfair to low income commuters— 54% and 55% on I-110 and I-10, respectively. However, the Equity Plan did some work in making the program more equitable, being important for 82% of respondents. Users with the Equity Plan made more use of the Express Lanes than the general population, though their trips were over 80% toll free to begin with.⁷ An equity review conducted before the project's inception found that low income drivers were unlikely to use Express Lanes on a daily basis, though credit programs (like the one offered in the project) improved those chances, which is what ended up happening. The report suggested that the city examine and modify the following policies to promote equity:

- “waiving account setup fees for low- income commuters;
- the distribution network for transponders;
- minimum account balances and the consequences of going below them;
- minimum monthly usage charges for low- activity accounts”⁸

The overall results of the Los Angeles project suggests that Express Lanes are a beneficial addition to commuting provided they come with transit investment. The changes in travel time on I-10 and I-110 were near negligible. However, the revenue provided by tolling was used to make transit investments that significantly improved commute options and accessibility. The

⁶ Joe Linton, “Balancing Cars, Cash, and Congestion: Metro Silver Line BRT in ExpressLanes”, StreetsBlog LA, 8 July 2014, <http://la.streetsblog.org/2014/07/08/balancing-cars-cash-and-congestion-metro-silver-line-brt-in-the-express-lanes/>

⁷ “Los Angeles Congestion Reduction Demonstration ExpressLanes Program National Evaluation: Technical Memorandum on Congestion, Tolling, Transit, and Equity Results”, U.S. Department of Transportation, 11 April 2014, http://media.metro.net/projects_studies/expresslanes/images/public_reports_fhwa_04-2014.pdf

⁸ “Metro ExpressLanes Project Draft Final Low-Income Assessment”, Los Angeles County Metropolitan Transportation Authority, 17 March 2010, http://media.metro.net/projects_studies/expresslanes/images/low_income_draft_final_report.pdf

improvements in transit also possibly outweighed the equity concerns posed by the project—while low income commuters were less likely to use the Express Lanes, they may have disproportionately benefited from increased BRT service.

Bay Area Express Lanes Projects

Various Bay Area transportation agencies have already built or are planning on building Express Lanes on local Highways. There are currently lanes operating on I-580, I-680, and State Route 237, with many more planned on various other Highways including 101.⁹ Being closer to home, the existing Bay Area Express Lanes offer valuable insight that is perhaps more pertinent to the Highway 101 Project than the Los Angeles Express Lanes Project. One unique feature of Bay Area Express Lanes is that most of them have specific entry and exit points, instead of allowing commuters to merge in and out as they please, to prevent congestion.¹⁰

The primary difference between existing Express Lanes in the Bay Area, and the Los Angeles Project, is that revenue from the lanes is used to pay for lane enforcement by the California Highway Patrol, as well as transit investments.¹¹ The Express Lanes in the Bay Area seem to be meeting basic performance standards. For example, State Road 237's (SR 237) Express Lane operated at above its minimum speed of 45 miles per hour about 92% of the time. SR 237 also served 56,000 more vehicles in 2015, than in 2014, pointing to increasing popularity. The lanes earned net revenue of about \$300,000 in 2015 after maintenance fees had been paid, surpassing projections of \$27,000. There is little information as to where this additional revenue goes. Despite an overall increase in cars on the road, the SR 237 Express Lane can save up to 14 minutes of commuting, depending on the time of day and direction travelled in.¹² About 17% of drivers in the lane used SOVs, a significantly lower percentage than the rates of solo-drivers seen in Los Angeles.¹³

Interestingly enough, despite low levels of SOV vehicles in the Bay Area Express Lanes, demand for the lanes from HOVs and Clean Air Vehicles (CAVs) is high enough that the lanes sometimes do not function as intended. When demand for lanes is too high despite maximum tolls, pushing speeds below the 45 mph threshold, the lane becomes closed to all but HOV vehicles.¹⁴ This suggests that the Highway 101 Express Lanes Project may need to consider being an HOT3+ lane instead of HOT2+, to manage demand while still collecting enough tolls.

