

## **Economic Impact Analysis of the SVRT BART Extension**

**Prepared For:**

**VTA**

**Prepared By:**



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## Purpose of the Study

The Santa Clara Valley Transportation Authority (VTA) commissioned Wilbur Smith Associates to conduct a study to assess the economic impacts of the proposed Bay Area Rapid Transit (BART) to Silicon Valley Project over the analysis period 2008-2030. The Silicon Valley Rapid Transit (SVRT) BART Extension is a 16-mile long extension of the existing BART system. The extension will originate south of the planned Warm Springs BART Station in the City of Fremont in Alameda County (to be implemented by 2013) and extend through the cities of Milpitas, San Jose, and Santa Clara in Santa Clara County using the former Union Pacific Railroad (UPRR). The SVRT Project is scheduled for completion in Fiscal Year (FY) 2016.

The findings from this study are intended to enable decision-makers within VTA to strategically assess the available policy options concerning the SVRT BART Extension investment and to have sufficient information to make key decisions that support and enhance the potential of the corridor as an economic asset to the State of California. Findings of this study include an indication of the general magnitude of the regional economic impacts ensuing from the SVRT BART Extension.

## Scope of Work

The objective of this study is to evaluate the economic impacts of the proposed SVRT BART Extension over the analysis period (2008-2030). Within this evaluation are the estimations of the potential transportation efficiency gains and the long-term economic impacts resulting from (a) travel efficiency gains accruing to highway users and potential SVRT BART users, (b) construction, operations, and maintenance expenditures of the SVRT BART Extension, (c) new land developments at future SVRT BART stations, and (d) an expanded labor market attributable to improved worker mobility and accessibility.

The region analyzed in this study is comprised of Santa Clara, Alameda, Contra Costa, San Francisco, and San Mateo counties, California. Some benefits of the SVRT BART investment are anticipated to spill over (a positive externality) from the immediately impacted geography of Santa Clara County into the adjoining, aforementioned counties. In order to quantify the spillover effect and evaluate as much of the total economic impacts as reasonably possible, Alameda and the remaining aforementioned counties (i.e., Contra Costa, San Francisco, and San Mateo Counties) are considered in the overall study region when modeling the long-term economic impacts of the proposed investment.

## Methodology

The four categories of benefits arising from the SVRT BART Extension include:

1. **Travel Efficiencies**, which are benefits accruing to highway users and potential SVRT BART users upon completion of the extension, as measured in terms of travel-time, vehicle-operating cost, accident, and emission savings.
2. **Construction Impacts**, which are the impacts arising from expenditures on local labor and materials used in constructing the facility.
3. **Operating and Maintenance Impacts**, which are the benefits arising from expenditures on local labor and materials used in operating and maintaining the facility, upon completion.
4. **Strategic Development Impacts**, which are the economic development impacts associated with attracting new land development and retaining business activity due to increased job accessibility and affordable mobility.

Short-term and long-term economic impacts of the proposed SVRT BART Extension are estimated utilizing an economic impact modeling software, developed by Regional Economic Models Inc. (REMI). This economic simulation model has the capability to forecast the impact that a change in an economic activity or policy will have on a region's economy. Impacts measured include changes in gross regional product (GRP), personal income, and employment.

### Travel Efficiency Gains

In estimating the travel efficiencies for highway users and SVRT BART riders, and the ensuing economic implications thereof, the study utilizes the outputs of highway travel and ridership characteristics, provided by VTA and AECOM Consult. The traffic data provided by VTA included vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) for the benchmark years 2005, 2016 (the opening year), and 2030 (the horizon year). Traffic forecasts were provided by vehicle classification (automobiles and trucks); trip purpose (work-related and non-work-related); daily peaks (AM and PM combined) and off-peak; and, total daily VHTs and VMTs for drive alone, two person carpool, three or more person carpool, and trucks. System-wide ridership<sup>1</sup> (boardings) for the baseline year 2005 and the benchmark years 2016 and 2030, which were based on the VTA travel demand model for the six-station SVRT BART scenario and the No-SVRT BART scenario, was provided by VTA. The SVRT BART Extension's annual ridership for the analysis period 2016-2030 was provided by AECOM Consult.

