

DANVILLE

SAN RAMON

DUBLIN

LIVERMORE

TRI-VALLEY RISING:

Its Vital Role in the Bay Area Economy

PLEASANTON

ACKNOWLEDGMENTS

This report was prepared by the Bay Area Council Economic Institute for Alameda County Transportation Commission. Sean Randolph (President and CEO) oversaw the development of the study. Tracey Grose (Vice President) designed the study and directed the analysis. The research team included Jeff Bellisario (Senior Research Associate), Saori Hamidi (Research Associate), and Alex Foard (Research Associate).

THE BAY AREA COUNCIL ECONOMIC INSTITUTE

Bay Area Council Economic Institute is a partnership of business with labor, government, higher education, and philanthropy that works to support the economic vitality and competitiveness of the Bay Area and California. The Association of Bay Area Governments (ABAG) is a founder and key institutional partner. The Economic Institute also supports and manages the Bay Area Science and Innovation Consortium (BASIC), a partnership of Northern California's leading scientific research universities and federal and private research laboratories. Through its economic and policy research and its many partnerships, the Economic Institute addresses key issues impacting the competitiveness, economic development, and quality of life of the region and the state, including infrastructure, globalization, science and innovation, energy, and governance. A public-private Board of Trustees oversees the development of its products and initiatives.

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ITS VITAL ROLE IN THE
BAY AREA ECONOMY

TRI-VALLEY RISING

An examination of the
Tri-Valley's assets and
the transportation
investments required
for sustaining
economic success



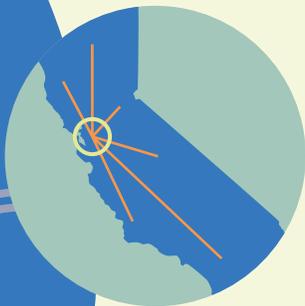
SUPPORTING THE REGION'S
ECONOMIC POTENTIAL WILL
REQUIRE IMPROVING THE
TRANSPORTATION SYSTEMS
THAT CONNECT THE
TRI-VALLEY WITH THE
BAY AREA AND CENTRAL VALLEY

Planned projects and future options:

- Extending BART to Livermore
- Expanding State Route 84
- Adding express lanes to I-580
and I-680 with dynamic pricing
- Adding auxiliary lanes to I-680
between Danville and San Ramon

The Tri-Valley is an integral component of the Bay Area economy. Situated on the east side of the Bay Area, the Tri-Valley encompasses the communities of Danville, Dublin, Livermore, Pleasanton, and San Ramon. With its robust research and development infrastructure and growing entrepreneurial environment, the Tri-Valley region is no longer just a nice place to live – it has become a vital node in the Bay Area innovation system.

The Tri-Valley's highly educated residents work throughout the Bay Area. The area's growing number of businesses and the two national labs located there collaborate with partners across the wider region. But physical constraints that impede the movement of people and goods pose a threat to the Tri-Valley's ability to maximize its economic contribution to the larger region.



High-value collaboration with the rest of the region is on the rise

66% OF PATENTS INCLUDE CO-INVENTORS IN THE WIDER BAY AREA

44% OF VENTURE CAPITAL INVESTMENT COMES FROM BAY AREA FIRMS

The Tri-Valley excels at preparing its youth for future success

GRADUATION RATES
Tri-Valley **95%**
Bay Area **80%**

UNIVERSITY PREPAREDNESS
Tri-Valley **60%**
Bay Area **38%**

The Tri-Valley invests in its distinctive quality of life by protecting open space and expanding other local amenities

155 SQUARE MILES OF PROTECTED OPEN SPACE

Proposed Tri-Valley transportation investments will yield economic benefits for the Bay Area region

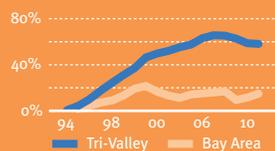
\$840 MILLION IN 2014 TRANSPORTATION EXPENDITURE PLAN INVESTMENTS

\$1.5 BILLION IN ECONOMIC OUTPUT

8,350 FULL-TIME EQUIVALENT JOBS CREATED

The Tri-Valley is growing at a faster rate than the Bay Area as a whole

EMPLOYMENT GROWTH RELATIVE TO 1994



POPULATION GROWN SINCE 2000

Tri-Valley **+20%**
Bay Area **+8%**

Commute volumes from Tri-Valley to San Francisco, Santa Clara, and San Mateo Counties are increasing:

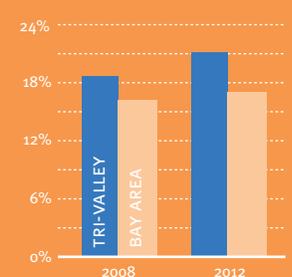
+66% SINCE 2007

Vehicle hours spent delayed per day are increasing on I-580

+26% SINCE 2011

The Tri-Valley is home to highly skilled talent

PERCENTAGE OF ADULTS WITH A MASTER'S DEGREE OR HIGHER



EXECUTIVE SUMMARY

The Tri-Valley is an integral component of the Bay Area economy. Situated on the east side of the San Francisco Bay Area and located within the I-580 gateway corridor, the Tri-Valley is a reference to its location that includes the Amador Valley, Livermore Valley, and San Ramon Valley. The Tri-Valley region encompasses the cities of Dublin, Livermore, and Pleasanton in Alameda County and the Town of Danville and the City of San Ramon in Contra Costa County. With its robust research and development infrastructure and its growing entrepreneurial environment, the Tri-Valley region is no longer just a nice place to live—it has become a vital node in the Bay Area innovation system.

The Tri-Valley's highly educated residents work throughout the Bay Area. The area's growing number of businesses and its two national laboratories collaborate with partners across the wider region. But physical constraints impeding the movement of people and goods pose a threat to the Tri-Valley's ability to maximize its economic contribution to the larger region.

The more connected the Bay Area population is with the multiple job centers in the region, the more flexible the region's economy can be in connecting skilled workers with appropriate jobs. Investing in the efficient movement of people is especially critical as the region's housing costs grow and as residents are pushed out of job centers in search of more affordable housing options. Longer commute distances place new burdens on the region's public transit systems and highways. And the highways linking the Central Valley with the Port of Oakland are becoming more congested as goods movement grows and agricultural exports increase.

THE TRI-VALLEY'S INNOVATION ASSETS ARE DRIVING ITS ECONOMY. With its highly skilled population, its strong growth in commercial activities connected to the two national labs, and its proximity to the rest of the Bay Area, the Tri-Valley is cultivating start-ups locally and attracting companies from other regions.

The Tri-Valley is growing at a faster rate than the Bay Area as a whole. Over the last two decades, the Tri-Valley has experienced an influx of people and jobs—population and employment are both growing faster in the Tri-Valley than in the broader region.

Between 2000 and 2012, the Tri-Valley's total population expanded by 20 percent, more than double the rate for the broader Bay Area.

Over that same period, the Tri-Valley added approximately 40,000 jobs – increasing employment by 21 percent – while job growth in the Bay Area has been 3 percent.

The Tri-Valley's business mix is diverse, and technology represents a growing area of activity. Technology-related industries have made significant employment gains in the last decade. Additionally, the information technology sector has proved resilient; its employment numbers since the recession have remained strong even as other industries have contracted. The national laboratories are spinning out start-ups based on lab research, and they are attracting other companies to the area as research partners.

The Tri-Valley has built an attractive business climate. By successfully leveraging the area's assets, the Tri-Valley has drawn in new businesses and corporate offices. Most notably, the concentration of small, standalone firms in the Tri-Valley has climbed. These independent firms account for 58 percent of the area's total employment.

KEY BAY AREA TRANSPORTATION ROUTES TRAVEL THROUGH THE TRI-VALLEY. Commuters move to, from, and through the Tri-Valley as it grows as a population and job center, and agricultural products move from the Central Valley to the Bay Area's primary port in Oakland and to inland distribution centers via the Tri-Valley.

The I-580 freeway serves as a significant regional and interregional commuter route, and it is also a major gateway for goods movement to and from the Bay Area's seaports. The I-580 corridor is one of the most heavily congested highway routes in the Bay Area. From 2011 to 2013, average daily vehicle hours of delay on I-580 through the Tri-Valley grew by nearly 26 percent. A portion of these delays is associated with truck traffic, as the I-580 corridor experiences the second-highest volume of truck traffic in the Bay Area. Trucks make up between 5 and 12 percent of all vehicle volume on I-580 in the Tri-Valley.

More than three-quarters of Tri-Valley residents who work commute to either Alameda or Contra Costa Counties to their place of business. With much of the Tri-Valley's working population remaining within the East Bay, 75 percent of working residents drive alone to work – higher than the Bay Area average of 67 percent. The opening of the West Dublin/Pleasanton BART station in 2011 has improved BART ridership within the Tri-Valley in recent years and has given another commute option to workers traveling between San Francisco and the Tri-Valley. Approximately 66 percent of the riders who moved through the two Tri-Valley BART stations in December 2013 were traveling to or from San Francisco.

As the Central Valley grows as a jobs and distribution center, pressure on I-580 and other transportation systems will increase. There is a significant flow of workers commuting into or through the Tri-Valley from the east. The population of neighboring San Joaquin County has increased by 24 percent since 2000, exceeding 700,000 in 2012. Over 42,000 of those residents commuted into the nine-county Bay Area in 2012, with many taking I-580 as their route through the Tri-Valley. Numerous companies are also locating new distribution facilities in San Joaquin County to take advantage of relatively low land costs and its proximity to highway links, railroads, and multimodal facilities.

HIGH-VALUE CONNECTIONS BETWEEN THE TRI-VALLEY AND THE BROADER REGION ARE GROWING, SUPPORTING INNOVATION AND ECONOMIC VITALITY IN THE BAY AREA. The Tri-Valley is cultivating new economic opportunities through its deep connections with the rest of the Bay Area, including labor flows, collaboration with regional partners, and investment flows.

Tri-Valley inventors are collaborating with inventors located across the Bay Area in advancing technology. In 2012, 886 patents were registered to primary inventors located in the Tri-Valley, representing significant growth over the last 20 years.

The Tri-Valley accounts for 5 percent of all Bay Area patents, a percentage that has remained relatively stable.

Increasingly, these patents have been registered with co-inventors located in other parts of the Bay Area. In 2012, 66 percent of all patents with a Tri-Valley inventor named were products of regional collaboration.

Lawrence Livermore National Laboratory's commercial licensing activity leads all other federal labs. Of the lab's more than 900 licensing agreements signed since 2001, 76 have been with Bay Area-based companies.

Sandia National Laboratory projects have been associated with 95 new companies since 1994, some as spin-offs and incubator creations.

The Tri-Valley is attracting increasing venture capital investment from around the Bay Area. In 2012, the East Bay's 925 area code (which comprises all of the Tri-Valley and surrounding parts of Contra Costa County) ranked 19th in venture capital investment in the United States. The Tri-Valley outpaces better-known innovation areas such as North Carolina's Research Triangle on this metric.

Growing interdependence with the rest of the Bay Area is demonstrated in increasing commute flows and rising travel distances. The total number of Tri-Valley commuters has grown by 3 percent from 2007 to 2012, and more residents are commuting longer distances to work. The number of Tri-Valley commuters traveling to Santa Clara, San Francisco, and San Mateo Counties increased 20 percent over this period.

HIGH QUALITY OF LIFE IS A LARGE PART OF TRI-VALLEY'S COMPETITIVE ADVANTAGE.

The Tri-Valley attracts high-value businesses—including corporate headquarters—through the high quality of life it offers residents.

Companies in the Tri-Valley are able to tap into a highly educated population within the area as well as across the Bay Area. Tri-Valley firms and the national labs hire highly skilled graduates from universities across the Bay Area, and they contribute to educational programs in the region. The area also attracts increasing numbers of foreign-born science and engineering professionals.

The percentage of adults in the Tri-Valley with at least a master's degree increased from 16 to 21 percent between 2000 and 2012, exceeding the rate of growth for the region overall.

By multiple measures, the Tri-Valley is outperforming the rest of the region in preparing its youth for success. The Tri-Valley has maintained high school graduation rates of 95 percent, and 60 percent of graduates are prepared for college.

Easily accessible protected space is abundant. With 99,000 acres (155 square miles) across the area set aside as open and mixed public access parkland, the Tri-Valley accounts for 10 percent of the 1 million acres of protected land in the Bay Area. The Tri-Valley also boasts one of the longest trails in the Bay Area, the Iron Horse Regional Trail, which runs 32 miles from Concord south through the Dublin/Pleasanton BART station to eastern Pleasanton.

IMPROVING TRANSPORTATION SYSTEMS BETWEEN TRI-VALLEY AND THE BROADER REGION WILL SUPPORT GROWING ECONOMIC ACTIVITY AND STRENGTHEN THE BAY AREA'S COMPETITIVENESS.

Economic growth in the Tri-Valley is in part dependent on its capacity to support the increasing number of high-value connections with Silicon Valley and the broader Bay Area.

The Tri-Valley's growing population and the increase in the number of jobs over the last decade have driven the need for new infrastructure projects. Although housing and corporate campuses have been built, the transportation infrastructure that is necessary to fully support them has lagged behind. Numerous Tri-Valley cities are carrying out plans to develop denser housing and better linkages with public transportation in order to better utilize land near transit centers.

The Tri-Valley has implemented numerous policies that will support the growing movement of people and goods in the Bay Area. The five local Tri-Valley governments and Alameda and Contra Costa Counties have come together to form the unique Tri-Valley Transportation Council to provide initial funding for regional transportation projects, including:

I-680 auxiliary lanes, allowing drivers to more easily enter and exit the highway, between Danville and San Ramon;

State Route 84 expansion, connecting I-580 at west Livermore to I-680 south of Pleasanton; and

I-580 and I-680 express lanes, allowing for dynamic pricing and better traffic flow.

Plans to extend BART to Livermore would offer a more seamless connection between the Tri-Valley and the broader Bay Area. The extension has the potential to strengthen a key transportation link, especially in light of the heavy traffic on I-580, the growing flow of workers out of the Central Valley, and the importance of the corridor to agriculture and shipping. Drivers on I-580 will benefit from a new station in Livermore, as it will likely lead to a decrease in the number of vehicles traveling to the Dublin/Pleasanton BART station. An extension of BART will also benefit the trucking industry, as reduced congestion on I-580 will lead to faster goods movement.

Projects impacting the Tri-Valley have strong representation in Alameda County's 2014 Transportation Expenditure Plan. Tri-Valley transportation projects are slated to receive over \$840 million in funding, including \$400 million for the extension of BART to Livermore. These expenditures will create new jobs, the earnings from which will be recycled back into the regional economy. The total projected economic impact of the \$840 million investment in Tri-Valley transportation programs and projects associated with the 2014 Transportation Expenditure Plan exceeds \$1.5 billion. Additionally, over 8,350 new full-time equivalent jobs will be produced from spending related to construction, maintenance, and operation of these programs.

INTRODUCTION

The Tri-Valley region's rolling landscape of oak trees and grassy hills is host to vineyards, diverse outdoor activities, and a burgeoning high-tech economy. The five communities of Danville, Dublin, Livermore, Pleasanton, and San Ramon, located on the eastern side of the Bay Area, offer a high quality of life while maintaining deep ties with key industries in tech-heavy Silicon Valley and the broader Bay Area.

With its research and development (R&D) infrastructure and its growing entrepreneurial environment, the Tri-Valley is no longer just a nice place to live—it has become a vital node in the broader Bay Area innovation system. As the two national labs in the region, Lawrence Livermore National Laboratory and Sandia National Laboratory, expand the commercial uses of their facilities and the applications of their R&D, the Tri-Valley can expect to see growing business activity and an increasing movement of people and goods between the region and the rest of the Bay Area.

Many of Tri-Valley's highly educated residents work outside the region, and an increasing number of workers are commuting into the Tri-Valley as local business activity grows. Moreover, the region serves as an important conduit for commuters from the Central Valley, as well as for high volumes of agricultural goods destined for domestic and international markets via the Port of Oakland. Given these developments, the Tri-Valley's transportation infrastructure serves the essential role of linking people, goods, and ideas to other parts of the Bay Area. If the Tri-Valley's growth trajectory continues, infrastructure improvements will be critical to sustaining this economic activity and its regional connectivity.

Building on prior research as well as through original analysis and stakeholder interviews, this report examines the unique value the Tri-Valley brings to the Bay Area economy and how it is changing. The report addresses the following questions:

How is the Tri-Valley economy changing?

How are the region's innovation assets developing?

How is the region linked to Silicon Valley and the broader Bay Area?

How is the Tri-Valley's transportation infrastructure enabling sustained economic growth?

How is the region positioning itself for success in the future?