Public opinion about Express Lanes in the Bay Area seems to be neutral to supportive. A survey of public opinion conducted by the Valley Transit Authority (VTA) in preparation for an Express Lanes project on I-85 and Highway 101 (in Santa Clara County, not San Mateo County), found

⁹ "MTC Express Lanes", Metropolitan Transportation Commission, <http://mtc.ca.gov/our-work/plans-projects/major-regional-projects/mtc-express-lanes>

¹⁰ Michael Cabanatuan, "New express lanes on I-580 Signal Freeway Revolution", San Francisco Chronicle, 9 February 2016, <http://www.sfchronicle.com/bayarea/article/New-Lexus-Lanes-on-I-580-signal-freeway-6819089.php>

¹¹ "State Route 237/I-880 Express Connectors Project", California Department of Transportation, March 2012, http://www.dot.ca.gov/dist4/237880express/docs/hot_lanes_fact_sheet_237880_2012.pdf

¹² "VTA Silicon Valley Express Lanes Program", Santa Clara Valley Transportation Authority, <http://www.vta.org/projects-and-programs/highway/silicon-valley-express-lanes>

¹³ "SR 237 Express Lanes FY 2015 Annual Report", Santa Clara Transportation Authority, 17 September 2015

¹⁴ Gary Richards, "Roadshow: What 'HOV Only' means on toll lanes...", The Mercury News, 17 August 2012, <http://www.mercurynews.com/2012/08/17/roadshow-what-hov-only-means-on-toll-lanes-at-highway-237-and-i-880/>

that 56% indicating support for the project. 30-40% of drivers said they would consider using the lanes— a higher margin than current usage on other Bay Area Express Lanes.¹⁵

Concerns primarily centered around equity. Multiple respondents brought up fear that the lanes would become “Lexus Lanes”, used only by high income commuters.¹¹ This concern has also been raised in other news reports, with even our community partner, TransForm, coming out against Express Lanes because of equity concerns unless funds were reinvested in public transit.¹⁶ Thus, it is rather concerning to see that there has not been an equity evaluation of the existing Bay Area Express Lanes. Despite listing an equity evaluation in its table of contents, the SR 237 Summary of Environmental Documents “do not address the use of express lanes by low-income individuals.”¹⁷ The Express Lanes Initial Studies that do include equity assessments simply note if there are high minority or low income populations near the proposed project, but do not empirically examine how the project might affect these communities, under the assumption that lower travel times in all lanes benefit all commuters.¹⁸

Takeaways

The differences between the Los Angeles and Bay Area Express Lanes Projects underscore the gaps that the Highway 101 Express Lanes Project is trying to bridge and some of the challenges it might face in doing so.

The first noticeable difference is the proportion of HOT drivers that use SOVs. It appears that despite similar toll rates, a significantly larger proportion of drivers on HOT lanes paid the toll and drove alone (44% vs 17%). This could be because Los Angeles commuters are more willing to pay the tolls, or Bay Area commuters are more likely to carpool. If the second is true, then it is worth modifying the survey to ask about the carpool habits of commuters. If Bay Area commuters are indeed more likely to carpool, an HOT2+ lane might be at capacity regardless of tolls, meaning an HOT3+ lane could be the only viable project option to reduce congestion. We cannot make that judgement, however, without having more data on the carpool habits of commuters.

The second major difference between the projects is the focus on reinvestment in the Los Angeles Project. This could partially be because the Los Angeles Project brought in significantly more revenue than the Bay Area Express Lanes, possibly because there were more solo drivers paying tolls. In any case, LA had more money leftover to use to improve transit alternatives, which is a popular proposal in both LA and the Bay Area. In our survey, we hope to target this area by asking questions about consumer’s transit preferences, to figure out which improvements might benefit them best.

¹⁵ “Silicon Valley Express Lanes Program Implementation Assessment and Plan”, Santa Clara Valley Transportation Authority, 21 November 2008, <http://www.vta.org/sfc/servlet.shepherd/version/download/068A0000001FZhglAG>

¹⁶ Michael Cabanatuan, “237 Express lane Opens - small step in huge plan”, SFGate, 27 March 2012, <http://www.sfgate.com/bayarea/article/237-express-lane-opens-small-step-in-huge-plan-3436456.php>

¹⁷ “Summary of State Route 237 Express Lanes Phase 2 Project in Santa Clara County Categorical Exemption/Categorical Exclusion and Technical Analyses...”, Metropolitan Transportation Commission, 27 July 2015, http://www.planbayarea.org/sites/default/files/pdf/SR_237_Express_Lane_Settlement_Summary_Final.pdf