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<sup>1</sup> Including the existing BART system in San Francisco, San Mateo, Contra Costa, and Alameda Counties.

Anticipated gains in travel efficiencies and the pertinent economic impacts included:

- Travel-time savings - Increasing BART ridership reduces auto travel and highway system dependency, which, in turn, reduces highway congestion. Reduced highway congestion potentially reduces travel times for both transit and highway users. Travel-time savings translate into lower operations costs for industries transporting commodities and for business travelers.
- Accident-cost savings - As diverted traffic to transit reduces the number of automobiles traveling on the highway network, the number of accidents is also reduced. Accident savings are quantified through the reductions in productivity losses, property damages, and insurance costs.
- Vehicle-operating cost savings (fuel and non-fuel) - As VMT and VHT are reduced, expenditures on fuel, non-fuel, and related expenses are reduced, as well. However, as these expenses are curtailed from reduced VHT and VMT caused by diverted traffic to transit, riders of the SVRT BART Extension incur an additional cost, which roadway users avoid: transit fares. Therefore, the net-change in costs is used in the analysis. The difference between the vehicle-operating cost savings and the incurred transit fares, if significant enough, provides area residents with an incentive to alter transportation patterns, from driving to the use of the SVRT BART Extension.
- Emission-cost savings - If a significant number of automobiles are removed from the highway system after the completion of the SVRT BART Extension, improvements in air quality for the San Francisco Bay area could be appreciable. Impacts from reduced pollution are entered as inputs into the economic model to examine the total effects on the regional economy.

Lower and upper estimates of highway user benefits are based on changes in the estimation of the VMT and VHT for the analysis period; the duration of peak and off-peak periods; and, fluctuations in fuel prices. The lower and upper values of the economic impacts that the proposed SVRT BART Extension is forecasted to have on highway users is due to changes in the duration of the peak period from two hours (lower values) to four hours (higher values) assuming an average working day of eight hours. Any increase in the duration of the peak period is expected to result in more economic benefits for the whole study region.

Lower and upper estimates of transit user benefits are based on (a) travel time cost values by rail relative to travel time cost by car<sup>2</sup>; (b) the estimated annual cost of driving a personal auto,

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<sup>2</sup> A stated preference survey in Brisbane, Australia, showed that travel time cost by rail was between 12% and 17% lower than travel time cost by car (Todd Litman. *Valuing Transit Service Quality Improvements – Considering Comfort and Convenience In Transport Project Evaluation*. Victoria Transport Policy Institute. May 7, 2007)

depending of the vehicle type<sup>3</sup>; and, (c) a minimum and maximum train size of three and ten vehicles (cars) per train<sup>4</sup>, respectively.

## Construction, Operations and Maintenance Expenditures

In assessing the benefits resulting from the construction, operations and maintenance costs of the SVRT BART Extension over the analysis period 2016-2030, the study utilizes the expenditures on construction, operations, and maintenance activities estimated by VTA. Construction costs utilized in this analysis captures only the hard costs (e.g., site preparation activities, structures, earthwork, maintenance facilities, and vehicles). This analysis does not include planning, engineering, and land or building acquisition costs since these costs do not contribute to the construction industry.

Economic impacts from the SVRT BART Extension to Santa Clara County will initially occur as a result of the actual construction of the facility, as expenditures on construction are of economic value to both the primary impact area (i.e., Santa Clara County) and the neighboring counties. Construction expenditures are of economic value because a large-scale infrastructure development expenditure increases GRP and supports the creation and retention of construction related jobs. Once the construction phase is completed, subsequent expenditures on operations and maintenance activities are required. This will also result in additional economic impacts for these counties. In analyzing the economic impacts of the SVRT BART Extension, the estimated construction, operations, and maintenance expenditures serve as inputs into the regional economic model for analyzing the economic impacts on the study region.