Section 1 examines the Tri-Valley's growing innovation assets. Section 2 explores the connections between the Tri-Valley and the broader Bay Area, considering how local economic value is generated through the region's linkages across its assets. Section 3 highlights the Tri-Valley's appeal as a location for business. Section 4 tracks a series of measures for how well economic gains are translating into increasing standards of living and competitive advantage. Section 5 addresses transportation and its importance in connecting the Tri-Valley's assets to the Bay Area. And Section 6 outlines a number of plans in place for supporting the growing interdependencies of the innovation assets located in the Tri-Valley with the broader regional innovation ecosystem. Throughout the report, examples of innovation in both business and government policy are also presented.

GROWING ECONOMIC ASSETS

Assets alone do not determine the success of a region, but they contribute to a fundamental foundation for economic vitality. Innovation assets, such as a talented workforce, R&D capacity, and a diverse business base fuel an entrepreneurial process and create new opportunities and linkages in the regional and global marketplace. As the Tri-Valley area develops as an economic center, these assets can be further leveraged and greater value can be generated through synergies, both within the Tri-Valley and in the broader Bay Area. This section identifies those assets that give the Tri-Valley crucial importance in the Bay Area.

KEY INSTITUTIONAL ASSETS

The Tri-Valley has developed numerous economic assets, including major company headquarters, two national labs, and various programs that facilitate integration between the laboratories and the business community. These anchor institutions serve as important drivers of economic growth in the region, employing Tri-Valley residents, producing business start-ups, attracting new businesses, and cultivating a vibrant innovation economy.

MAJOR CORPORATIONS

From telecommunications to consumer packaged goods, the businesses in the Tri-Valley are varied, and the Tri-Valley serves as the headquarters for many major companies. The region is able to differentiate itself from other destinations by offering businesses the ability to house large workforces. The Tri-Valley's ample land availability has allowed for the construction of corporate campuses, office parks, and business centers in close proximity to local amenities and transportation. A combination of affordable workspace, access to the region's highly educated labor pool, and proximity to the larger region has made the Tri-Valley home to some of the nation's largest companies.

The corporate headquarters of multinational energy giant **Chevron Corporation**, which employs over 3,500 employees, is located in San Ramon.

Safeway, the second-largest supermarket chain in North America; medical device maker **Thoratec**; and **Workday**, a human capital management software vendor, are headquartered in Pleasanton.

Ross Stores, the third-largest off-price retailer in the United States, operates out of Dublin.

US Foods, a foodservice distributor and the 13th-largest private company in the U.S., manages its Northern California distribution services in Livermore.

Additionally, numerous major companies in a broad range of industries conduct significant operations in the Tri-Valley, including **Oracle Corporation** (via its acquisitions of PeopleSoft and Taleo), **SAP** (via its acquisition of Sybase), **AT&T**, **Cisco Systems**, **Sage Software**, **Kaiser Permanente**, **Clorox**, **Pacific Gas & Electric**, **United Parcel Service**, **General Electric**, **Toyota**, **EMC**, **Roche Molecular Systems**, **Robert Half International**, **Epicor**, **IBM**, and **Accenture**. These companies are also among the top employers in the Tri-Valley region.^{1,2} As these companies grow and expand their employment bases, the region will continue to attract a growing number of workers from other cities in the Bay Area.

NATIONAL LABORATORIES

In addition to the economic benefits of having many major companies located in the Tri-Valley, the area also benefits from the operations of two national laboratories—**Lawrence Livermore National Laboratory** (Lawrence Livermore, LLNL) and **Sandia National Laboratories' California site** (Sandia/CA). LLNL is most noted for its leadership in high-performance computing—it houses Sequoia, one of the world's fastest supercomputers—and for its leadership in lasers and optics—it is home to the National Ignition Facility, a 192-beam laser that is the largest in the world. It is also known for the recent discovery of *livermorium*, a chemical element. Originally funded to safeguard the U.S. nuclear arsenal, these world-class research institutions have broadened their focus to include commercial applications.

LLNL's scientific research has generated significant economic benefits in the broader community, as new advances have been incorporated into numerous products and technologies. As of 2012, the sales of these products and technologies have exceeded \$300 million.³ Many of these developments have been commercialized by Bay Area companies outside of the Tri-Valley.

Aside from their significant contributions across a range of science and engineering fields, both laboratories invest in the surrounding community through partnerships with schools, universities, and various charitable giving programs. Both laboratories support educational programs that help schools develop better science curricula and encourage students to pursue scientific research.

Their facilities are located adjacent to each other in Livermore, and both labs employ large numbers of scientists, engineers, and technicians. Lawrence Livermore, with an annual budget of \$1.5 billion, employs approximately 6,000 at its campus, with almost half of these employees residing in the Tri-Valley. Sandia employs another 1,200 workers.

REGIONAL COLLABORATIVE EFFORTS

There are multiple efforts under way in the Tri-Valley that aim to bring business and researchers together to spur technological advances and to encourage the continued development of the area's innovation system.

Innovation Tri-Valley Leadership Group (ITV) was formed in 2010 by a group of business leaders committed to organizing an effort to interconnect the businesses, research labs, educational institutions, and civic leaders of the Tri-Valley. ITV creates programs to attract new businesses, help existing businesses expand, fill workforce opportunities, and brand the Tri-Valley as an attractive region in which to work and live. After studying the efforts of other successful regions, ITV has developed a plan with three pillars:

Business Innovation: Attract businesses and jobs to the region.

Cultural Innovation: Develop an innovative workforce by connecting high school students with universities and enrich the quality of life through the support of cultural amenities.

Public-Private Innovation: Better leverage intellectual property and advocate for greater infrastructure investment in the region.

ITV has formed committees around each of these pillars—marketing, business and membership, quality of life, and education—with the aim of increasing public engagement, improving access to education and health care services, and promoting Tri-Valley's innovation ecosystem. Specifically, ITV has been instrumental in facilitating cross-sector collaboration and has accomplished the following tasks as it moves to create a more unified economic development effort in the area:

Developed a website and mobile platform that allows partners to share information about their contributions to the Tri-Valley's innovation activity.

Created a plan to maintain assets and address gaps in the innovation environment through industry-focused committees.

Established links between business and education by conducting a survey to assess the workforce readiness of the Tri-Valley's student population and by fostering the development of internships at area companies.

Promoted professional development programs for math and science teachers at the national laboratories and innovation-focused businesses.

Advocated for collaborations that support Tri-Valley businesses in scaling up, such as the Bridgelux/Livermore/Chevron partnership detailed later in the report.

Created the annual Innovation Forum in conjunction with the Livermore Valley Chamber of Commerce and helped to produce TEDxLivermore and Startup Weekend, a program matching young entrepreneurs with venture capitalists.

For 2014, ITV's projects include organizing a forum around health care and medical technology, completing a pilot initiative for business permit streamlining that includes new state legislation, exploring opportunities for more university extension courses, enhancing offerings of pediatric health care services in the area, and advocating for an extension of BART to Livermore.

Livermore Valley Open Campus (LVOC), a joint venture between LLNL and Sandia, is a newly opened research and development area to encourage lab collaboration with external partners in academia and industry. This expanding area will facilitate the growing cooperation with industry in the areas of high performance computing, cyber security, combustion research, transportation research, advanced manufacturing, and climate and energy research. LVOC works with commercial entities from large companies to start-ups. LVOC facilities include the Combustion Research Facility, managed by Sandia, and the High Performance Computing Innovation Center, managed by Lawrence Livermore.

The Innovation for Green Advanced Transportation Excellence (i-GATE) is the Tri-Valley portion of the California Innovation Hub (iHub) program launched in 2010. The iHub program aims to boost California's national and global competitiveness by stimulating partnerships, economic development, and job creation around specific research clusters through state-designated iHubs. In the Tri-Valley, i-GATE promotes collaborations between LLNL, Sandia, government, universities, and business. It also acts as a business incubator for the labs. While its original focus was to support developments in green transportation and clean energy, i-GATE now provides a wide range of support for start-ups, such as offering research and development space and facilitating the licensing of LLNL and Sandia technologies. Four of the five Tri-Valley cities are partners in this endeavor.

I-GATE: FOSTERING NEW BUSINESS GROWTH WITH THE NATIONAL LABS

i-GATE is focused on identifying high-potential ventures and increasing their likelihood of success by facilitating strategic partnerships in a dynamic environment for interaction. A one-stop support center for start-ups, such as Dreambox and VIRES Aeronautics, i-GATE has graduated five startups over the past year, which collectively raised over \$4 million in seed investment.

dreambox

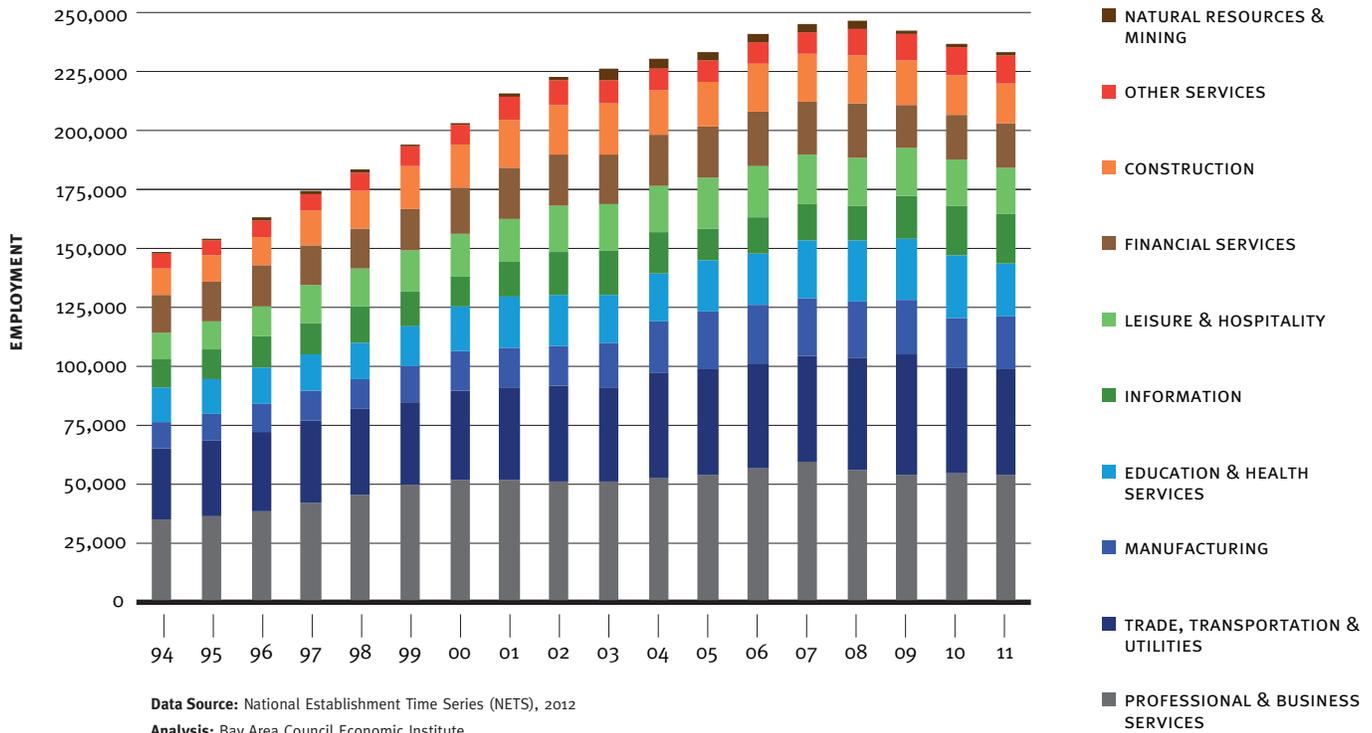
Dreambox LLC, the creator of the first automated 3D printing vending machine, utilized i-GATE's research and development space, the expertise of LLNL researchers, and the opportunity to present the prototype at an i-GATE vendor expo. Because of this support, Dreambox was able to successfully develop a working prototype of its 3D printing vending machine that allows users in businesses, schools, and retail locations to print objects from their own designs or from selections from an online store. Dreambox's founders are now utilizing this technology under the moniker Twindom, which prints miniature 3D likenesses. Its affiliate in the developing world, called Dreambox Emergence, is opening access to production capabilities through its self-sufficient 3D printing units.

VIRES AERO

VIRES Aeronautics, founded in 2012, has developed a proprietary wing design. By increasing lift and decreasing drag, the new design creates wings that are more efficient than conventional wings. i-GATE provided the start-up environment, allowing VIRES to garner technical support, obtain capital, develop its first prototype, and speed its path to commercialization. VIRES's wing design can be used to retrofit legacy aircraft, enabling faster takeoff and landing, increasing payload capacity, improving maneuverability, extending range, and reducing fuel consumption. It is also the foundation for a new construction of low-cost, easily manufactured unmanned aerial vehicles. In February 2014, VIRES received \$1 million in venture funding to scale its work in the burgeoning commercially operated drone market.

EMPLOYMENT BY SECTOR

Tri-Valley



BUSINESS BASE: DIVERSITY, CONCENTRATION, AND TRENDS

The Tri-Valley's economy is not solely driven by the presence of the national laboratories and the technologies they are exploring. The area has long been home to the headquarters of large corporations, and it continues to attract employers with its strong labor pool, central Bay Area location, diverse housing mix, and relatively affordable office space. The Tri-Valley also contains two large business parks, Bishop Ranch in San Ramon and Hacienda in Pleasanton, which together house approximately 20 million square feet of office space. The Tri-Valley's business base is diverse, which has helped to buffer the region from recent downturns. From 1994 to 2008, the Tri-Valley added nearly 100,000 jobs across all sectors. Over this period, employment expanded by 65 percent, with strong growth in manufacturing and construction. In comparison, Bay Area employment grew by 17 percent over the same period.⁴

Since 1994, jobs in information—including those related to software, telecommunications, publishing, and data processing—have increased by 86 percent, outpacing the rate of growth for all jobs in the Tri-Valley, indicating that the information technology sector has taken a greater foothold in the region. While total Tri-Valley employment dropped 4 percent between 2008 and 2011 (with the largest losses in financial services, education, and health services), the information sector witnessed job gains of 51 percent over the three-year period.

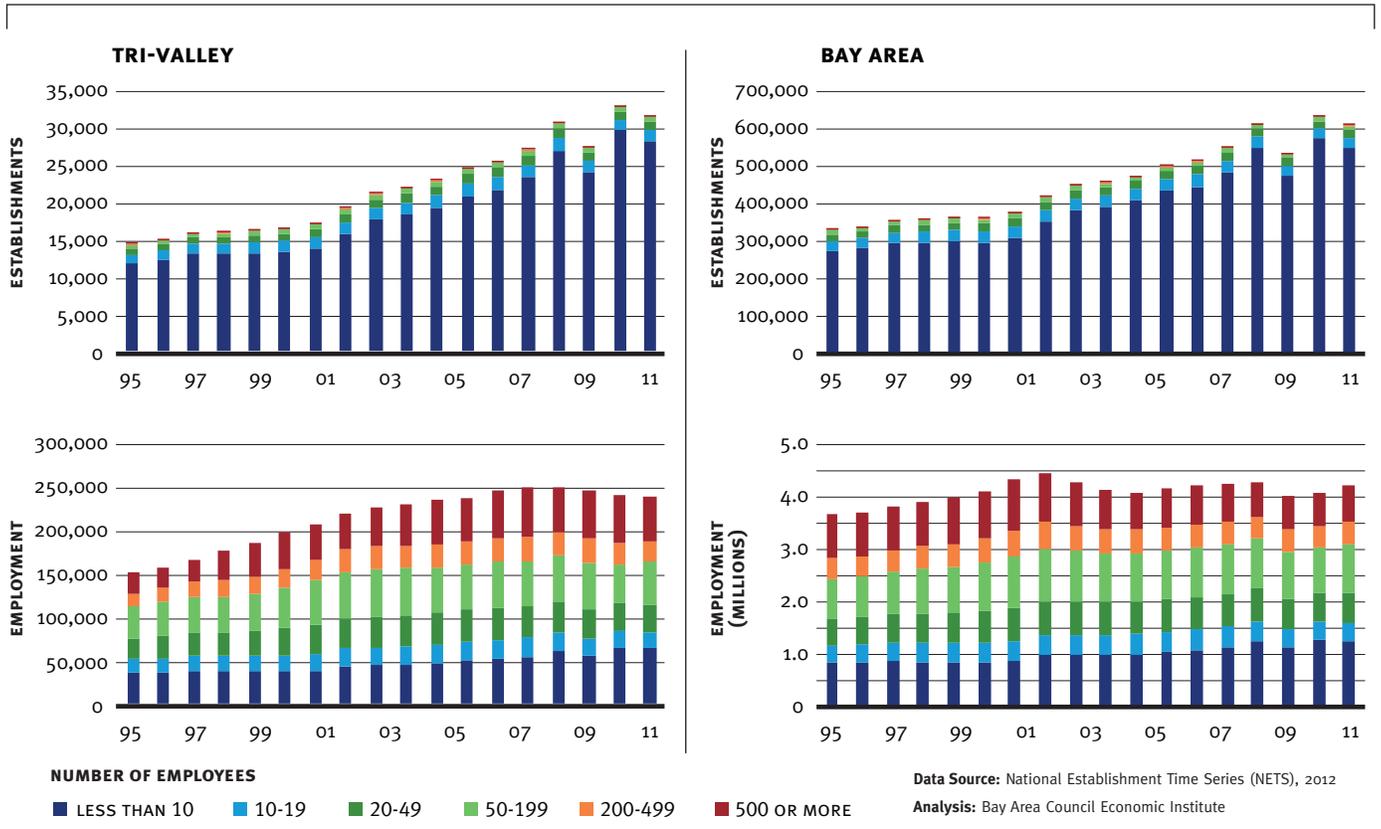
CITY SPOTLIGHT: PLEASANTON AND THE CAR-SHARING PROGRAM AT HACIENDA

As Pleasanton's largest business center, Hacienda covers 875 acres and comprises nearly 60 percent of Pleasanton's office and flex building inventory. It combines 7.5 million square feet of office and flex space with nearly 900,000 square feet of retail space and approximately 1,500 residential units.