¹⁸ “Legal Documents”, Plan Bay Area, <http://www.planbayarea.org/2040-plan/quick-facts/legal-settlements/legal-documents>

The final major difference was that the Los Angeles Project included a lengthy equity review, while the Bay Area Projects do not. This underscores the dangerous gap in information in Bay Area Express Lanes Projects surrounding the needs of low income commuters. If we are to institute an Express Lanes project that successfully improves the commutes of all community members, as was the case in Los Angeles, we need to understand the impacts of the project on low income commuters. Our survey hopes to fill this gap in information by targeting low income commuters to learn how their preferences might vary from the general population.

Methodology

Our survey efforts centered on a mix of response types: paper surveys, electronic surveys, and qualitative feedback. Although the primary goal of our field days was to maximize the number of survey responses, we discovered that different sites yielded different interactions and in turn future efforts could be tailored to maximize desired responses. We focused on a survey format to standardize responses across numerous individuals so that we could obtain data-driven analysis. Statistical inferences and trends are much easier to identify when quantitative data is involved. Although we focused primarily on in-person surveying we also sought online responses to convenience individuals as well as save on time. It should be noted that we averaged one response for every hour at a field site. Online responses from our field sites did not manifest but jumped after reaching out to our community partners who connected us with email channels.

Since this project is the first stepping stone in a line of stages for our community partners we structured our efforts around testing survey approaches and identifying inefficiencies. Additionally, we hoped to find gaps or issues in the survey itself. Although high survey counts help establish statistical significance, testing procedures took precedent as it would inform future campaigns organized by our community partners. In particular, conversations with individuals about their commutes proved quite useful in identifying travel problems outside the scope of our survey. In the future, these interaction could produce additional insights for future campaigns.

Field Sites

Workplace Visits (California Ave and El Camino Real in Redwood City)

Benefits:

- + workers limited to a single space
- + possibility that multiple employees could fill out survey per stop
- +able to leave information brochures

Downsides:

- workers limited by free time
- workers limited by store solicitation policy
- customer interactions take priority
- time consuming

Recommendations:

- Visit sites during non-peak hours or inclement weather to minimize customer interruptions
- Leave informational brochure with link to online survey (Usually the images are useful when speaking with workers in person; however, based on experience, people usually do not fill out the electronic survey through the link found on the brochure.)
- Convenience workers as much as possible
- Schedule another time to come back if busy
- Obtain qualitative feedback on survey or opinion of commute when possible
- Target non-food business because of lower foot traffic

Transit Hubs (Caltrain)

Benefits:

- + Many commuters concentrated in single space
- + Commuters more willing to converse about their experiences
- + able to leave informational brochures
- + travel distance short
- + new passengers onboarding frequently

Downsides:

- passenger time limited by travel distance or time till next stop
- interactions better at non-peak travel times
- time consuming

Recommendations:

- Leave informational brochure with link to online survey
- Convenience riders as much as possible
- Obtain qualitative feedback on survey or opinion of commute when possible
- Visit during less intense travel times

Farmers Market (Palo Alto)

Benefits:

- + Many individuals concentrated in an area
- + Travel distance between people is short
- + Able to leave informational brochures
- + New people enter frequently
- + Individuals more willing to converse about their experiences

Downsides:

- individuals can easily leave
- people limited by Sunday plans
- individuals might be focused on their errands
- time consuming

Recommendations:

- Leave informational brochure with link to online survey
- Convenience individuals as much as possible
- Obtain qualitative feedback on survey or opinion of commute when possible
- Visit during high traffic times

Deliverables

Major Findings ([full findings report](#)):

Disclaimer: the findings provided in the following statistical analyses are only meant to highlight any potential trends within the survey data. Given the small sample size of the survey responses, they will not accurately represent the actual population that our survey is interested in. Note: it is possible to estimate the actual number of survey responses needed for our survey analyses to be statistically accurate in representing actual public opinion; however, that is out of the scope of this report. To do so would require data from a similar and complete survey report.