## Land Use Development Impacts

In estimating the strategic development impacts, the study utilizes the possible land use changes that may occur as a consequence of the SVRT BART Extension within a one-quarter mile radius of six future stations in Santa Clara County (i.e., Milpitas Station, Berryessa, Diridon/Arena, Alum Rock, Downtown San Jose, and Santa Clara). According to analysis conducted by Economic Research Associates (ERA), the projected changes within close proximity of the six identified future SVRT BART stations would likely be realized in terms of increased demand for housing<sup>5</sup>, office space, retail space, and hotel rooms. Anticipated changes in the demand for land development in the immediate proximity of the six stations include the reallocation of land use within Santa Clara County and the influx of resources from outside of Santa Clara County. This study focused on the influx of resources since it represents induced development from the SVRT BART Extension.

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<sup>3</sup> APTA 2007 Public Transportation Fact Book, *58th Edition*, American Public Transportation Association, May 2007, pp 39

<sup>4</sup> San Francisco Bay Area Rapid Transit District. Short-Range Transit Plan FY08 through FY17 & Capital Improvement Program FY08 through FY32. August 2007, pp 2-14

<sup>5</sup> In terms of housing, high-density, multi-family housing (e.g., condominiums, townhouses, and cooperatives) is the focal point of the analysis, in line with the ERA study, which points to the fact that low-density, single-family housing is not desirable near train station areas.

The projected demand values were converted into monetary terms, such as costs of constructing the development. Monetized demands were then entered as inputs into the REMI model to determine the corresponding economic benefits resulting from the construction phase of the influx of resources from outside the county, as well as the long-term impacts given the fact that the employment, income, and GRP generated extend beyond the short-term effects of the construction phase.

### **Affordable Mobility Benefits**

Affordable mobility benefits that accrue to residents and workers in the study region are other anticipated benefits resulting from the SVRT BART Extension that will contribute to the economic competitiveness of Santa Clara County. Population groups with a statistically higher propensity to utilize the proposed SVRT BART Extension, based on socio-demographic characteristics and the catchment areas of the proposed SVRT BART stations, were identified for the purposes of determining the extent of the affordable mobility benefits that will accumulate. Affordable mobility benefits accruing to targeted population groups (i.e., low-income people, households without a personal vehicle, minority population, and disabled residents) within one quarter mile catchment area of the SVRT BART Extension, that may likely utilize this alternative mode of transportation as a commuting means, were estimated based on historical U.S. Census data and GIS-based techniques applied to the existing and future BART system in the study area.

Upon its completion, the SVRT BART Extension will complement the regional rail transportation network by connecting the cities of Santa Clara, San Jose, and Milpitas in Santa Clara County with major Bay Area cities in San Mateo, Alameda, and San Francisco counties. Improved transit systems in Santa Clara County have the potential to expand employment opportunities for the workforce in the county by providing an expanded employment market to public transportation users in locations outside Santa Clara County where wages are higher than within the county.

This study estimated the potential increases in wages, as calculated by the annual wage differentials between the wages in Santa Clara and the counties with higher wages accessible via the SVRT BART extension (i.e., San Mateo and San Francisco Counties). The lower estimate represents the income differential difference between San Mateo and Santa Clara Counties while the higher estimate represents the income differential between San Francisco and Santa Clara Counties. Based on these findings, this analysis assumed that the targeted public transportation users who are anticipated to be employed in San Francisco and San Mateo Counties (because of working in areas with higher wages than Santa Clara County) are expected to spend a significant portion (68%) of the increase in their income in Santa Clara County.<sup>6</sup> The additional retail expenditures were input into the REMI models to assess the economic impacts resulting from affordable mobility benefits in Santa Clara County.

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<sup>6</sup> According to the Census Bureau's Consumer Expenditure Survey, roughly 68% of total consumer expenditures were on retail items other than automobiles and associated expenses (e.g., gasoline), in 2005.

## Accessibility Benefits

The new SVRT BART infrastructure is anticipated to lay the foundation for future economic growth via increased worker accessibility. Due to mitigated congestion and increased travel speeds on the roadway network, workers, given designated travel times, are expected to have access to places of employment beyond that which was previously attainable prior to the completion of the public transportation expansion.