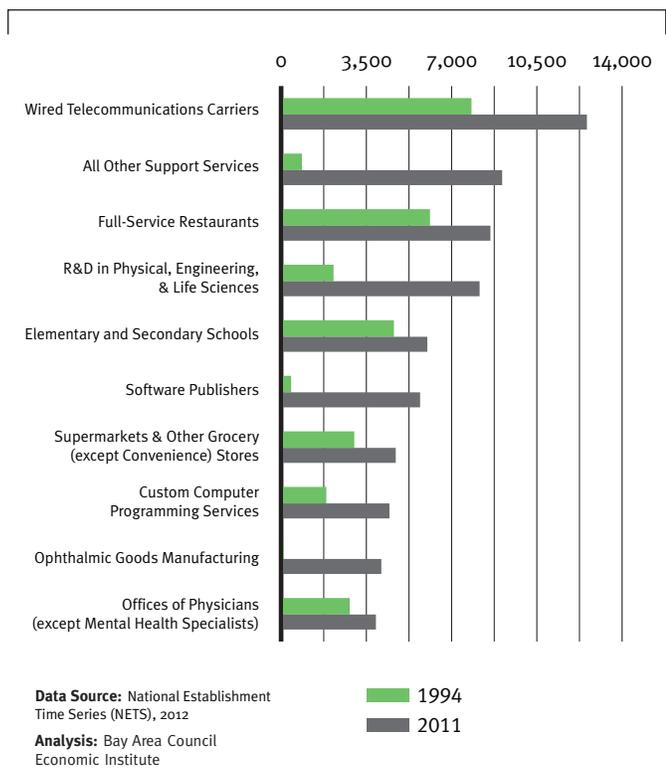
In September 2013, Toyota and the nonprofit City CarShare launched a new car-sharing program at Hacienda called DASH. It is a three-year pilot program that is offering short-distance transportation options for employees who rely on carpool, vanpool, or public transportation. Toyota has provided 30 emission-free Scion iQ electric vehicles—only 100 exist worldwide—for the DASH program. These cars are located at charging stations scattered around the business park. The cars in the program allow employees to attend local meetings or run errands in the area surrounding Hacienda. It is hoped that DASH will encourage single-car commuters to use public transit, join a carpool, or become car-sharing members.

BUSINESS SIZE

Employment and Establishments in Tri-Valley and the Bay Area



TOP TEN TRI-VALLEY INDUSTRIES BY EMPLOYMENT



The top employers span a mix of technology and population-serving sectors. The largest employment segment in 2011 was wired telecommunications carriers, employing over 12,500 people. This is nearly all attributable to AT&T's regional headquarters in San Ramon.⁵

Three technology industries have reported significant employment gains since 1994: R&D in physical, engineering, and life sciences; software publishers; and custom computer programming services. Combined, these three industries expanded by a factor of three over 1994. While employment in software has receded since its peak in 2002, jobs related to computer programming and technology R&D have remained stable over recent business cycles.

The Tri-Valley's business base is primarily composed of very small firms. This reflects the trend nationwide, as well as the trend in the Bay Area.⁶ Firms with fewer than 10 employees comprise 90 percent of all establishments in the Tri-Valley, up from 82 percent in 1994. In the Bay Area as a whole, small firms have similarly seen their share increase from 83 percent in 1994 to 90 percent in 2011. Tri-Valley establishments with fewer than 10 workers are most highly concentrated in the professional services, health care, real estate, and construction industries.

In terms of employment, very small businesses have accounted for a growing percentage of jobs in the Bay Area since 2000, with their share increasing from 20 percent to nearly 30 percent of employment in 2011. In the Tri-Valley, the addition of 6,000 new jobs from small establishments since 2009 has pushed their concentration to nearly 27 percent of all employment.

In the Bay Area as a whole, the percentage of jobs in large firms dropped from 20 percent to 15 percent between 1994 and 2011. In the Tri-Valley, however, the share of jobs in large firms with more than 500 employees increased from 16 to 22 percent from 1994 to 2011. In absolute terms, the number of people employed in large firms has more than doubled since 1994. Large employers, such as Kaiser Permanente, Chevron, and Clorox, frequently seek campus-like settings, and hence move out of denser metro areas into regions like the Tri-Valley.

TALENT DEVELOPMENT AND ATTRACTION

The Tri-Valley is a magnet for highly skilled people who come to the region to work at the national labs, corporate headquarters, and entrepreneurial ventures. The area also boasts some of the highest levels of educational attainment for its youth. Thus, the Tri-Valley is both attracting world-class talent and cultivating world-class talent locally.

A HIGHLY EDUCATED POPULATION

The ability to attract top talent from around the country and world is an important indicator of regional economic vitality. The Bay Area is one of the most highly educated regions in the United States. Within the region, educational levels are highest in Silicon Valley⁷ and the Tri-Valley, and they have increased at a faster rate in the Tri-Valley than in the rest of the region since 2000.

In the Tri-Valley, the percentage of adults (ages 25 or older) with at least a master's degree increased from 16 to 21 percent between 2000 and 2012.

In Silicon Valley, this share of the population rose from 16 to 19 percent.

In the Bay Area overall, this share increased from 14 to 17 percent.

The strong growth of Tri-Valley's skilled workforce can be explained in part by an influx of highly educated workers. During this period, population growth in the Tri-Valley outpaced growth in the broader region. Between 2000 and 2012, the total adult population expanded by 22 percent in the Tri-Valley, more than double the rates for Silicon Valley and the Bay Area. Since 2000, the total population in the Tri-Valley has increased by 57,000 to 338,725.

Across all three areas, the percentage of the population with less than a four-year degree has dropped since 2000. Receding by 9 percentage points, this population has dropped faster in the Tri-Valley than in Silicon Valley (where it dropped by 4 percentage points) or in the Bay Area (where it fell by 5 percentage points).

HEALTHCARE TECHNOLOGY CLUSTER

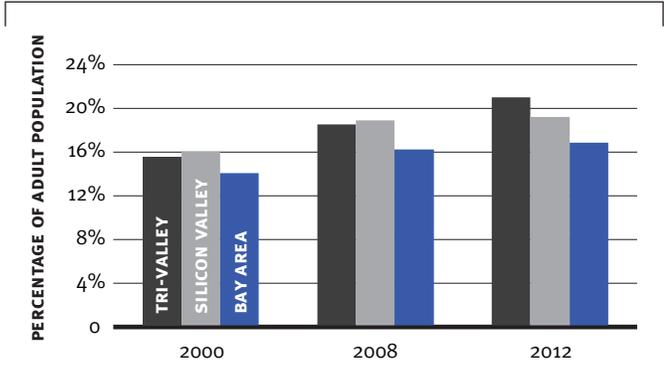
As advanced technologies become more intertwined with the health care industry, the Tri-Valley is building its reputation as a hub of innovation in health care technology. Employment in the medical, dental, and hospital equipment sector is 2.8 times more concentrated in the Tri-Valley than in the Bay Area. While small companies are leading this charge, Tri-Valley's roots in health care technology can be traced back to **Kaiser Permanente**. The medical provider employs 5,000 people at its Pleasanton technology campus, which is home to the largest civilian electronic medical records system in the world.

Smaller employers are also making national inroads in the growing field of health care technology from headquarters in the Tri-Valley. **HealthTell**, located in San Ramon, is an early stage company that is developing new tools for individuals to monitor their health status. Its OneTest technology allows users to check for over 30 illnesses, ranging from cancer to infectious disease, with only a single drop of blood.

Title21 Software provides highly configurable and scalable automation applications to the life science industry. Its system is focused on blood and biologics testing, but can be applied to any industry regulated by the Food and Drug Administration. Through collaborations with other organizations across the country, Title21 has been able to extend its technology to applications in project management, document control, audits, analytics, inventory control, and training and learning management. Title21 employs 15 people in its Pleasanton location.

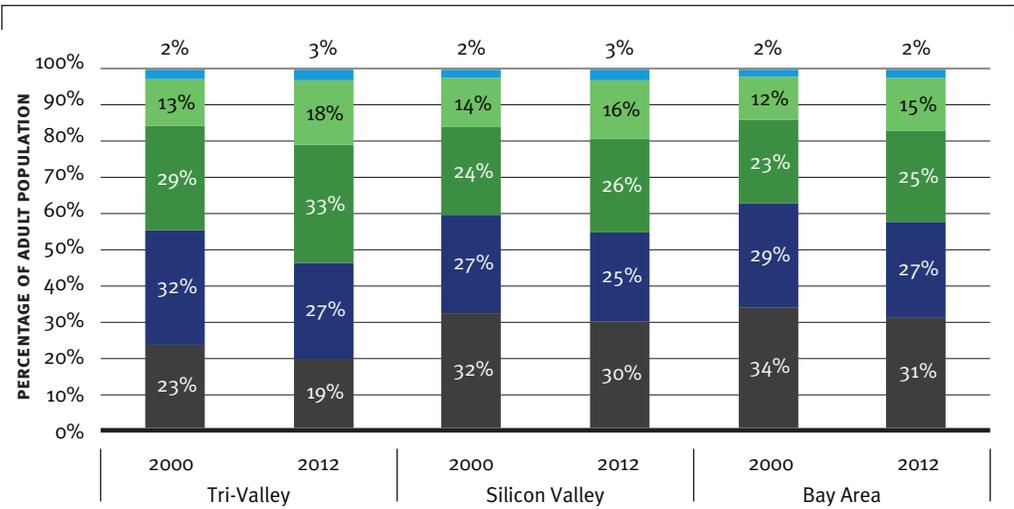
Pleasanton-based **Veeva Systems** offers a good example of a healthcare technology company that started in the Tri-Valley that will continue to grow there. Veeva provides cloud-based customer relationship management and regulated content management products for the global life sciences industry. The company has over 190 customers, ranging from the world's largest pharmaceutical companies to emerging biotechnology companies. Veeva is now a publicly traded company after it launched an initial public offering in October 2013 that raised \$217 million. In June 2014, the firm agreed to a deal that will allow it to move its 250 employees to a 141,000-square-foot office building in Hacienda. The new location will allow Veeva to expand its operations in Pleasanton.

PERCENTAGE OF ADULTS WITH A MASTER'S DEGREE OR HIGHER
Tri-Valley, Silicon Valley, and Bay Area



Note: Adults are defined as anyone 25 years old or older.
Data Source: U.S. Census Bureau three-year American Community Survey estimates and 2000 Decennial Census
Analysis: Bay Area Council Economic Institute

EDUCATIONAL ATTAINMENT BY DEGREE
Tri-Valley, Silicon Valley, and Bay Area



■ DOCTORATE
■ BACHELOR'S DEGREE
■ MASTER'S OR PROFESSIONAL DEGREES
■ SOME COLLEGE OR ASSOCIATE'S DEGREE
■ HIGH SCHOOL OR LESS

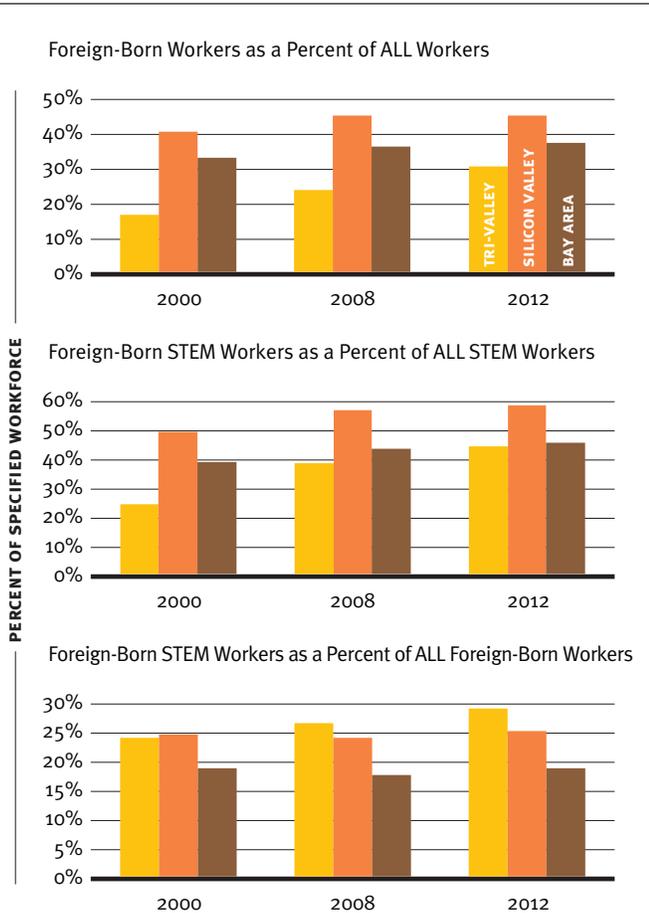
Note: Adults are defined as anyone 25 years or older.
Data Source: U.S. Census Bureau, three-year American Community Survey estimates and 2000 Decennial Census
Analysis: Bay Area Council Economic Institute

ATTRACTING GLOBAL TALENT

The Tri-Valley attracts highly skilled talent from around the world, indicating how closely the region is linked to global innovation hubs and the degree to which it is competing with the world for top talent. The Bay Area has always been a destination for top global talent, and its world-class universities have served as important ports of entry for highly capable and ambitious people.

While foreign-born workers are more highly concentrated in Silicon Valley and the broader region than in the Tri-Valley, foreign-born workers in the Tri-Valley are more likely to be in science, technology, engineering, and math (STEM) fields than workers in other parts of the region. And, the number of foreign-born STEM workers is growing at a faster rate in the Tri-Valley.

FOREIGN-BORN WORKFORCE IN THE BAY AREA AND TRI-VALLEY



Data Source: U.S. Census Bureau, three-year American Community Survey estimates and 2000 Decennial Census

Analysis: Bay Area Council Economic Institute

INVESTING IN STEM EDUCATION

With a large concentration of technology-related companies in the Tri-Valley, the business community has taken a strong interest in ensuring that the next generation of workers is properly equipped with skills in STEM fields. Innovation Tri-Valley is currently pursuing an analysis of the region's school districts to catalogue educational standards in STEM. It also aims to support the engagement of the business sector with the education community in a dialogue on the future of STEM education.

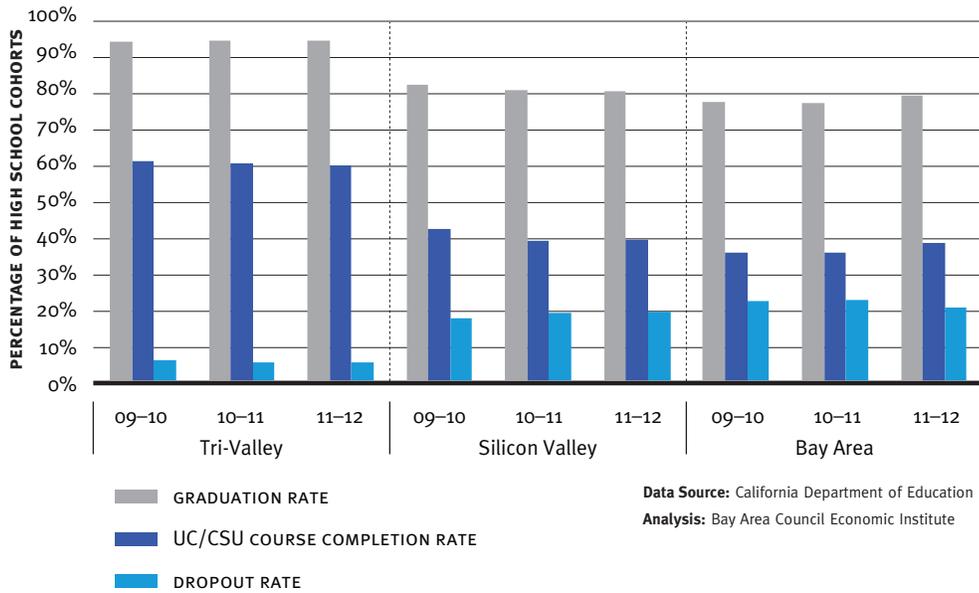
Numerous Tri-Valley companies are already active in supporting the technical training of students through community outreach and programs in schools, including formal STEM support from both SAP and Chevron.