These findings are based on the initial phase of our community partners' survey process with a survey number of about 50 responses through field visits and an online survey. This summarization will be framed through a demographics, commute investment preferences, and project building alternative views. We conducted a statistical analysis on Excel (which serves as an initial analysis, as that our response number is not enough for an accurate picture of the population) and used the survey report visualizations from Google Forms to inform our findings and recommendations. Our findings are summarized below:

Demographics: Most of our survey respondents drive alone to work (71.9%), and most commute times (66.7%) are more than a half hour. Less of the respondents (24.6%) said that they are satisfied with their commute, though about 25% of respondents are neutral to it. When choosing how to commute to work, travel time was ranked as most important by most people.

How long does it typically take you to get to work? (54 responses)

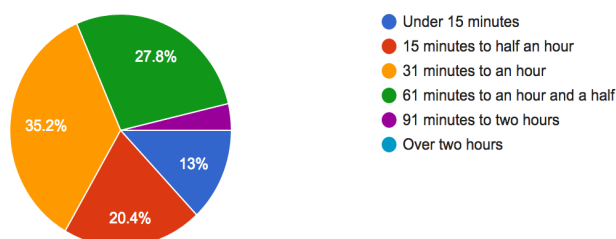


Figure __: Commute time Google Form visualization

Transportation investment preferences: By far, according to an analysis of the total survey respondent population, most people said that more frequent Caltrain service would benefit their commute (mean: 3.29). Other preferred benefits include: last mile connectors, adding more lanes to Highway 101, more affordable transit fares, and bicycle and pedestrian improvements. However, when income is taken into account, the rankings of preferred benefits slightly shift. We looked at the responses of survey respondents

earning lower than the median household income in the Bay Area. Though more frequent Caltrain service is also preferred the most, more affordable transit fares, bicycle and pedestrian improvements, and last mile connector investments are preferred, in that order.

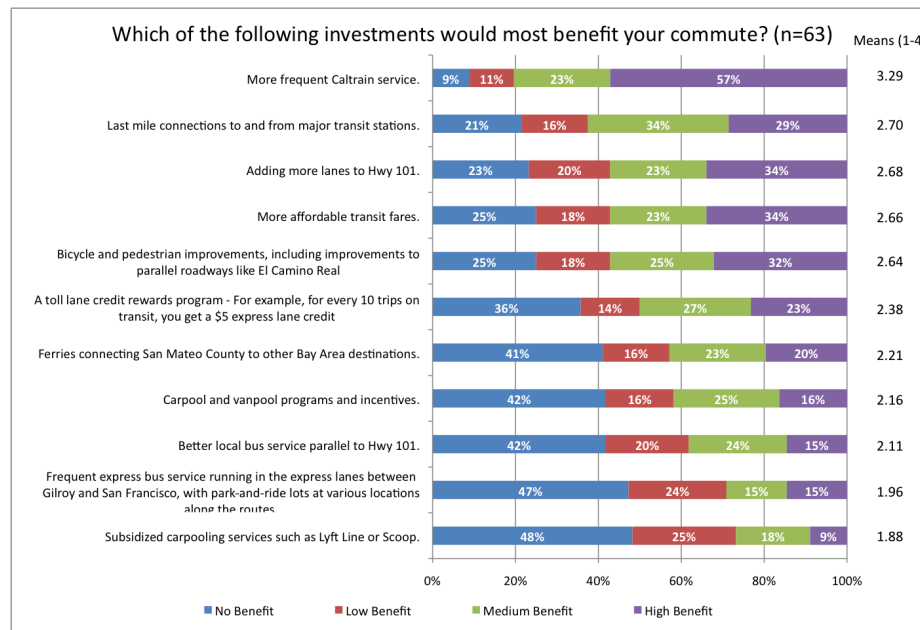


Figure __: Transportation Investment Preferences

Project building alternative views: Survey respondents were generally neutral on the topic of widening or converting a lane to an High Occupancy Toll (HOT) Lane (widening mean: 3.00, conversion mean: 3.07). When determining which addition to the project would affect their support for the conversion alternative, 78.7% of the respondents said that they would support the conversion alternative if the revenues from the tolls would be used towards improving transportation options along Highway 101 and parallel routes. In terms of responding to different parts of the Express Lanes projects, people agreed with toll revenues going towards transportation improvements (mean: 3.88), toll revenues paying for public transportation improvements instead of adding highway lanes (mean: 3.77), and whether they can afford to pay tolls (mean: 3.52). People disagreed more with their usage of the Express Lanes and that toll lanes varying depending on income and congestion. Respondents were generally neutral about offering a discounted rate for low income commuters, and the general concept of Express Lanes.