In this part of the analysis, the focus is on the accessibility benefits resulting from the SVRT BART Extension to Santa Clara County because of (geographically) expanded available labor markets. A spatial distribution of the main employment generators in Santa Clara County was mapped from Traffic Analysis Zones (TAZs) data, provided by VTA, in conjunction with GIS-based techniques. Main employment generators along the freeway system in Santa Clara County were identified. Main employment generators correspond to the 0.75 (or 75%) quartile and represent 25% of the TAZs with the highest number of jobs in the San Francisco Bay Area and Santa Cruz, Monterey, San Benito, and San Joaquin counties. The geographically expanded labor market was approximated by calculating the difference between the numbers of workers who travel to places of employment via personal vehicle under the BART Scenario and under the No-BART Scenario for the constant, designated travel times.

Retail expenditures on food away from home served as the basis for estimating the economic impacts associated with accessibility benefits resulting from the SVRT BART Extension. For the purposes of this analysis, it was assumed that the additional number of workers with access to main employment generators in Santa Clara County will spend roughly 5.7% of his/her total retail expenditures on food away from home.<sup>7</sup> The additional retail expenditures are input into the REMI model to assess the economic impacts resulting from the improved accessibility to main employment generators in Santa Clara County.

## Concluding Remarks

### Relevant Findings

**Table E 1** and **Table E 2** present the low and high monetary estimates (in 2005 constant dollars) of the overall economic impacts that the SVRT BART Extension is expected to have on the study region. Economic impacts are expressed in constant 2005 dollars, using a constant discount rate of seven percent.<sup>8</sup> In addition, the estimated number of additional jobs, both temporary and permanent, that are likely to be generated in the study region over the analysis period 2008-2030, are presented.

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<sup>7</sup> According to the U.S. Census Bureau's Consumer Expenditure Survey, the average person spends roughly 5.7% of his/her total retail expenditures on food away from home.

<sup>8</sup> The U.S. Office of Management and Budget (OMB) directs federal agencies to use a seven percent discount rate in their base-case analysis of proposed investment; this rate is seen as the marginal pre-tax rate of return on an average investment in the private sector in recent years.

As suggested by the lower estimate, it is anticipated that the SVRT BART Extension will generate an additional \$6.00 billion in GRP, \$2.28 billion in personal income, and \$4.56 billion in travel-time savings to travelers commuting over the analysis period (2008-2030). In addition, it is expected that the SVRT BART Extension will create, on average, 2,415 temporary jobs annually associated with construction activities pertaining to both the SVRT BART Extension and the land use development around the new six stations<sup>9</sup> and 2,426 permanent jobs, on average, annually that are tied to the travel efficiency gains, operation and maintenance of the SVRT BART Extension, induced development, and affordable mobility and accessibility benefits.

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<sup>9</sup> As a result of the influx of resources from outside Santa Clara County.

**Table E 1: Overall Benefits Received as a result of the SVRT BART Extension over the Analysis Period 2008-2030 based on**