Clorox, which conducts much of its research in Pleasanton, has made a strong commitment to science education through classroom demonstration programs and mentorship opportunities. Since 2010, Clorox has worked to improve awareness of these programs within the corporation, and employee participation has increased from 70 to 300 employees annually since that time. Once limited to employees in R&D functions, the program now includes employees from the information technology, human resources, and marketing departments, among others. Clorox is also increasing its connections with external education partners, including nonprofit organizations and universities, in order to expand the program's impact.

Tri-Valley school districts also participate in two programs that help to advance STEM education in the area. Industry Initiatives for Science and Math Education is a statewide initiative that places teachers at participating businesses to gain hands-on experience in the practical applications of the subject that they teach. The four Tri-Valley school districts also have a strong STEM focus through Project Lead the Way, a national program that helps students to develop STEM skills in middle and high school. Two teachers from each school district are currently piloting an expansion of this program to elementary schools in order to create a pipeline of interested students.

PREPARING YOUTH FOR SUCCESS

Rate of Graduation, Share of Graduates Who Meet UC/CSU Requirements, and Dropout Rate



Foreign-born talent contributes substantially to the Bay Area's innovation system. Foreign-born workers account for 38 percent of all workers in the Bay Area. Silicon Valley boasts a higher percentage (45%), while the Tri-Valley is less reliant on workers coming from out of the country (31%). However, foreign-born workers have nearly doubled in share in the Tri-Valley, expanding from 17 to 31 percent between 2000 and 2012. This jump of 14 percentage points exceeded the increase in the share of foreign-born workers in the Bay Area overall (4 percentage points) and the increase in Silicon Valley (5 percentage points).

The Tri-Valley is currently home to 62,185 foreign-born workers, 29 percent of whom are employed in STEM fields. STEM workers born abroad make up 46 percent of all STEM talent in the Bay Area. Likewise, STEM workers born abroad make up 45 percent of STEM workers in the Tri-Valley but 59 percent in Silicon Valley.

DEVELOPING LOCAL TALENT

A region's ability to attract global talent is a mark of success, but the local economy also needs a strong homegrown workforce in order to support long-term economic growth. Investing in high-quality education for youth is not only an investment in the future but also adds to the quality of life and serves to attract businesses and skilled talent.

By multiple measures, the Tri-Valley is outperforming the rest of the region. Over the most recent three academic years,⁸ the Tri-Valley has maintained high school graduation rates of 95 percent (weighted across four school districts). In addition, 60 percent of graduates meet course requirements for applying to the University of California and California State University systems. In contrast, graduation rates are closer to 80 percent in Silicon Valley (defined here as San Mateo and Santa Clara Counties) and in the Bay Area as a whole, with fewer than 40 percent of their respective graduates prepared for college.

The Tri-Valley's superior performance in high school achievement begins with a very strong primary school system. As measured by the Academic Performance Index (API),⁹ Tri-Valley school districts are some of the strongest in the Bay Area. The average 2013 Growth API across four school districts in the Tri-Valley was 908, significantly higher than the 818 average posted by the rest of the region, and the 790 average score for all of California. In comparison, school districts in Silicon Valley averaged an 842 Growth API in 2013.

2

As the Bay Area's business base and population continue to grow, expanding the variety of commute options is increasingly important in order to support sustained economic growth.

VALUE- GENERATING CONNECTIONS WITHIN AND OUTSIDE THE TRI-VALLEY

The connections between the Tri-Valley and the broader Bay Area are a measure of the economic value of its many assets. And examining the region's interdependencies illustrates the important role the Tri-Valley plays in the Bay Area economy. Such connections include labor flows, the generation of new products and ideas with partners outside the region, collaboration between the business sector and the labs, and investment flows.

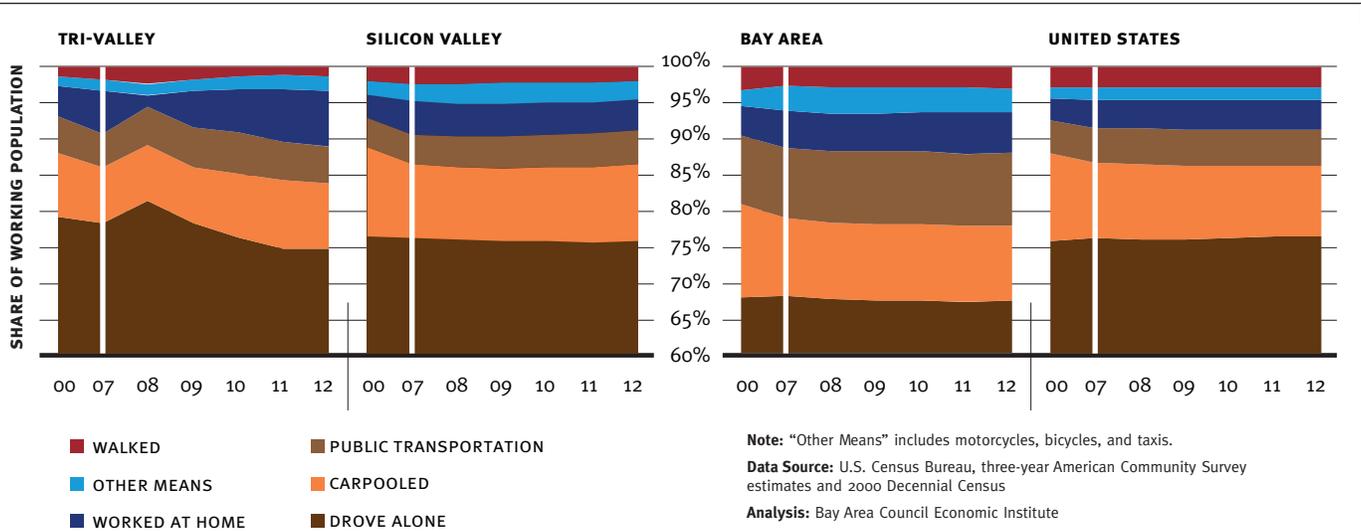
CHARACTER OF COMMUTE FLOWS

The variety of options available to people for getting to and from work is in part a measure of the flexibility of a region's labor force (see Section 5 for more detail on the Tri-Valley's transportation system). Companies and industries grow and contract over time and through business cycles, and labor flows shift as a result. While Bay Area workers have been changing jobs with greater frequency since the early 1990s,^{10, 11} people are not necessarily uprooting their homes each time they change jobs. The more connected the region's population is with its job centers, the more flexible and adaptive the economy can be in terms of connecting skilled workers with appropriate jobs. As the Bay Area's business base and population continue to grow, expanding the variety of commute options is increasingly important in order to support sustained economic growth.

Because home prices and rents in the Bay Area continue to be high, residents are being pushed out of job centers in search of more affordable housing.¹² As a result, Bay Area companies are finding it necessary to reach further outside their nearby geographies to recruit the talent they need. Longer commute distances place new burdens on the region's public transit systems and highways. To ensure appropriate links between population centers and employment hubs, it is paramount to provide easy commute options.

Demonstrating the area's growing connection to other economic centers in the region, the number of Tri-Valley residents commuting to Santa Clara, San Mateo, and San Francisco Counties increased by 20 percent from 2007 to 2012.

MEANS OF COMMUTE

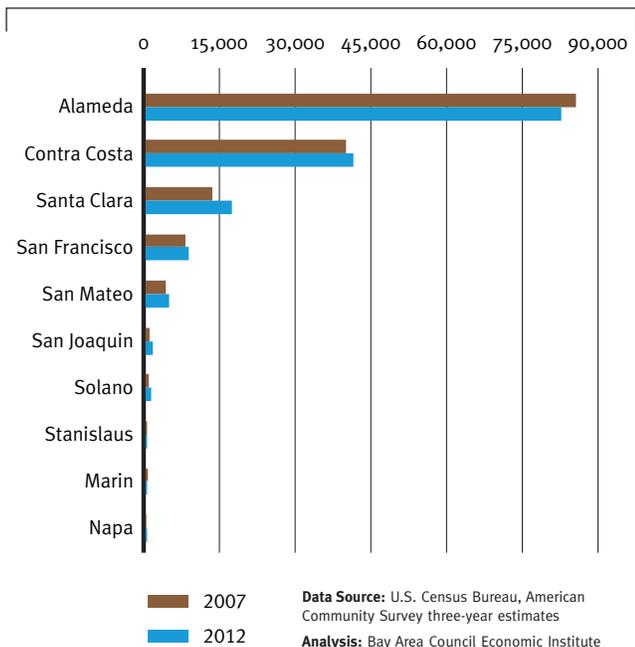


COMMUTE CHOICES

Currently, Bay Area residents are able to take advantage of a wide variety of commute options—highways, heavy and light rail tracks, bus routes, and ferry lines crisscross the region. But even with high transit accessibility for many of the region's residents¹³ and high population density,¹⁴ the majority of Bay Area residents commute to work by car.

However, transportation mode shares in the Bay Area do differ significantly from U.S. averages. In the United States, 76 percent of workers drive alone to work. In the Bay Area, this is the case for only 67 percent. The difference is in large part owing to the use of public transportation. Ten percent of the workers in the Bay Area who commute ride on public transportation—double the U.S. rate of 5 percent.

TRI-VALLEY COMMUTERS BY DESTINATION COUNTY
2007 & 2012



Within the Bay Area, significant differences in commute choices exist among sub-regions. With their suburban development patterns, Silicon Valley and the Tri-Valley have commutes that are more reflective of the national trend. Three-quarters of workers drive alone to work, and only 5 percent use public transportation in both the Tri-Valley and Silicon Valley.

Tri-Valley workers are also far more likely to work from home than others in the Bay Area. These workers include telecommuters, as well as small business owners and consultants. In a trend that began in 2008 and increased through the recession and subsequent recovery, the portion of the Tri-Valley labor force working from home has grown to 8 percent. In contrast, people working from home account for just 4 percent of workers in Silicon Valley and 6 percent in the Bay Area as a whole.

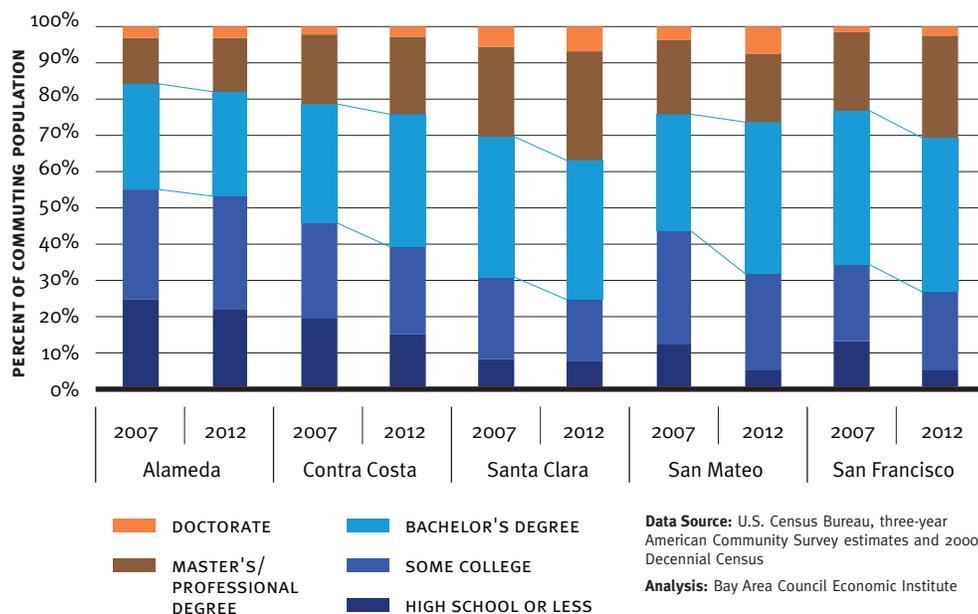
More than three-quarters of Tri-Valley residents who work commute to either Alameda or Contra Costa Counties as their place of employment.¹⁵ While the total number of Tri-Valley commuters has grown by 3 percent from 2007 to 2012, the number of residents remaining within the counties for work has fallen by 1 percent.

Demonstrating the area's growing connection to other economic centers in the region, the number of Tri-Valley residents commuting to Santa Clara, San Mateo, and San Francisco Counties increased by 20 percent over this period. This increase was driven by a surge in commutes to Santa Clara County (up 29%). Santa Clara County has twice as many commuters from the Tri-Valley as San Francisco County. Annual commuting costs for Tri-Valley drivers traveling into San Francisco and San Jose are estimated at \$4,830 and \$4,499, respectively.¹⁶ For those traveling by BART between the Dublin/Pleasanton and Embarcadero stations, annual costs fall to \$2,987.

Commutes by level of educational attainment reveal different patterns across segments of the Bay Area labor pool. Tri-Valley commuters with lower levels of education tend to work closer to home. The closer proximity of home and workplace for lesser-skilled workers has been found to be a function of mobility.¹⁷

TRI-VALLEY COMMUTERS BY DESTINATION AND EDUCATIONAL ATTAINMENT

2007 and 2012



As income declines, people have a reduced willingness to travel long distances for work, especially in areas where public transportation options are limited.

The educational levels of Tri-Valley commuters to Santa Clara, San Mateo, and San Francisco Counties are high and becoming more so. Most notably, Tri-Valley commuters to San Mateo County with a college degree have increased in share from 57 percent to 69 percent. These commute flows of skilled people suggest that the Tri-Valley’s attractiveness as a place to live lies not just in the quality of life it offers but also in its proximity to other job centers in the Bay Area.

RELATIONSHIP WITH THE CENTRAL VALLEY

The Tri-Valley is also strongly linked with the Central Valley in terms of the movement of people and goods. As the Central Valley grows as a job and distribution center, the pressure on I-580 and other transportations systems passing through the area will increase.

There is a significant flow of workers commuting into or through the Tri-Valley from the east. The population of neighboring San Joaquin County has increased by 24 percent since 2000, exceeding 700,000 in 2012. Over 42,000 of those residents commuted into the nine-county Bay Area in 2012,¹⁸ with many taking I-580 as their route through the Tri-Valley.

For some time, San Joaquin County has served as a bedroom community for the Bay Area; however, the county has promoted business growth of higher-value research and development facilities in recent years. The aim is to improve the quality of life of its residents and capitalize on its ample space for large industrial developments, especially as land in other parts of the Bay Area becomes more limited and more costly.

Multiple projects highlight the growth potential of San Joaquin County as jobs follow eastward population growth. In Lathrop, a 4,905-acre master-planned community called River Islands is slated to develop 11,000 residential units in addition to a 350-acre business campus designated for office headquarters and laboratory space. In Tracy, construction is under way at the Cordes Ranch development, which will house 30 million square feet of office space on 1,783 acres—making it the largest business park in Northern California.