Links

Two relevant links are:

- our information and survey website link to the Google Form
 - <https://sites.google.com/view/101expresslanes>
- our map to display where people live with information displaying most frequently answered commute times according to each area

- https://qui44.carto.com/viz/9a7ac838-03cb-11e7-a19e-0ef24382571b/public_map

Going deeper into the data collected by the survey, we are also interested as to the how public opinion shifted between several different parameters found in the survey. Due to limitations in time, we focused only on how public opinion differed between responses directed towards the widening alternative and the conversion alternative. Recall that the centerpiece of the survey is to better understand how different groups perceive the widening alternative compared to the conversion alternative as a solution to mitigate traffic congestion along Highway 101; we are especially interested in how different groups perceive the addition of benefits for low-income commuters and how the addition of those benefits may shift public opinion of the widening alternative and conversion alternative. Therefore, we conducted three different analyses of the survey data, with the survey responses grouped by: 1) Household Income, 2) Primary Mode of Transit, and 3) Average Commute Time to Work. *Note: full statistical analysis and charts of these three analyses may be found in the Excel workbook, Highway 101 Pilot Survey Analysis.*

Note about the format of Questions 52 and 53 of the Highway 101 Pilot Survey:

Q 52. If the features you selected above were incorporated into the express lanes conversion alternative, would it affect your level of support for the project?

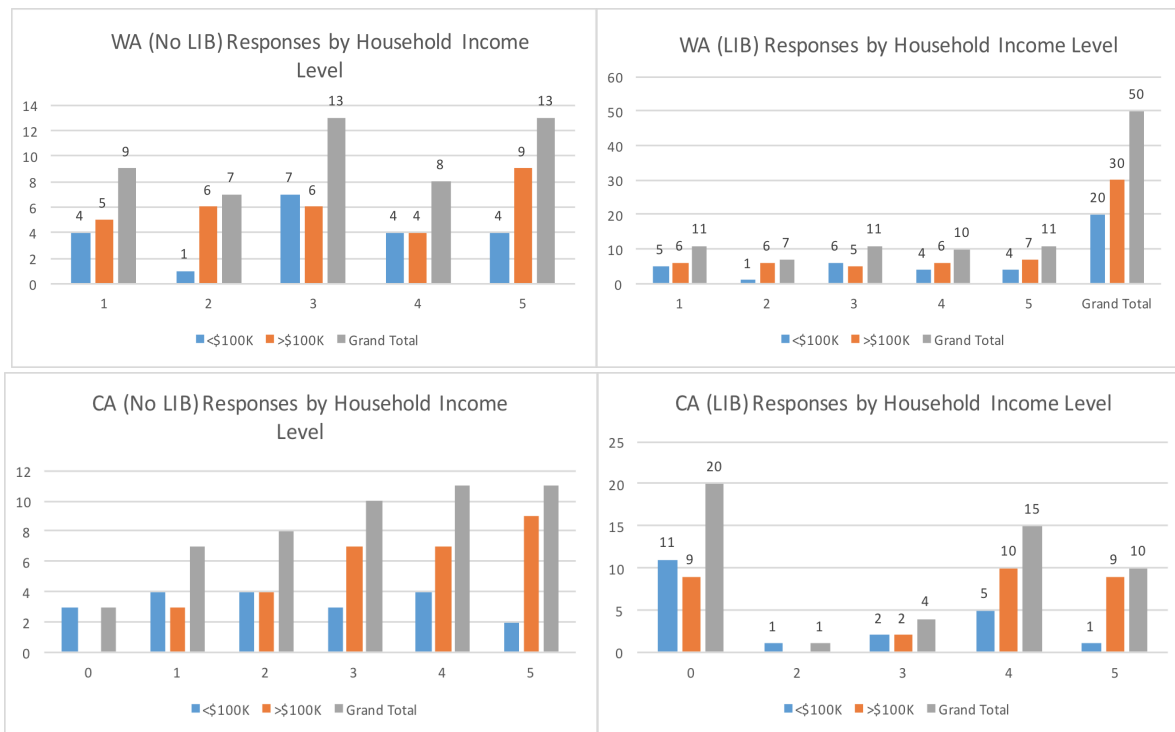
Q 53. If you responded yes to the previous question, please state your level of support for the conversion alternative, assuming the features you checked above were incorporated. (This means that people that said no, left the question entirely blank!)