Economic Impact	Highway User Benefits	Transit User Benefits	Construction of the SVRT BART Extension	Operations and Maintenance of the SVRT BART Extension	Construction Phase of the Influx of Resources from Outside the County	Influx of Resources from Outside of Santa Clara County	Mobility and Accessibility Benefits	GRAND TOTAL
<b>Low Estimates of the Economic Impacts</b>								
<b>Santa Clara County</b>								
GRP (millions of 2005\$)	\$1,221.00	\$16.61	\$920.25	\$338.66	\$143.82	\$159.12	\$1,680.39	\$4,479.85
Average Annual Temporary Jobs	---	---	1,487	---	119	---	---	1,606
Average Annual Permanent Jobs	571	16	---	468	---	85	503	1,643
Personal Income (millions of 2005\$)	\$251.00	\$5.56	\$598.23	\$199.50	\$90.72	\$66.60	\$327.10	\$1,538.71
Commute travel time savings (millions of 2005\$)	\$2,497.00	\$39.59	---	---	---	---	---	\$2,536.59
<b>Alameda County</b>								
GRP (millions of 2005\$)	\$341.00	\$1.34	\$181.35	\$57.12	---	---	---	\$580.81
Average Annual Temporary Jobs	---	---	259	---	---	---	---	259
Average Annual Permanent Jobs	266	1	---	65	---	---	---	332
Personal Income (millions of 2005\$)	\$79.00	\$0.32	\$110.16	\$26.32	---	---	---	\$215.80
Commute travel time savings (millions of 2005\$)	\$1,116.00	\$2.40	---	---	---	---	---	\$1,118.40
<b>Rest of Bay Area</b>								
GRP (millions of 2005\$)	\$387.00	\$1.15	\$439.47	\$121.66	---	---	---	\$949.28
Average Annual Temporary Jobs	---	---	550	---	---	---	---	550
Average Annual Permanent Jobs	327	1	---	123	---	---	---	451
Personal Income (millions of 2005\$)	\$101.00	\$0.31	\$331.47	\$91.70	---	---	---	\$524.48
Commute travel time savings (millions of 2005\$)	\$899.00	\$2.28	---	---	---	---	---	\$901.28
<b>Study Region</b>								
GRP (millions of 2005\$)	\$1,949.00	\$19.10	\$1,541.07	\$517.44	\$143.82	\$159.12	\$1,680.39	\$6,009.94
Average Annual Temporary Jobs	---	---	2,296	---	119	---	---	2,415
Average Annual Permanent Jobs	1,164	18	---	656	---	85	503	2,426
Personal Income (millions of 2005\$)	\$431.00	\$6.19	\$1,039.86	\$317.52	\$90.72	\$66.60	\$327.10	\$2,278.99
Commute travel time savings (millions of 2005\$)	\$4,512.00	\$44.27	---	---	---	---	---	\$4,556.27

**Table E 2: Overall Benefits Received as a result of the SVRT BART Extension over the Analysis Period 2008-2030 based on High Estimates of the Economic Impacts**

Economic Impact	Highway User Benefits	Transit User Benefits	Construction of the SVRT BART Extension	Operations and Maintenance of the SVRT BART Extension	Construction Phase of the Influx of Resources from Outside the County	Influx of Resources from Outside of Santa Clara County	Mobility and Accessibility Benefits	GRAND TOTAL
<b>Santa Clara County</b>								
GRP (millions of 2005\$)	\$3,228.00	\$33.29	\$920.25	\$338.66	\$310.68	\$347.76	\$1,821.05	\$6,999.69
Average Annual Temporary Jobs	---	---	1,487	---	259	---	---	1,746
Average Annual Permanent Jobs	1,137	36	---	468	---	182	3,932	5,755
Personal Income (millions of 2005\$)	\$508.00	\$12.48	\$598.23	\$199.50	\$191.70	\$137.34	\$405.73	\$2,052.98
Commute travel time savings (millions of 2005\$)	\$4,754.00	\$44.54	---	---	---	---	---	\$4,798.54
<b>Alameda County</b>								
GRP (millions of 2005\$)	\$1,310.00	\$2.11	\$181.35	\$57.12	---	---	---	\$1,550.58
Average Annual Temporary Jobs	---	---	259	---	---	---	---	259
Average Annual Permanent Jobs	531	3	---	65	---	---	---	599
Personal Income (millions of 2005\$)	\$160.00	\$0.58	\$110.16	\$26.32	---	---	---	\$297.06
Commute travel time savings (millions of 2005\$)	\$2,086.00	\$2.70	---	---	---	---	---	\$2,088.70
<b>Rest of Bay Area</b>								
GRP (millions of 2005\$)	\$2,306.00	\$2.72	\$439.47	\$121.66	---	---	---	\$2,869.85
Average Annual Temporary Jobs	---	---	550	---	---	---	---	550
Average Annual Permanent Jobs	878	3	---	123	---	---	---	1,004
Personal Income (millions of 2005\$)	\$496.00	\$0.85	\$331.47	\$91.70	---	---	---	\$920.02
Commute travel time savings (millions of 2005\$)	\$1,759.00	\$2.57	---	---	---	---	---	\$1,761.57
<b>Study Region</b>								
GRP (millions of 2005\$)	\$6,844.00	\$38.12	\$1,541.07	\$517.44	\$310.68	\$347.76	\$1,821.05	\$11,420.12
Average Annual Temporary Jobs	---	---	2,296	---	259	---	---	2,555
Average Annual Permanent Jobs	2,546	41	---	656	---	182	3,932	7,357
Personal Income (millions of 2005\$)	\$1,164.00	\$13.91	\$1,039.86	\$317.52	\$191.70	\$137.34	\$405.73	\$3,270.06
Commute travel time savings (millions of 2005\$)	\$8,599.00	\$49.81	---	---	---	---	---	\$8,648.81