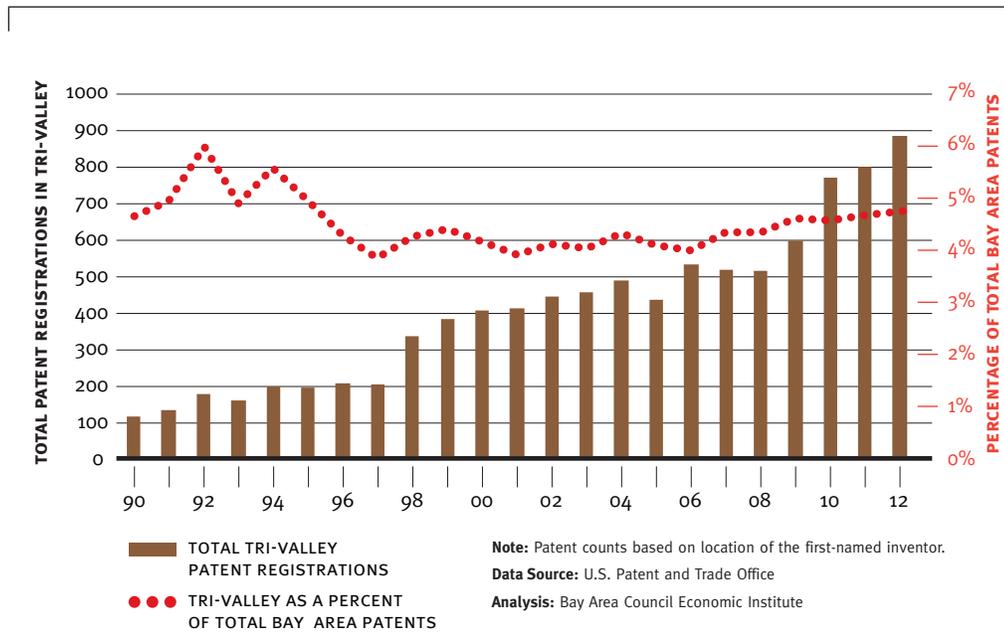
Companies are also taking advantage of San Joaquin County’s central location with respect to major multimodal facilities, the Ports of Stockton and Oakland, railroads, and multiple highway links. Distribution and fulfillment centers populate many highway corridors through the county. Large land parcels have been re-zoned for commercial development to support the growing demand for warehousing. Online retailer Amazon recently opened two Central Valley fulfillment centers in 2013. **Amazon** occupies one million square feet of space in Tracy, in addition to another facility further south along I-5 in Patterson in Stanislaus County. Both locations house employees that deal with high-end technology while fulfilling customer orders.

Best Buy, Home Depot, Restoration Hardware, Safeway, and Costco are just a few of the corporations that have utilized large, undeveloped tracts of land in San Joaquin County for their logistics operations. Palo Alto-based **Tesla Motors** has also recently leased an industrial facility in Lathrop to grow its manufacturing capabilities, and Stockton had been touted as a potential site of the company’s multi-billion dollar battery factory.¹⁹ As these businesses increase their footprints in San Joaquin County, the transportation infrastructure in the Tri-Valley will be further stressed by the need to link this growing job and population center to the rest of the Bay Area.

Research collaboration in the form of patents, commercial efforts with the labs, and investment flows illustrate the growing interdependence of the Tri-Valley with the broader Bay Area in driving innovation.

PATENT REGISTRATIONS

Tri-Valley and Bay Area



THE TRI-VALLEY'S INNOVATION SYSTEM

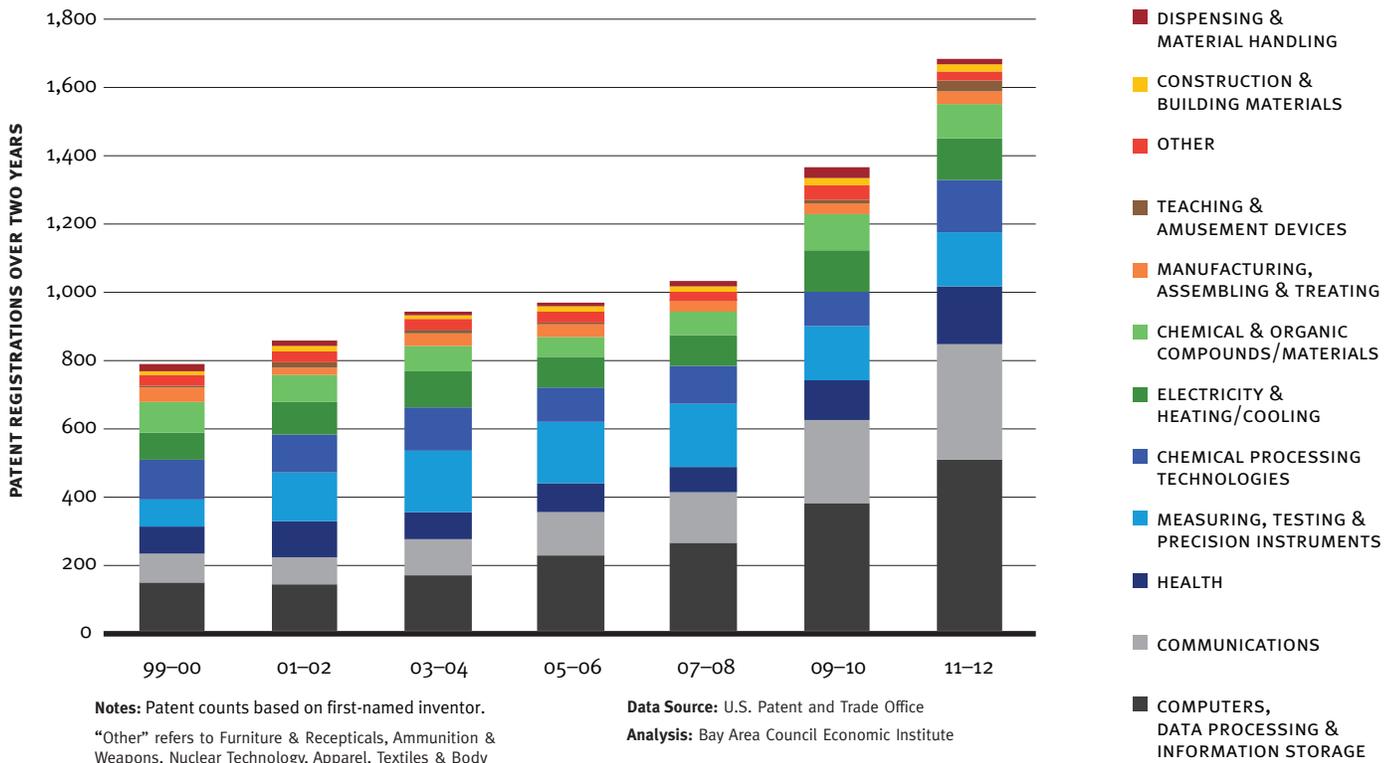
The Tri-Valley's geographic positioning supports regional connectivity, not only for its workers and residents but also for its businesses; entrepreneurs, investors, and researchers are spread throughout the broader Bay Area. Research collaboration in the form of patents, commercial efforts with the labs, and investment flows illustrate the growing interdependence of the Tri-Valley with the broader Bay Area in driving innovation.

PATENT ACTIVITY

The Tri-Valley's residents are contributing to technological advances across multiple fields. In 2012, 886 patents were registered to primary inventors located in the Tri-Valley, representing significant growth over the last 20 years. By technology area, two categories accounted for half of all registrations in 2012: computers, data processing, and information storage (30%) and communications (20%). Since 1999, the strongest growth has been in the areas of computer, data processing, and information storage (24%), communications (15%), and measuring, testing, and precision instruments (14%).

The concentration of patent activity by technology area compared with the same patent activity in the Bay Area as a whole reveals some of the Tri-Valley's distinct areas of technical expertise.²⁰ The highly specialized missions of the national laboratories, which have been primarily focused on safeguarding the nation's nuclear arsenal, are reflected in the three categories with the highest concentrations relative to the Bay Area: ammunition and weapons; nuclear technology; and dispensing and material handling. Other areas of highly concentrated activity include construction and building materials; measuring, testing, and precision instruments; teaching and amusement devices; and manufacturing, assembly, and treating.

PATENT REGISTRATIONS IN TRI-VALLEY BY TECHNOLOGY AREA



CONCENTRATIONS BY TECHNOLOGY AREA RELATIVE TO THE BAY AREA

Tri-Valley Patent Registrations

	Since 1999	99-00	01-02	03-04	05-06	07-08	09-10	11-12
Ammunition & Weapons	3.01	2.00	2.37	5.88	1.99	3.50	3.10	2.08
Nuclear Technology	2.33	2.57	0.00	3.41	5.56	0.00	2.32	2.92
Dispensing & Material Handling	1.93	1.52	1.54	1.18	1.33	2.52	4.34	2.25
Teaching & Amusement Devices	1.63	1.14	2.01	1.52	1.03	0.44	2.15	2.12
Apparel, Textiles & Body Adornment	1.27	1.14	0.93	2.16	0.00	0.74	1.29	1.99
Measuring, Testing & Precision Instruments	1.71	1.41	2.17	1.90	1.71	1.79	1.50	1.65
Manufacturing, Assembling & Treating	1.53	2.00	1.08	1.69	1.52	1.45	1.48	1.65
Construction & Building Materials	1.72	1.29	1.38	1.73	2.10	2.32	1.88	1.60
Chemical Processing Technologies	1.30	1.40	1.05	1.24	1.34	1.64	1.21	1.45
Furniture & Receptacles	1.31	1.16	1.64	0.64	2.25	0.98	1.45	1.33
Food, Plant & Animal Husbandry	1.06	0.76	0.78	0.54	1.62	1.06	1.90	1.21
Chemical & Organic Compounds/Materials	1.00	1.13	0.93	0.96	0.82	0.80	1.30	1.10
Health	1.03	0.96	1.15	0.83	1.15	0.99	1.06	1.07
Communications	0.86	0.85	0.75	0.81	0.80	0.82	0.87	0.92
Electricity & Heating/Cooling	0.89	0.86	0.92	0.93	0.84	0.88	0.97	0.87
Computers, Data Processing & Information Storage	0.73	0.68	0.62	0.63	0.72	0.73	0.74	0.79
Transportation/Vehicles	1.43	0.52	1.66	1.91	1.11	1.97	2.67	0.58

Note: Patent counts refer to all utility patents whose first named inventor is located in the Tri-Valley. Patent concentrations are defined as the ratio of specific sector patents to total patents in an area. To find a relative concentration, patent concentrations for the Tri-Valley were divided by patent concentrations for the Bay Area. A 1.00 relative concentration means there is an equal ratio of patents in a sector registered in the Tri-Valley and the Bay Area as a proportion of the total number of patents in each area.

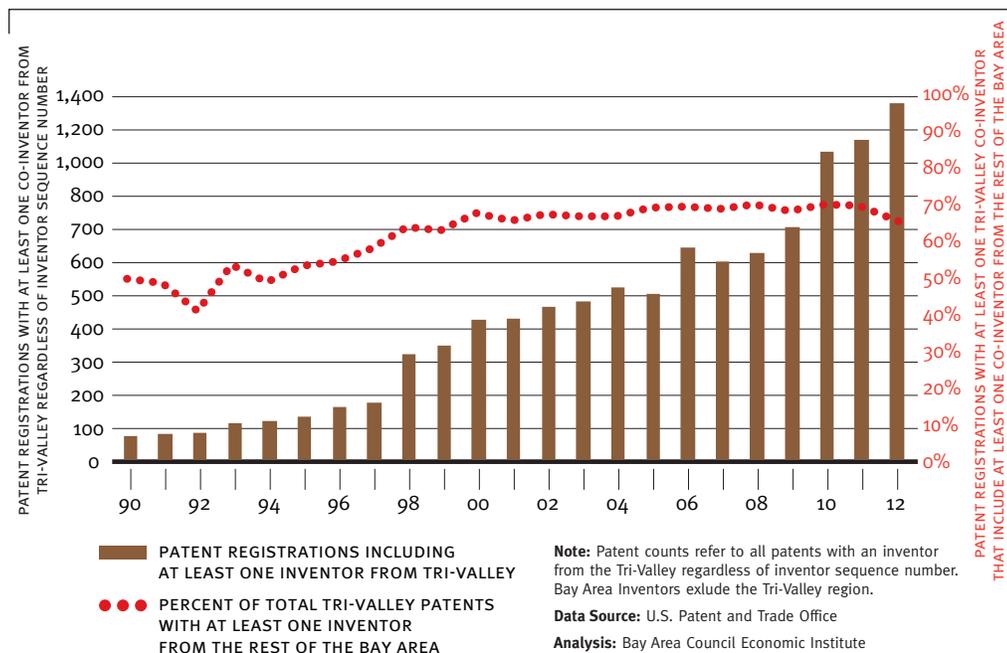
Data Source: U.S. Patent and Trade Office

Analysis: Bay Area Council Economic Institute

■ LESS THAN 1.00 ■ 1.00 – 1.49 ■ 1.50 OR GREATER

COLLABORATION PATTERNS WITH THE BAY AREA

Patents with Co-Inventors from Tri-Valley and the Rest of the Bay Area



Typically, patent activity is reported by the location of the first named inventor on a patent registration. However, if we look at all of the names listed on a single patent, evidence of growing regional collaboration emerges. Since 1995, the majority of patents registered each year to a Tri-Valley inventor have been the result of collaboration with another Bay Area inventor outside of the Tri-Valley. In 2012, approximately 66 percent of all patents with at least one Tri-Valley inventor named in the registration were the result of regional collaboration.

Inventors in the Tri-Valley are also working on inventions with partners from around the world. Over 8 percent of patents registered with at least one Tri-Valley inventor in 2012 include at least one co-inventor located outside the United States. Between 1990 and 2012, global co-patenting increased at an annualized rate of 21 percent. By technology area, increased global co-patenting has been driven by the Tri-Valley's two most significant areas of innovation: communications, as well as computer, data processing, and information storage.

TECHNOLOGY COMMERCIALIZATION: COLLABORATION BETWEEN BUSINESS AND LABS

The Tri-Valley's two federal research laboratories, Lawrence Livermore and Sandia (the California extension of the main campus in New Mexico), have been shifting their focus beyond their core national security missions to include work on a broader array of technologies for commercialization and to contribute to local economic development. This is motivated in part by the need to diversify funding sources beyond federal appropriations, as well as by the desire to increase economic engagement and have a positive impact on surrounding communities.

These endeavors have led to a growing number of research partnerships with industry and to focused efforts supporting entrepreneurial activity through access to lab technology, personnel, and facilities. Procedures are also being established that allow scientists at the lab to explore entrepreneurial ventures while on leave.

Lawrence Livermore's commercial licensing revenue leads all other federal labs. Since 2001, LLNL has executed 918 license agreements. Licenses have been granted to a mix of small and large companies spread throughout the country and world. Of the more than 900 agreements signed since 2001, 76 have been with Bay Area-based companies. In fiscal year 2013, the lab received income from its licensing activity totaling \$8.6 million.

In addition to licensing technologies to industry, LLNL has also been successful in direct commercialization through the formation of business start-ups.

Four companies that were founded by LLNL scientists—**Cadence Design, Cepheid, Digital Globe, and Rambus**—now have a collective market value of over \$8 billion.

QuantaLife, an LLNL technology licensee, was recently purchased by **Bio-Rad** for \$180 million. Its Droplet Digital PCR technology, which allows the study of biological systems at unprecedented levels of resolution, emerged from LLNL research on biological weapons detection.

Of the more than 900 licensing agreements Lawrence Livermore National Laboratory has signed with partners since 2001, 76 have been with Bay Area-based companies.

The Tri-Valley's area code ranked 19th in venture capital investment in the United States in 2012.

Further commercial benefits can be expected to come from LLNL's High Performance Computing Innovation Center (HPCIC), which was created in 2011 to facilitate partnerships with industry. The HPCIC leverages decades of U.S. investment in computing, providing a platform for over 100 universities, laboratories, and industry partners to test and deploy high performance computing solutions. In another externally focused initiative, LLNL has a memorandum of understanding with the Keiretsu Forum, the world's largest network of angel investors. The Forum's expertise in structuring, investing in, and implementing go-to-market strategies will be applied to LLNL's portfolio of technologies available for commercialization.

Sandia supports a number of knowledge exchange projects with industry. In particular, its transportation division has collaborated with **General Motors, Ford, Chrysler, Cummins, Caterpillar, John Deere, Detroit Diesel Corporation, Navistar, Mack Trucks, ExxonMobil, Chevron, BP, Shell, and Conoco Phillips** to improve engine design and fuel efficiency. Other collaborations have included working with banks on network security, partnering with Silicon Valley companies to test hardware for user data protection, and installing bio-threat detection at public facilities such as the Oakland Coliseum and San Francisco International Airport.

Sandia has executed over 850 licenses since 2001, including government-use licenses. These licenses have resulted in over \$9.6 million in licensing revenue for the lab. This figure includes upfront fees and sales royalties. Over 500 of those licenses remain active, with more than 100 California-based companies represented as licensees. Since 1994, Sandia researchers and projects have been associated with 95 new companies, either as spin-offs, incubator creations, or with other institutional support.

CAPITAL FLOWS

Moving a promising new technology to market as a viable new product requires capital. Without a source of funding to scale up, the growth of start-up companies can easily be stymied. Additionally, fast-growing, entrenched companies also depend on capital infusions to bring new products to market and to expand. With their close proximity to Silicon Valley, Tri-Valley businesses in search of venture capital investments do not have to go far. Fifteen of the top 25 venture capital firms in the United States (measured by dollars invested in 2013) are located in Silicon Valley.²¹ More than 40 percent of venture capital dollars invested in 2012 within the United States came from a Bay Area-based firm.²² With new ideas and businesses being born out of the Tri-Valley's research centers and the talents of its residents, the area has been able to attract significant venture capital investment.