Due to the ambiguity of the question formats, these questions do not effectively encapsulate public opinion towards the conversion alternative with and without features that support low-income commuters. In order to complete the statistical analysis of public opinion towards the conversion alternative, we had to retroactively fill in the blank responses with 0's, which somewhat compromises the authenticity of the of survey responses.

Widening and Conversion Alternative Responses by Household Income

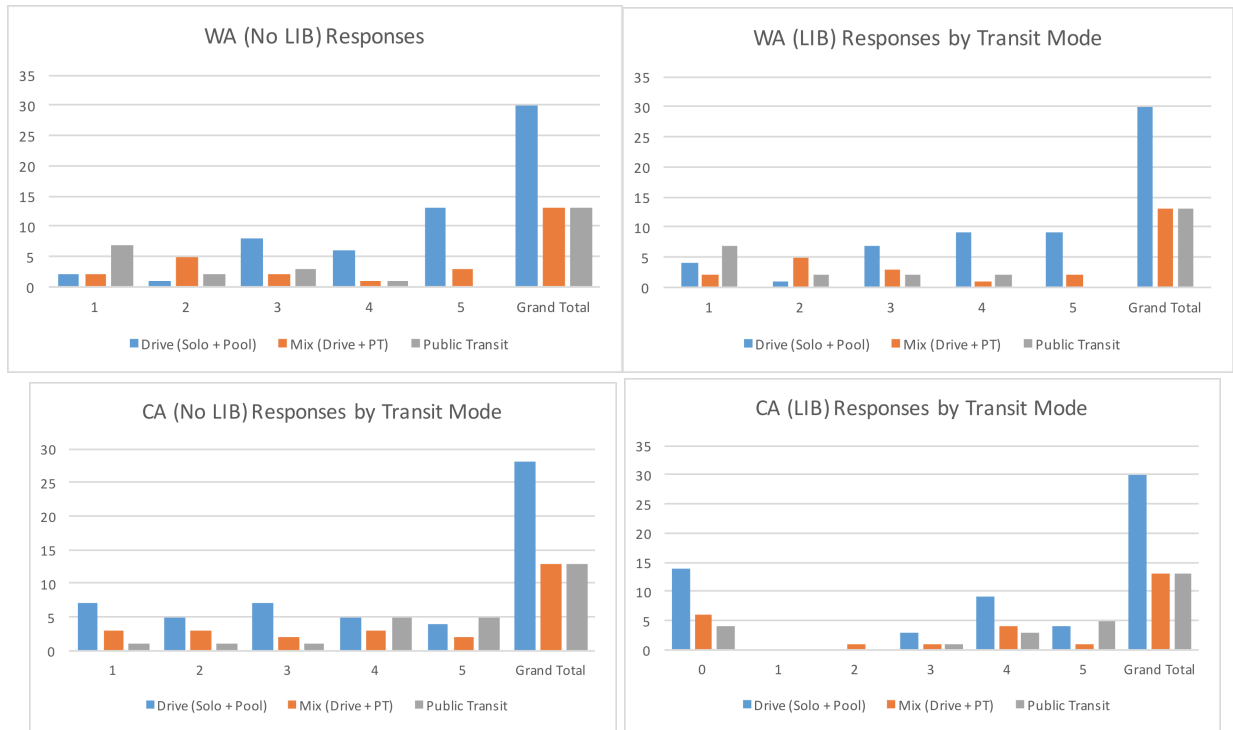
- Overall, we found that there was no statistically significant difference in public opinion among survey respondents with household incomes both below and above \$100K/yr towards the widening alternative, whether or not benefits are provided to low-income commuters. The same is true for the conversion alternative. Generally, public opinion remains the same towards the widening and conversion alternative, whether or not benefits are provided for low-income commuters. *Note: the statistical significance between the pairs of parameters is found using a simple paired t-test for means.*
- For the widening alternative without low-income benefits, the widening alternative with low-income benefits, the conversion alternative without low-income benefits, and the conversion alternative with low-income benefits, the mode = mean = median = 3. In

other words, survey respondents generally have “no opinion” or are “unsure” of the four potential solutions to mitigating traffic congestion along Highway 101 (with the exception of the conversion alternative with low-income benefits as survey respondents were also given the option to respond with “no support” towards it).