As suggested by the higher estimate, the SVRT BART Extension is expected to generate an additional \$11.42 billion in GRP, \$3.27 billion in personal income, and \$8.65 billion in travel-time savings to travelers commuting over the analysis period (2008-2030). In addition, the SVRT BART Extension is anticipated to generate an annual average of 2,555 temporary construction jobs and 7,357 permanent jobs.

Santa Clara County is expected to be the main beneficiary of the expected economic benefits. Based on the lower estimates, it is anticipated that Santa Clara County will account for 66% of the total benefits, while Alameda and the rest of the Bay Area will account for 14% and 20%, respectively, of the total economic benefits generated by the SVRT BART Extension. Based on the higher estimates, it is anticipated that Santa Clara County will account for 65% of the total benefits, while Alameda and the rest of the Bay Area will account for 13% and 22%, respectively of the total economic benefits generated by the SVRT BART Extension.

Highway user benefits, construction of the SVRT BART Extension, and affordable mobility and accessibility benefits will comprise 86.0% of GRP (32.4%, 25.6% and 28.0%, respectively) based on the lower estimates of the overall benefits. As far as the higher estimates are concerned, these three items will account for 89.4% of GRP with highway user benefits comprising 60.0% of GRP.

The construction activities associated with the new land development around the proposed six SVRT BART stations, due to influx of resources from outside of Santa Clara County (i.e., induced development), are expected to contribute between 2.4% (lower estimate) and 2.7% (higher estimate) of the additional total GRP. In terms of personal income, this activity will account for 4.0% (at the low end) and 5.9% (at the higher end) of the additional total personal income. As far as employment is concerned, this activity will contribute an average of between 4.9% (lower estimate) and 10.1% (higher estimate) per year of the additional total temporary jobs created over the analysis period 2008-2025.

The long-term economic benefits associated with the new land development around the proposed six SVRT BART stations, due to influx of resources from outside of Santa Clara County (i.e., induced development), are expected to contribute between 2.6% (lower estimate) and 3.0% (higher estimate) of the additional total GRP and between 2.9% (at the low end) and 4.2% (at the higher end) of the additional total personal income. As far as employment is concerned, this activity will contribute an average of between 2.5% and 3.5% per year of the additional total permanent jobs created over the analysis period 2008-2025.

Operations and maintenance of the SVRT BART Extension, between 2017 and 2030, is estimated to contribute between 4.5% to 8.6% to the additional total GRP. In terms of personal income, this activity is expected to account for 9.7% to 13.9% of the additional total personal income. As far as employment is concerned, operations and maintenance of the SVRT BART Extension will contribute between 8.9% to 27.0% of average annual employment over the entire analysis period.

An improved and expanded BART system is anticipated to increase passenger mobility and accessibility in the Bay Area. This analysis reveals that the SVRT BART Extension is estimated to generate mobility benefits for the targeted population groups<sup>10</sup> by providing them with an affordable transportation alternative for commuting to work.

Over the analysis period 2017-2030, the average annual number of workers from the four targeted population groups, who are anticipated to commute to work using the SVRT BART Extension in conjunction with the existing BART system, is estimated to be around 30,479 workers. In terms of accessibility benefits, the anticipated expanded labor market will account for 384,420 additional workers per year with access to main employment generators in Santa Clara County for the designated commute travel time (i.e., 30, 45, 60, and 90 minutes) over the analysis period 2017-2030.

Workers who are classified into one or more of the targeted population groups within the catchment areas of the SVRT BART stations are expected to have access to, and use, the SVRT BART to commute to work to neighboring counties that offer higher wages, as compared with Santa Clara County. As a result of creating an affordable transportation alternative, the SVRT BART Extension will contribute to the economic wellbeing of disadvantaged residents of Santa Clara County. This affordable mobility benefit will result in an additional average annual income ranging from \$68.88 million to \$536.16 million over the analysis period 2017-2030. A significant portion of this income (68%) generated from outside of Santa Clara County will be spent on retail purchases within the county, thereby generating additional GRP, jobs, and personal income in Santa Clara County.