I-GATE RESIDENT START-UPS

i-GATE is a regional innovation hub located in the Tri-Valley, supporting entrepreneurs and start-ups with networking events, mentorship, education programs, and collaborative infrastructure in a new facility recently opened in downtown Livermore. Sandia and LLNL partner heavily with i-GATE to support technologies coming out of lab initiatives and on fostering the regional innovation ecosystem. i-GATE is home to six start-ups, including the sample of current and former residents detailed below.

TerrAvion is a precision agriculture technology start-up that uses aerial imaging to detect crop health down to the level of individual plants. The company provides online access to color, infrared, and thermal aerial images of each customer's fields every week via its Overview product. i-GATE has assisted TerrAvion with early customer introductions and has helped to identify talent. The company has hired seven new employees since relocating from Pittsburgh, Pennsylvania, and it was recently selected as one of the top six picks at Y Combinator's demo day by the Silicon Valley Business Journal.

KalpTree Energy developed a working prototype of its flexible solid-state battery technology that enables increased battery capacity at competitive prices in a range of applications. i-GATE recently introduced KalpTree Energy to its first investor, and the company is now preparing to move to its own office space.

C2D Technology has created a process to deposit a diamond-like carbon coating onto the interior of cylinder liners for gasoline and diesel engines in order to enhance performance.

Positron Dynamics is developing technology to improve the generation and storage of positrons for use in aerospace propulsion, non-destructive testing, and reverse engineering of integrated circuits. The founders of Positron Dynamics live in other parts of the country but have an on-site intern provided by i-GATE to monitor experiments. The company received initial funding in 2012 from Breakout Labs, a part of the Thiel Foundation based in San Francisco.

POC Medical Systems has utilized technology from Lawrence Livermore and Sandia to develop a point-of-care diagnostic device for the detection of cancer and other major medical conditions. When the device is used in developing countries, testing is performed near or at the site of patient care; the quick delivery of test results facilitates rapid changes in treatment plans.

US LADAR was founded in 2013 with the primary goal to provide state-of-the-art machine vision sensors with an emphasis on technology that enables autonomous navigation.

In 2012, the East Bay's 925 area code (covering all of the Tri-Valley and surrounding parts of Contra Costa County) ranked 19th in venture capital investment in the United States.²³ On this metric, the Tri-Valley outpaces better-known innovation areas, such as North Carolina's Research Triangle. The region is led by Pleasanton, which ranks 10th in venture capital investment by city in the Bay Area, with \$284 million invested in 2012.²⁴ A sampling of recent Tri-Valley venture capital investments is detailed below.

Bridgelux (February 2012). The Livermore-based provider of LED lighting technologies received \$25 million in strategic funding from Kaistar Lighting, which is based in Xiamen, China. Bridgelux had previously raised around \$185 million in venture capital funding from a consortium of investors led by VantagePoint Capital Partners (Silicon Valley), DCM (Silicon Valley), El Dorado Ventures (Silicon Valley), and Chrysalix Energy (Vancouver). Bridgelux's patented light source technology replaces traditional technologies with integrated, solid-state lighting solutions that enable lamp and luminaire manufacturers to provide high-performance, energy-efficient white light for the interior and exterior lighting markets, including street lights, commercial lighting, and consumer applications.

TriReme Medical, Inc. (November 2012). Pleasanton-based medical device maker TriReme garnered \$18 million in funding. Luminor Capital (Singapore) led the round. Proceeds will go toward developing the company's catheters and expanding its commercial infrastructure worldwide.

Five9 (May 2013). The San Ramon-based provider of cloud-based contact center software raised \$22 million in funding. SAP Ventures (Silicon Valley) was the lead investor in the

round and was joined by return backers Adams Street Partners (Chicago/Silicon Valley), Hummer Winblad Venture Partners (San Francisco), and Partech International (San Francisco).

Tria Beauty (June 2013). Dublin-based Tria Beauty, which sells light- and laser-based consumer beauty products, received a \$40.5 million investment. The funding was provided by Aisling Capital (New York), De Novo Ventures (Silicon Valley), Technology Partners (Silicon Valley), and Vivo Ventures (Silicon Valley).

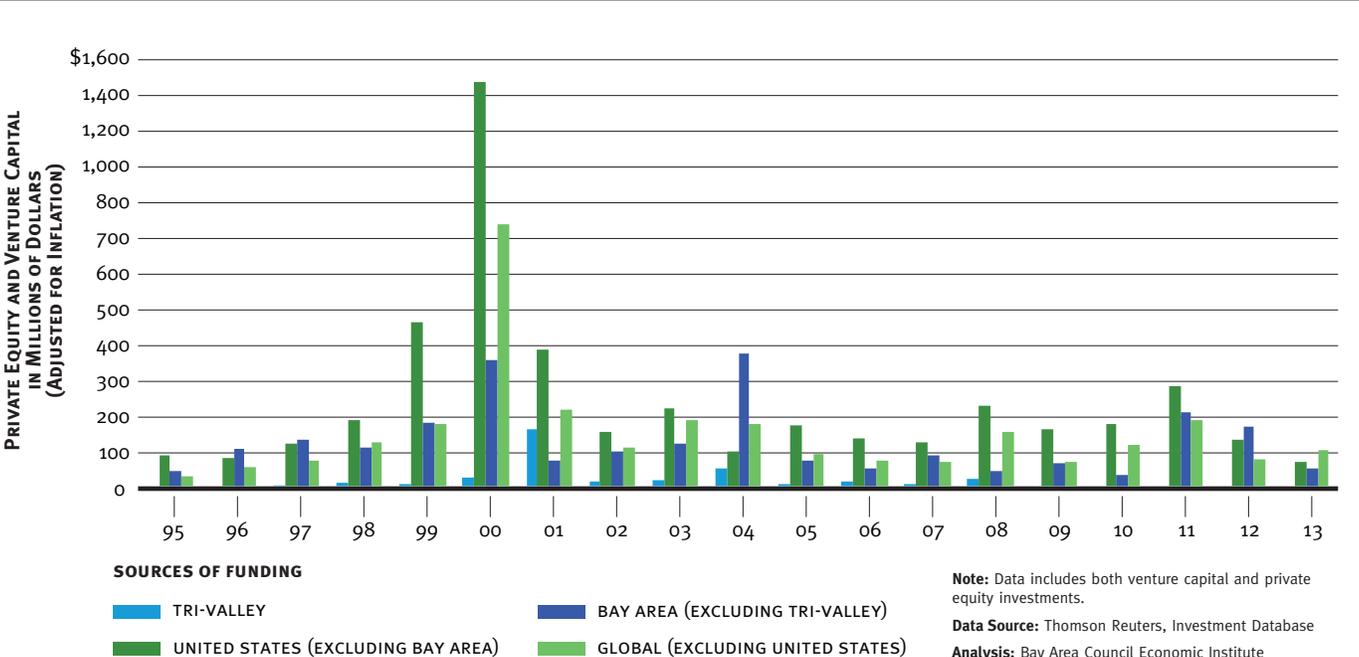
Accelea Inc. (October 2013). San Ramon-based Accelea, a provider of civic engagement solutions for government agencies, raised \$40 million in new equity funding led by Bregal Sagemount (New York).

Danville Materials Inc. (January 2014). The San Ramon-based designer, manufacturer, and seller of clinical dental materials and equipment completed an \$8.5 million senior debt and equity investment from Triangle Capital Corporation (Raleigh, North Carolina).

Neotract (January 2014). The Pleasanton-based developer of minimally invasive medical devices that address urological disorders received \$50 million of venture funding from long-time investor New Enterprise Associates (Silicon Valley).

ServiceMax (March 2014). Pleasanton-based ServiceMax received a \$71 million investment from a consortium of investors led by Meritech Capital Partners (Silicon Valley). ServiceMax is a supplier of software to field service technicians. Its largest customers include General Electric, Tyco International, and Medtronic.

INVESTMENT IN TRI-VALLEY BY REGION OF ORIGIN THROUGH 2013



CITY SPOTLIGHT: LIVERMORE AND THE CHEVRON / BRIDGELUX ENERGY EFFICIENCY PROJECT

With the help of Innovation Tri-Valley, Livermore has formed a unique public-private partnership to promote a comprehensive energy efficiency strategy within the city. The three-pronged approach, launched in 2013, included the installation of 1.4 MW of solar generating capacity with the help of Chevron Energy Solutions. These solar installations are anticipated to offset almost 90 percent of the electricity costs at three sites: the civic center, the maintenance service center, and the municipal airport. The savings are expected to generate more than \$10 million over the life of the project.

Chevron Energy Solutions also partnered with Bridgelux, an LED lighting producer based in Livermore, to retrofit 6,000 city-owned streetlights. The LED streetlights operate with 50 percent less power and require far less maintenance than ordinary street lighting. Streetlights typically account for 10 to 40 percent of a municipality's energy costs, and the energy used amounts to the third-largest use of power by local governments today, according to the Clinton Climate Initiative. The partnership helped Bridgelux move its LED technology from lab to commercialization, and the program has been expanded to other California cities, including Dublin.

Lastly, the partnership also includes an education component. Twenty local students were trained as Energy Ambassadors and hired to help city residents save money by improving home energy efficiency.

The Tri-Valley region attracts capital from all parts of the United States as well as from China. Investment in Tri-Valley companies is also coming from diverse sources. Since 1995, the Bay Area (excluding the Tri-Valley itself) has accounted for 45 percent of total private equity and venture capital investment in the Tri-Valley region. Over the same period, 24 percent of investment has come from other U.S. locations, and 28 percent has originated from outside the United States. Only 3 percent of private equity and venture capital injected into Tri-Valley businesses has come from within the area. While the Tri-Valley does boast a growing number of private equity and venture capital firms—such as **Northgate Capital** and **Sigma Partners** in Danville and **Tri-Valley Capital**—the investment landscape continues to be dominated by Silicon Valley and San Francisco firms.

SMALL BUSINESS INNOVATION AWARDS

Publicly sponsored award and grant programs represent another source of capital that can assist fledgling companies in commercializing their technologies. The Small Business Innovation Research (SBIR) program provides competitive grants for domestic small businesses to support research and development efforts for technology with potential commercial application. A related program, Small Business Technology Transfer (STTR), supports public-private partnerships between small businesses and nonprofit research institutions with the aim of bridging the gap between basic science and commercialization. These federally funded programs support high-tech innovation and entrepreneurship across the country as well as some of the specific research needs of 11 different government agencies. These highly competitive awards are divided into two categories: Phase I is for the establishment of technical merit, feasibility, and commercial potential; Phase II is for the continuation of the work initiated in Phase I. In 2012, the Bay Area received 291 awards, with the Tri-Valley taking home 12 of these.

SBIR & STTR AWARDS IN THE TRI-VALLEY REGION IN 2012

2012 PHASE I AWARDS

SPONSORING AGENCY	FIRM NAME	AMOUNT	AWARD
Department of Defense	The Peregrine Falcon Corporation	\$99,717	<i>Novel Monolithic Microwave Integrated Circuit (MMIC) High Flux Heat Exchanger</i>
	Onyx Optics, Inc.	\$78,660	<i>Reduced-Cost Grinding and Polishing of Large Sapphire Windows</i>
	Xradia, Inc.	\$149,994	<i>Optimized X-ray Microscope (OXM) for IC Reverse Engineering</i>
Health and Human Services	Integrated Dynamic Electron Solutions	\$149,558	<i>Develop Ponderomotive Phase Plate for Transmission Electron Microscopy of Biospec</i>
	Livermore Instruments, Inc.	\$592,021	<i>Real-Time Reagent-Free Noninvasive Diagnosis of Tuberculosis</i>
National Science Foundation	Dirac Solutions Inc.	\$147,668	<i>STTR Phase I: Software-Defined Multi-pulse Wideband Radios for Spectrum Reuse and Assured Communications</i>
Department of Energy	Xradia, Inc.	\$149,995	<i>Development of Optimized Controls and Hardware for Synchrotron Hard X-Ray Microscopes with Advanced Spectroscopic Capabilities</i>
	Ultracel Corp.	\$149,808	<i>Integrated Reformer with an Electrochemical Separator using a High Temperature Solid Acid Membrane</i>
NASA	Grainflow Dynamics, Inc.	\$124,870	<i>Flexible Transfer of Regolith in Micro-Gravity and Vacuum</i>

2012 PHASE II AWARDS

SPONSORING AGENCY	FIRM NAME	AMOUNT	AWARD
Department of Defense	Robust Chip Inc.	\$999,810	<i>Solutions for Single-Event Effects in Ultra Deep Submicron Semiconductor Technologies Using Simulation and Layout Techniques</i>
	Fred Cohen & Associates	\$999,998	<i>Anomaly Detection At Multiple Scales (ADAMS)</i>
Department of Energy	Dirac Solutions Inc.	\$999,627	<i>Ultra-secure RF Tags for Safeguards and Security</i>

SUPPORTING BUSINESS GROWTH

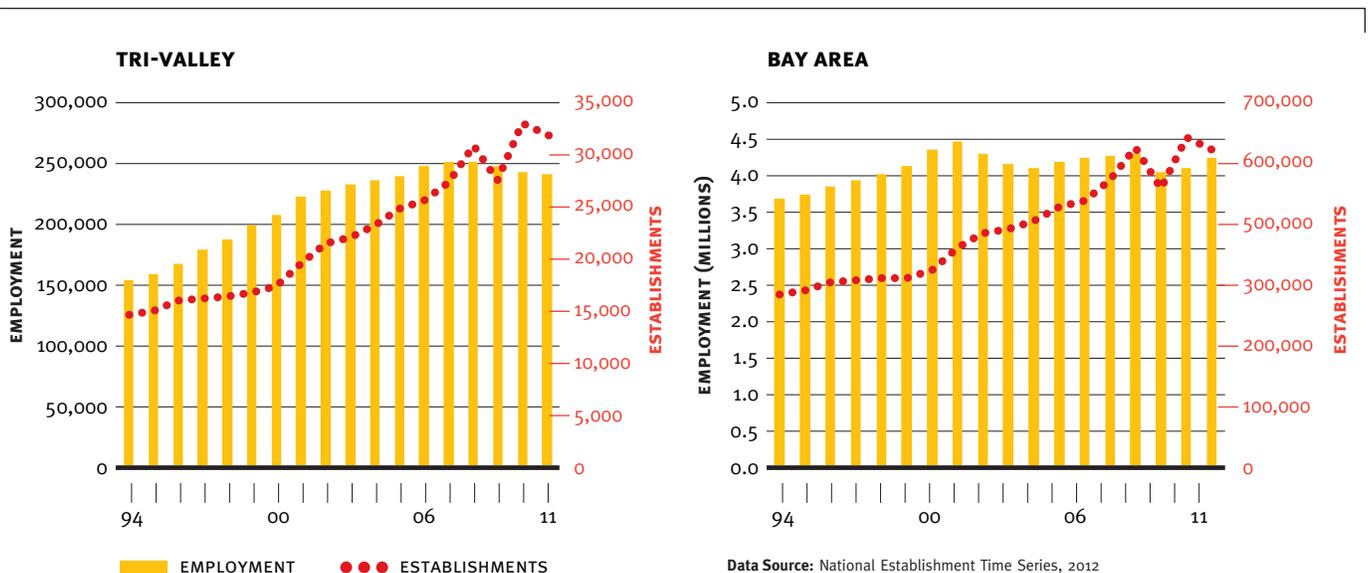
The Tri-Valley's business base is growing and diversifying. With its relative proximity to Silicon Valley, San Francisco, and the Central Valley, the Tri-Valley is well positioned to connect its businesses with customers, partners, and suppliers. Moreover, the region offers an appealing environment for small businesses, as its affordable commercial space and skilled workforce create opportunities for new companies to grow. New firms in similar industries are able to locate near each other, furthering information sharing, innovation, and technical capacity.

BUSINESS CHARACTERISTICS

Since 1994, employment growth in the Tri-Valley has been steadier than in the Bay Area overall, although the trends in firm growth have been similar. Until the recent recession, the Tri-Valley had exhibited a much faster pace of employment growth than the Bay Area: employment in the Tri-Valley grew at 3.9 percent annually between 1994 and 2007, compared with 1.2 percent in the Bay Area.