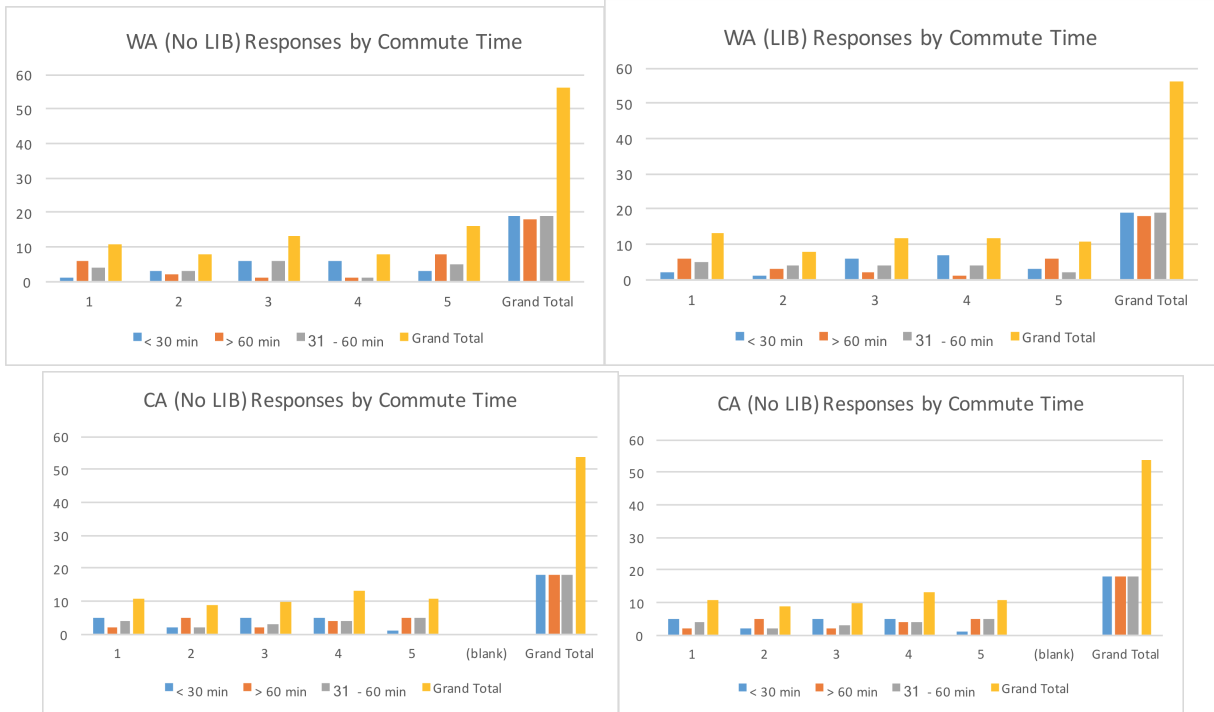
Widening and Conversion Alternative Responses by Primary Mode of Transportation

- Overall, we found that there is no statistically significant difference in public opinion between the widening alternative with or without low-income benefits among *all survey respondents*.
- However, *among all survey respondents*, there appears to be a significant difference in public opinion between the conversion alternative with or without low-income benefits. More analysis will be needed in order to better understand this result. *Note: Due to time limitations, the summary for Widening and Conversion Alternative Responses by Primary Mode of Transportation does not sort statistical significance of survey responses by group as in the summary for the Widening and Conversion Alternative Responses by Household Income. Instead, the Excel worksheet only shows the t-test for all survey responses.*



Widening and Conversion Alternative Responses by Average Commute Time to Work

- Overall, we found that there was no statistically significant difference in public opinion among survey respondents grouped by their average commute time to work with towards the widening alternative, whether or not benefits are provided to low-income commuters. In other words, generally, public opinion remains the same towards the widening alternative, whether or not benefits are provided for low-income commuters.
- The same is true for the conversion alternative, with one key exception. While there is no statistically significant difference in opinion among commuters whose average commute time to work is under half an hour long as well as commuters whose average commute time to work is thirty-one minutes to an hour long, among commuters whose average commute time to work is over an hour long, they are more likely to “Not support”, to have “No Opinion”, or to be “Not Sure” (again, the format of the conversion alternative questions makes it difficult to ascertain survey respondents actual opinion towards the conversion alternative) of the conversion alternative when benefits to low-income commuters are added.