The new SVRT BART infrastructure is expected to lay the foundation for future economic growth via increased worker accessibility. A positive change in the size of the labor market, accessible to the main employment generators, given a constant travel time for commuting to places of employment, is suggestive that the SVRT BART Extension will expand the job market in Santa Clara County by providing employment access to more workers, irrespectively of their commute travel time. These accessibility benefits are translated into additional GRP, jobs, and personal income in Santa Clara County from the retail expenditures that workers are anticipated to make in Santa Clara County.

As suggested by the lower estimate, the affordable mobility and accessibility benefits are estimated to generate an additional \$1.68 billion in GRP, 503 annual jobs, and \$327 million in personal income in Santa Clara County, from 2017 to 2030. As suggested by the higher estimate, the mobility and accessibility benefits are estimated to generate an additional \$1.82 billion in GRP, 3,932 annual jobs, and \$ 405.73 personal income in Santa Clara County from 2017 to 2030.

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<sup>10</sup> These target population groups are (1) low income populations; (2) minority population groups; (3) households with no personal vehicle available; and, (4) the disabled population.

## Extensions of Work

Given the exhaustive analyses carried out in this study, several segments exhibit the potential for further investigation. These segments are as follows:

### 1. Travel Time Savings for Freight Trips

In estimating the travel-time savings for freight trips, it was assumed that there were 365 workdays per year. It was further assumed that each workday lasts for 8 hours. While some truck trips are constrained by the operating hours of the businesses receiving the goods being delivered by these trucks, other truck trips are restricted by the business' guidelines on delivery hours. A typical example of the distribution of truck trips by time of day<sup>11</sup> suggest that truck trips extend beyond 8 hours. On average, truck trips extend to 12 hours per day. The conservative estimates presented in Section 5.5.1 of the technical memorandum could be refined in future work based on more information regarding truck travel characteristics in the study region.

### 2. Incidental Costs for New SVRT BART Riders

Some new SVRT BART riders could incur additional costs in the form of parking fees that they need to pay if they park-and-ride to get to their final destinations. This additional cost should be included in the estimation of the potential net vehicle-operating cost (VOC) savings that accrue to riders who park their cars and ride the SVRT BART. If information on parking fees are available, the estimates presented in Section 5.2.2 could be refined. This additional cost is expected to reduce the net VOC savings presented in the aforementioned section.

### 3. Foregone Employment Benefits

As shown in this analysis, the potential benefits resulting from new residential and commercial development around new SVRT BART stations, improves targeted worker's mobility of residents within the SVRT BART catchment areas. Furthermore, the resulting increased accessibility to main employment generators in Santa Clara County will contribute to the attractiveness of Santa Clara County as a place to live and work. The SVRT BART Extension has the potential to create foregone employment benefits for Santa Clara residents who forgo job related trips in the absence of transit services. This subject deserves attention since it contributes to the attractiveness of Santa Clara County. This additional analysis will require information on county population who are not working because of the lack of a means of public transportation to get to work.

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<sup>11</sup> Barber, Gerald. *Aggregate Characteristics of Urban Travel*. The Geographic of Urban Transportation. Second Edition. 1995.

#### 4. Correlation between Accessibility Benefits and Housing Prices

Northern California is home to one of the nation's most expensive housing markets where housing prices are much higher than other regions in the U.S. For Bay Area workers with lower incomes, affordable housing is a major concern. Once the SVRT BART Extension becomes fully operational, people could live further away from their places of work because of the improved accessibility to main employment generators in Santa Clara County.

A useful extension of the present work would be to correlate housing property values in the study region, including rental rates, with the estimated SVRT BART accessibility benefits. The aims of such an undertaking are to determine (whether the improved transit system (access thereto) in the study region allows low-income residents to live further away from their places of employment thereby offsetting the high housing prices in the Bay Area.