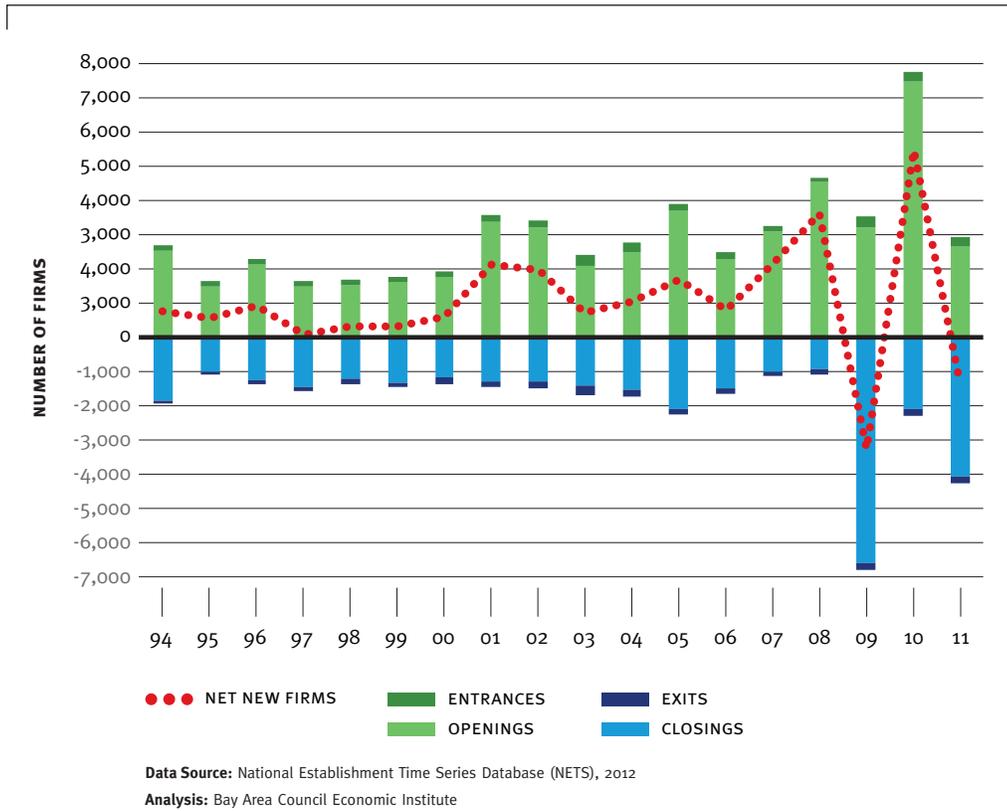
Following the bursting of the dot-com bubble, the Bay Area saw a significant decline in employment, while job growth in the Tri-Valley continued to progressively climb from 2001 to 2007. The recent recession slowed this growth in the Tri-Valley, where job losses during the recessionary years were less severe than in the broader Bay Area. Since that time, job numbers in the Tri-Valley have recovered more slowly than in the broader Bay Area.

GROWTH IN EMPLOYMENT AND ESTABLISHMENTS



BUSINESS CHURN IN THE TRI-VALLEY

Entrances, Exits, Openings, and Closings

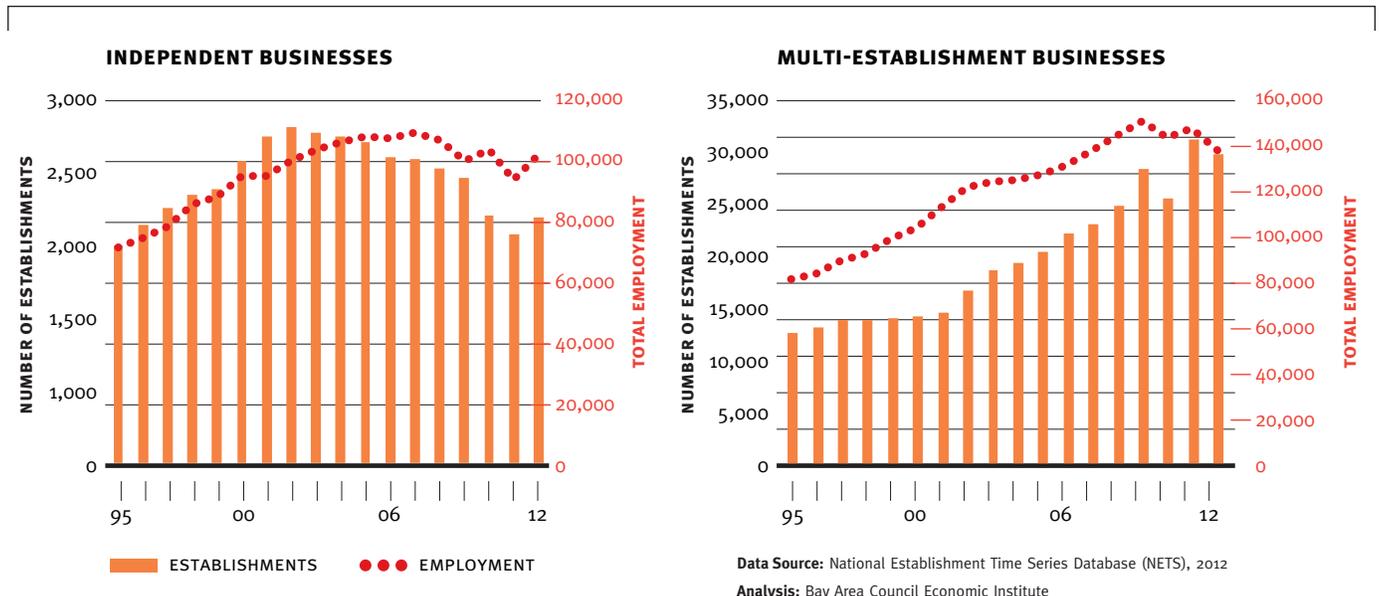


Firm growth in the Tri-Valley tracked that of the Bay Area quite closely up to the recent recession. Since 2007, the number of firms increased by 17 percent in the Tri-Valley, whereas the number of firms in the Bay Area increased by just 11 percent over the same period.

BUSINESS START-UP RATES

Business churn is defined as the change over time in the number of firms added or lost in a region. Firms are added to an area when they move in from other regions or when entirely new firms are formed. Firms are lost when they go out of business or move out of the area.

TRI-VALLEY ESTABLISHMENTS AND EMPLOYMENT IN INDEPENDENT AND MULTI-ESTABLISHMENT FIRMS



The number of businesses in both the Bay Area and the Tri-Valley had been growing steadily each year until the recent recession pushed many firms out of business. Since that time, the churn of openings and closings has become more volatile. Trends in business churn in the Bay Area and Tri-Valley look very similar, although the churn of firms moving in and moving out of the Tri-Valley is proportionally higher than in the Bay Area.

The growing volatility in business churn over the last 10 years is largely driven by independent firms, defined as firms that have only one location or establishment without a connection to a parent company. From 2000 to 2008, the number of independent firms displayed consistent year-over-year growth in the Tri-Valley. Over that same period, the number of multi-establishment firms fell each year. In 2009, significant declines were the norm across all firm types throughout the Tri-Valley, but a rebound in openings of independent businesses in 2010 made up for many of the closures of 2009.

Since 2000, the concentration of independent firms in the Tri-Valley has climbed, owing heavily to the area's technical talent base and its propensity for small firm innovation. Independent firms accounted for 58 percent of the area's total employment in 2011, driven primarily by growth in the professional and business services sector. These businesses have more than doubled their employment in the area since 1994, averaging 5 percent growth per year. Although the independent manufacturing sector is still relatively small overall (one-third the size of the professional and business services sector), employment in this sector has more than doubled since 1997, to over 13,000 positions. Manufacturers represent the fourth-largest employer in the independent business category.

CITY SPOTLIGHT: DUBLIN AND THE BUSINESS INCENTIVE PROGRAM

Many Bay Area municipalities offer incentives and tax relief to attract and retain businesses. The City of Dublin is one such locality where a business incentive program has played an important role in the city's economic development. Following the recent economic downturn, Dublin lost nearly 30 percent of its sales tax revenue as a result of commercial foreclosures and declining sales. Likewise, property tax receipts declined due to a halt in residential construction. The city subsequently developed a toolbox of incentives that have been used to attract new businesses and create jobs.

Sales Tax Reimbursement Program. In order to catalyze business property investments, the city will reimburse up to 50 percent of a business's annual sales tax for a period of five years, up to the amount that was invested in the property. For larger businesses, the 50 percent sales tax reimbursement is extended to 10 years.

Sewer Capacity Assistance Program. The city has had some difficulty attracting new restaurants as a result of high fees for sewer connections. To combat this, Dublin adopted a credit of up to 25 percent of the sewer connection fees.

Commercial Façade Improvement Program. To assist with beautification efforts and increase the city's desirability for new residents and businesses, Dublin created this grant program in 2011. Commercial businesses located in the Downtown Dublin Specific Plan Area can apply to the city annually for reimbursement of up to \$5,000 for qualifying building projects, or for a matching grant that provides reimbursement of 66 percent of eligible costs up to \$70,000.

Small Business Assistance Program. Increasing regulatory burdens had been creating disincentives to small business development in Dublin. The Small Business Assistance Program established a fund to assist businesses with the cost of complying with laws related to disability access requirements, trash enclosures, sewer connections, and other similar local, state, and federal obligations.

A COMPETITIVE EDGE AND A HIGH QUALITY OF LIFE

A community prospers when it is able to maintain a competitive edge in a constantly changing global context while also maintaining the well being of its residents. Successfully expanding and leveraging the Tri-Valley's assets will lead to a more attractive business climate, enhanced productivity, and a higher standard of living. The quality of life in a region depends on the character of the surroundings, the affordability of housing, and the ease of access to recreational activities. A regional reputation for arts and culture helps spur creativity and makes it easier to attract and retain talent. Transportation options and accessibility also play an important role in supporting the growth of local businesses and luring new residents, as the ability to seamlessly move about the region contributes to an enhanced quality of life.

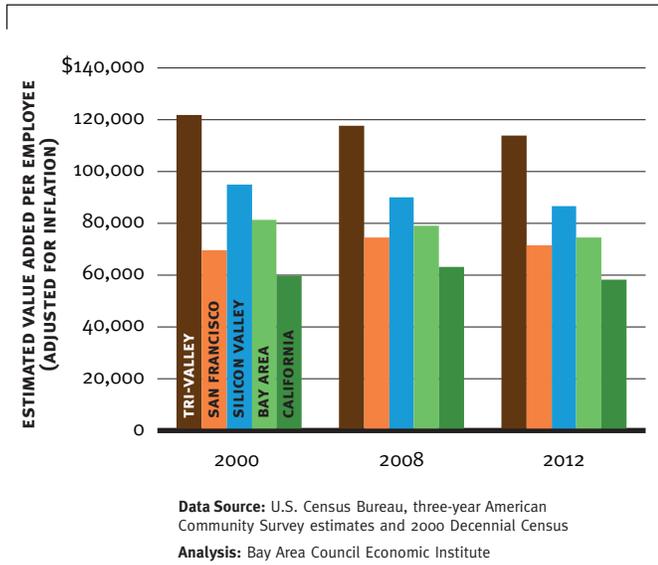
ECONOMIC OUTCOMES

The innovation assets and connections highlighted in the previous sections have made the Tri-Valley an attractive locale for business expansion, which has in turn led to increased economic activity and positive outcomes for the area. The economic activity of a geographic area is measured in terms of Gross Domestic Product (GDP), calculated as the total output of all goods and services produced. GDP per worker is a measure of economic productivity (or value added per worker) in a geographic area.

In terms of productivity, both the Tri-Valley and the broader Bay Area have surpassed the national average by approximately 25 to 30 percent over the last five years.²⁵ In 2011, the value added per worker in the Tri-Valley was estimated at \$180,000, and in the Bay Area as a whole, \$184,000. Nationally, value added per worker was just \$142,000. The gap between Bay Area productivity and national productivity per employee also continues to grow. The difference has increased from 18 percent to 30 percent from 2001 to 2011, reflecting the Bay Area's concentration of higher-value industries, such as those focused on technology, investment, and technical business services.

MEDIAN HOUSEHOLD INCOME

Tri-Valley, Bay Area, and California

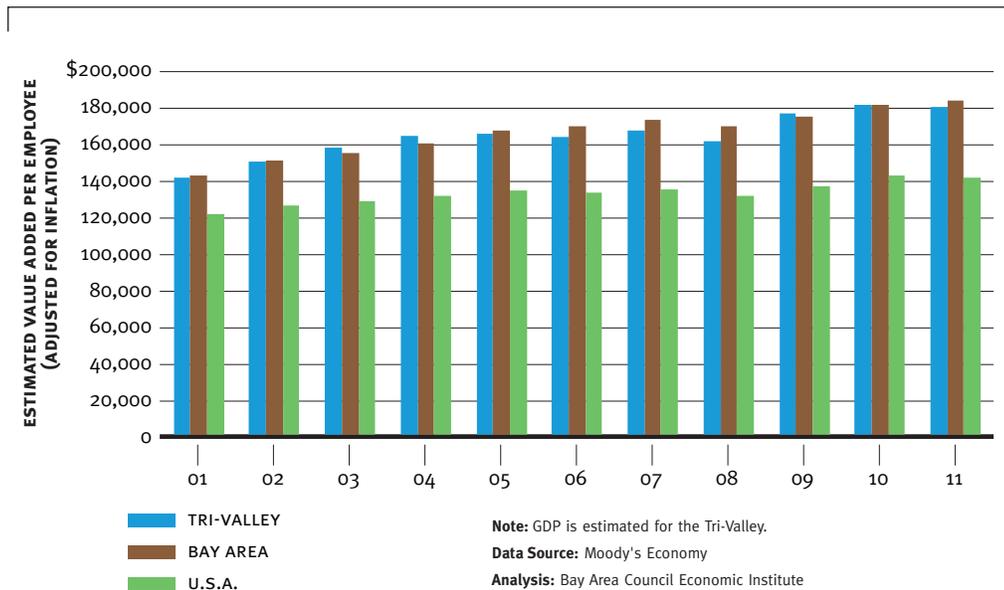


With approximately 240,000 people employed within the Tri-Valley, the area accounted for an estimated \$28.5 billion in production value in 2011, or 5.5 percent of the overall Bay Area economy.²⁶ Between 2008 and 2012, total employment in the Tri-Valley fell by approximately 10,000 jobs; however, over this same period, income per worker grew from \$65,500 to \$73,000—exceeding the pre-recession peak by 5 percent in inflation-adjusted dollars. This may reflect the relative resilience of higher-paying technology-related companies in the Tri-Valley during the recession. In comparison, Bay Area income per worker moved up only 3 percent from its 2007 high. While average worker incomes have grown in the Tri-Valley, total payroll figures of \$11.5 billion remain well below the pre-recession high of \$13.0 billion in 2007.

While productivity has steadily increased, Bay Area household incomes have experienced slight declines in real terms (adjusted to 2013 dollars) since 2000. Median annual household income in the Tri-Valley in 2012 was 53 percent higher than in the broader Bay Area and nearly twice as high as the median income for California. In 2012, adjusted median household income was \$74,000 in the Bay Area and \$114,000 in the Tri-Valley.

PRODUCTIVITY: GDP PER WORKER

Tri-Valley, Bay Area, and United States



LIVABILITY

When asked why they chose to locate their businesses in the Tri-Valley, business leaders repeatedly cite quality of life, access to skilled talent, and proximity to partners and clients in the broader Bay Area. Access to the Bay Area’s unique innovation environment makes the Tri-Valley an appealing destination for new and expanding businesses.

The Tri-Valley’s 2012 population of nearly 340,000 has been fairly consistent since the onset of the recession in 2008; however, since 2000, the area’s population has increased by 20 percent. The Tri-Valley’s suburban feel and its proximity to San Francisco, Oakland, and San Jose make it an attractive place to settle for many of the people employed by the growing number of firms in the Bay Area.

The share of the Tri-Valley population between the ages of 45 and 65 has grown from 26 to 31 percent since 2000. In contrast to regional and national trends, young people aged 18 to 24 have increased in share from 6 to 8 percent. Both of these trends could be the product of the influx of young families into the Tri-Valley over the course of the last decade. As the heads of these households have aged, they have moved into the 45-to-65-age bracket, while their children now fall into the 18-to-24 grouping.