Recommendations Summary ([full recommendation report](#))

Summary of Methodology Recommendations

1. According to field survey observations, we recommend some changes to the survey content. Because of some criticism about leading questions on the survey, we recommend presenting information about the project without making it seem as though we are trying to convince the respondent. Because of difficulty in analyzing incorporating features into express lanes for the conversion alternative, the question of incorporating the listed features should be asked as well for the widening alternative. There also needs to be a question about commuters preferences in regards to HOV2+ vs HOV3+.
2. Due to the ambiguities of the format, we recommend revising the final questions pertaining to public opinion towards the conversion alternative. From field experience, survey respondents have the most trouble understanding the aim of the questions and, from a statistical perspective, it would be more useful if the question were more open for responses or were comparable to the questions asked regarding the widening alternative.
3. We recommend reforming the survey methodology to gain more responses during work hours on field survey days, particularly from workers in the food/ beverage industry, and to record qualitative experiences through utilizing a shorter or an initial five minute, oral survey to record survey respondent anecdotes.

Summary of Survey - based recommendations

1. Because support for the Highway 101 Express Lanes Project is largely neutral, more education and lobbying is necessary to increase public support for Express Lanes.
2. More education on why the conversion alternative might be beneficial to the widening alternative would be helpful though induced demand was outlined as an effect in the survey.
3. Because there is a general lack of support for initiatives that support low income commuters, this suggests that more efforts to change public opinion regarding progressive transportation measures might be necessary.
4. Toll revenues going towards transportation improvements on Highway 101 or parallel routes seems to be the most consistently appreciated aspect of the project, and may serve as a way to garner more public support.
5. Because commuters were supportive of using funds to improve transportation options along Highway 101 and parallel routes, this insight could be used towards other transit advocacy work by TransForm and Friends of Caltrain.
6. Low income commuters have different transportation needs, and this needs to be taken into account in project development and transportation improvement investment, which means that how the project impacts various demographics in the Bay Area needs to be taken into account.

Conclusion

This project was a learning process not only on understanding the complexity of transportation issues in the Bay Area, but also on surveying and collaboration. From the beginning we learned that we have collaborative work styles and worked effectively with each other. As we moved deeper into the project and into the quarter, we had some difficulty in communication, however we learned to keep each other accountable. Our project roles were fluid, but we were also able to contribute to the project process through our strengths. In an snapshot, Amulya kept the team on the project timeline and shared her astute insight on project processes, Victoria lent her technical expertise through statistical analysis and survey experience, Alex contributed through survey technique and insight, and Jacque created graphics and project materials to convey information effectively. Even though we had a short period of time to create and iterate our survey, we learned about the ins and outs about the difficulty of surveying. However, it was exciting to be able to utilize our strengths in this complex project and partner with transportation advocacy experts to create our final deliverables and report.

In this initial phase of the Highway 101 Express Lanes survey process, the Stanford team was able to test the survey in the field on four sites and online through a Google Site, create information graphics about the High Occupancy Toll (HOT) Lane project on Highway 101, and perform a statistical analysis on a sample size of about fifty. The results were enough for the Stanford team to make recommendations for Friends of Caltrain and TransForm to scale up the survey process in the coming months. Our deliverables from this project have been collected and stored in a folder on Google Drive shared with Adina from Friends of Caltrain and Chris from TransForm. These results and recommendations laid out in this report and summarized in the final report aim to convey the information needed to continue getting the insights needed to advocate for the best option in implementing the Express Lanes project on Highway 101. In general, in this initial phase of the survey, the respondents from field visits and from the online survey were generally neutral about the concept of Express Lanes and about benefits for low-income commuters. Because of this general sentiment from the respondents, generally, we recommend to continue to educate Bay Area commuters on HOT Lanes and about the difference between widening and converting a general purpose lane to a HOT lane. There are also a few recommendations on the content and methodology of the survey to create a more streamlined process for field surveying. With these insights on the initial survey results and recommendations on next steps, survey content, and survey methodology, we have great optimism in the scaling up of this survey process and continued advocacy for equitable transportation options through Express Lanes on Highway 101 by Friends of Caltrain and TransForm.