HOUSING CHARACTERISTICS

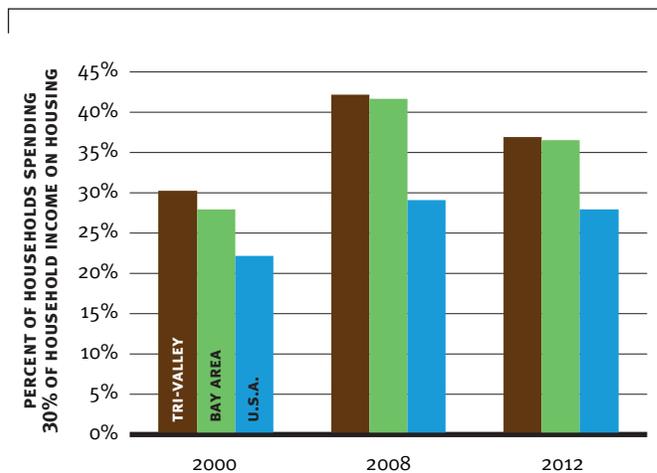
Given the suburban development patterns in the Tri-Valley, the area’s housing mix differs significantly from the mix in the broader region. The rate of homeownership is higher, and houses tend to be newer and larger, single-family structures. Seventy-seven percent of units are owner occupied, compared with 62 percent in the Bay Area. In the Tri-Valley, 72 percent of units are single-family homes, a much higher share than seen in the Bay Area overall (58 percent). Only 9 percent of the homes in the Bay Area were built after 1999. In contrast, 18 percent of Tri-Valley homes were built in the last 15 years.²⁷ And in the cities of San Ramon and Dublin, over 30 percent of the homes were constructed after 1999.

The prevalence of newer, standalone structures in the Tri-Valley correlates with higher home values. Eighty-three percent of Tri-Valley homes are valued above \$400,000, compared with 66 percent for the Bay Area. Additionally, Tri-Valley homes are twice as likely to have four or more bedrooms, and Tri-Valley households are more than three times as likely to have two or more vehicles when measured against the region as a whole.

Despite their relative affluence, residents of the Tri-Valley report a similar housing cost burden as residents region-wide. When a household spends more than 30 percent of household income on housing, it is considered cost-burdened. The fact that the housing cost burden in the Tri-Valley corresponds very closely to that of the Bay Area suggests that the Tri-Valley housing market is closely integrated with the rest of the region.

HOUSING COST BURDEN FOR HOMEOWNERS

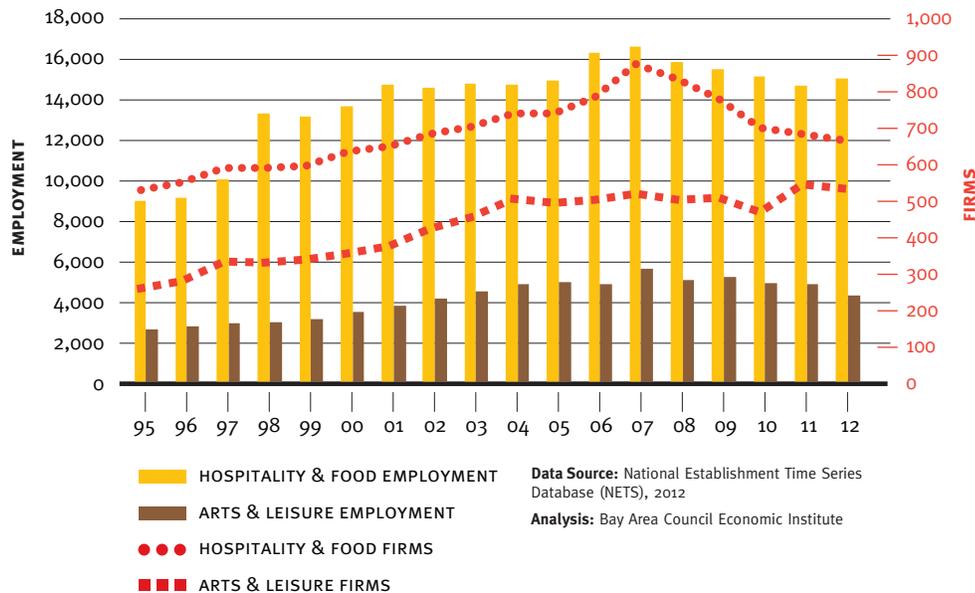
Households Spending more than 30% of Income on Housing



Data Source: U.S. Census Bureau, three-year American Community Survey estimates and 2000 Decennial Census
 Analysis: Bay Area Council Economic Institute

HOSPITALITY & LEISURE EMPLOYMENT AND ESTABLISHMENTS

Tri-Valley



OPEN SPACE

Easily accessible protected open space is abundant in the Tri-Valley, with 99,000 acres (155 square miles) set aside as open and mixed public access parkland. This acreage amounts to 10 percent of the 1 million acres of protected land in the Bay Area and consists primarily of state and regional parks, including Mount Diablo State Park, Pleasanton Ridge Regional Park, Del Valle Regional Park, and Brushy Peak Regional Preserve. In addition, Tri-Valley cities maintain 133 urban parks.

In addition to having a vast amount of open space, the Tri-Valley boasts one of the longest multi-use trails in the Bay Area. The Iron Horse Regional Trail was established in 1986 along an abandoned Southern Pacific Railroad right of way. Currently, the trail runs 32 miles from Concord south to the Pleasanton/Livermore border at Isabel Avenue, with approximately half of the mileage contained within the Tri-Valley area. The trail provides an important connection between residential and commercial areas, business parks, schools, public transportation, and community facilities. Plans are underway to extend the trail another six miles through Livermore, and eventually all the way to the San Joaquin County line.

With over nine miles of trail within their boundaries, San Ramon and Danville serve as important midpoints. Additionally, the cities are undertaking planning efforts to make the trail corridor safer for bicyclists and pedestrians. Community outreach has taken place in anticipation of the construction of over-street bridge crossings at Bollinger Canyon Road and Crow Canyon Road in San Ramon and at Sycamore Valley Road in Danville. The trail also abuts Danville's historic downtown, allowing users easy access to retail establishments and restaurants.

LEISURE AND HOSPITALITY

With nearly 300 full-service restaurants, 90 hotels and motels, and 17 golf courses and country clubs in 2012, the Tri-Valley has a vibrant leisure and hospitality industry. These businesses employ a significant number of workers, many of whom commute into the Tri-Valley to reach their workplaces.

Hospitality- and leisure-related businesses in the Tri-Valley witnessed steady growth from 1995 through 2007, with employment gains over this period driven primarily by hospitality and food services businesses, which added 8,730 jobs. During this period, annual growth in both the number of firms and the number of jobs for hospitality and leisure businesses within the Tri-Valley grew faster than in the broader Bay Area, by 1.5 percent and 2.5 percent, respectively. Since 2007, the area has seen a decline within the sector, though hospitality and food service employment did grow in 2012 for the first time since the recession.

While the Bay Area and the Tri-Valley have similar concentrations of leisure businesses,²⁸ there is a great deal of diversity in the services these businesses offer.

Membership golf clubs in the Tri-Valley employ 541 of the 1,731 employees working in this industry in the Bay Area.

Public golf courses are also easy to find, with a 2.46 relative concentration versus the broader Bay Area, meaning they make up a larger component of the total business base in the Tri-Valley compared to the wider region.²⁹

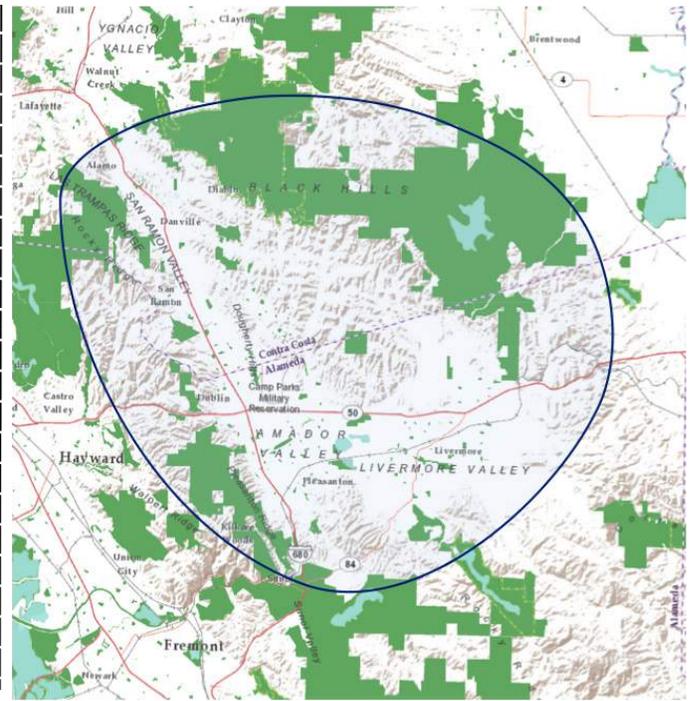
Tri-Valley residents and visitors have easy access to health clubs and spas; businesses in these two industries have a relative concentration of 1.78.

PROTECTED LAND IN THE BAY AREA AND TRI-VALLEY

San Francisco Bay Area



Tri-Valley Region



Source: Greeninfo Network, Esri, USGS, and NOAA

Analysis: Bay Area Council Economic Institute

AGRICULTURE

The Tri-Valley is also home to nearly all of the agricultural land in Alameda County, which provides economic value to the area. The gross value of all agricultural production in the county in 2013 was \$42 million. An Urban Growth Boundary, approved in 2000 as Measure D, limits the development that can occur outside of Pleasanton, Dublin, and Livermore. Much of this land is privately owned and all of it is zoned for agricultural uses. Under the rules of the Urban Growth Boundary, this land cannot be carved into parcels smaller than 100 acres and can only be developed if annexed by a city or through voter approval.

While the majority of this land is used for cattle grazing, wine grapes have become the Tri-Valley's signature crop, most notably in the South Livermore Valley. Winemaking was encouraged in the South Livermore Valley Area Plan, in which the 100-acre parcel size minimum was decreased to 20 acres if the landowner maintained a conservation easement and the land was planted with wine grapes, olives, or pistachios.

With 53 wineries, the Tri-Valley area now grows wine grapes on over 4,000 acres. Notably, Livermore has over 45 wineries, ranging from small family-owned operations to heavyweight wineries.³⁰ It is credited as being the first region to bottle varietals labeled Chardonnay, Sauvignon Blanc, and Petite Sirah.³¹ The Tri-Valley is also home to **Wente Vineyards**, California's oldest, continually operated family-owned winery founded 130 years ago. Livermore hosts and sponsors numerous wine-related events throughout the year, including food and wine festivals, wine consumer showcases, shop and sip events, and holiday celebrations, where visitors can taste wines from multiple wineries while participating in vineyard tours, speaker series, shopping, wine seminars, and cooking classes.³²

In addition to wine grapes, the production of which created \$16.0 million in gross value in 2013, Alameda County agricultural producers derive value from field crops (hay and alfalfa), nursery products (ornamental trees and shrubs, bedding plants, and indoor decorative plants), and livestock. Much of this production is concentrated in the Tri-Valley given its parcels of land that are protected for agricultural uses.

ENABLING A ROBUST ECONOMY: TRANSPORTATION AND LAND USE

Because of its many assets, the Tri-Valley is well positioned to take advantage of the growing number of economic opportunities in the Bay Area. But positioning the region for success going forward will require investments in infrastructure to support the growing movement of people and to strengthen the increasing number of high-value connections with Silicon Valley and the broader Bay Area. Given its location, the Tri-Valley is a critical hub in the Bay Area's transportation system: commuters move to, from, and through the area as it grows as a population center and as a job center; agricultural products move from the Central Valley to the Bay Area's primary port in Oakland; and goods move from the port to inland distribution centers.

HIGHWAYS

The main highway routes through the Tri-Valley region are I-580 and I-680. The I-580 freeway is the primary east-west vehicle route, connecting the Bay Area with the Tri-Valley and the Central Valley. It serves as a significant regional and interregional commuter route, and it provides access to the I-5 freeway to transport goods to and from Southern California and points beyond.

With connections to the interstate network, I-580 is also a major gateway for goods movement to and from the Bay Area's five seaports, most notably the Port of Oakland. The Port of Oakland accounts for nearly all agricultural products exported from Bay Area ports, and it relies heavily on I-580 as an inbound corridor for much of this trade, as there are few viable alternative travel routes. In 2013, approximately half of the port's exports by value were related to food products, much of which are grown in the Central Valley.³³

Agricultural products rely heavily on trucking for moving products to port. Of Bay Area agricultural waterborne exports by tonnage, 94 percent traveled to ports by truck. For all Bay Area exports, this is the case for just 46 percent.³⁴ Given trucking's importance in linking the Central Valley to the port, I-580 experiences heavy truck traffic. Between the West Dublin/Pleasanton BART station and the Livermore city limits, I-580 carried an annual average daily traffic (AADT) volume of 162,667 vehicles in 2012. Trucks make up between 5 and 12 percent of the traffic flow on I-580 within the Tri-Valley.

VEHICLE VOLUMES ON I-580 IN THE TRI-VALLEY – 2012

City	Milepost	Description	Leg	Vehicle AADT	Truck AADT	Truck % of Total
Livermore	8.265	Greenville Road	Back	143,000	14,872	10.4%
Livermore	8.265	Greenville Road	Ahead	142,000	11,829	8.3%
Livermore	10.689	First Street	Back	166,000	7,553	4.6%
Livermore	10.689	First Street	Ahead	165,000	20,130	12.2%
Pleasanton	20.726	Route 680 Junction	Back	184,000	12,457	6.8%
Pleasanton	20.726	Route 680 Junction	Ahead	176,000	16,174	9.2%
Corridor-Wide Averages				162,667	13,836	8.5%

Note: Back leg measurements are taken behind ascending mileposts; ahead leg measurements are taken in front. Annual average daily traffic (AADT) counts are two-directional flows.

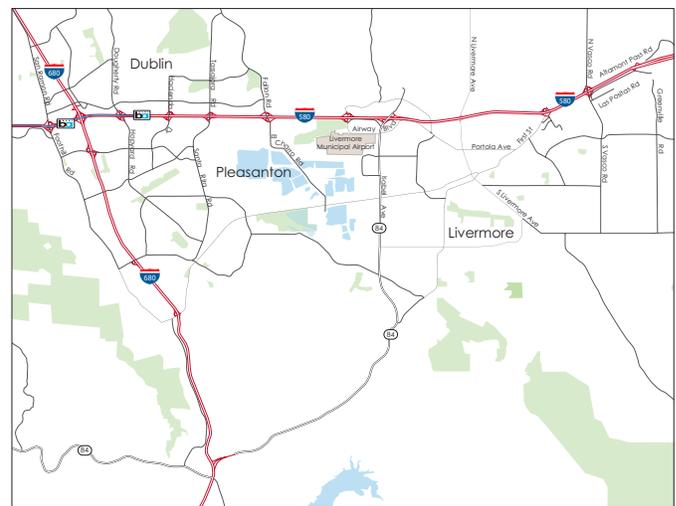
Data Source: Caltrans Annual Average Daily Truck Traffic

Analysis: Bay Area Council Economic Institute

The I-580 corridor experiences the second-highest volume of truck traffic in the Bay Area, with nearly 14,000 trucks per day. Most of this truck traffic is long-haul trucking and involves the heaviest vehicles.³⁵ The Altamont Pass on I-580 to the east of Livermore is a steep grade through hilly terrain that further slows traffic. Trucks traveling through the Altamont Pass are generally unable to maintain typical freeway speeds, which can cause additional congestion and bottlenecks as they come into the Tri-Valley. To help alleviate this problem, a dedicated truck climbing lane is planned to accommodate trucks moving over the Altamont Pass.

The Metropolitan Transportation Commission (MTC) released a ranking of Bay Area freeway corridors with the heaviest commuting delays in 2008.³⁶ This study reported that eastbound I-580 (from the I-680 junction to North Livermore Avenue) in the evening peak hours ranks as the third most congested route in the Bay Area. Moreover, westbound I-580 (I-205 to Airway Boulevard in Livermore) during the morning peak hours is the sixth most congested corridor in the region. More recent data points to an increasing level of congestion on I-580. From 2011 to 2013, average daily vehicle hours of delay on I-580 through the Tri-Valley grew by nearly 26 percent. In 2013, approximately 4,800 hours of daily delay occurred within the I-580 Tri-Valley corridor in each traffic direction as compared to a 60 mile per hour benchmark.³⁷

MAJOR TRI-VALLEY ROADWAYS



AVERAGE DAILY VEHICLE HOURS OF DELAY IN THE TRI-VALLEY

Year	I-580 East	I-580 West
2013	4,852	4,796
2012	4,733	4,257
2011	3,814	3,853

Note: Average daily vehicle hours of delay is a measure of the amount of time collectively spent on highway corridors at a speed below the 60 mile per hour benchmark.

Data Source: Caltrans Mobility Performance Report using Performance Monitoring System (PeMS)

Analysis: Bay Area Council Economic Institute

Approximately 66 percent of the riders who moved through Tri-Valley BART stations in December 2013 were traveling to or from San Francisco.

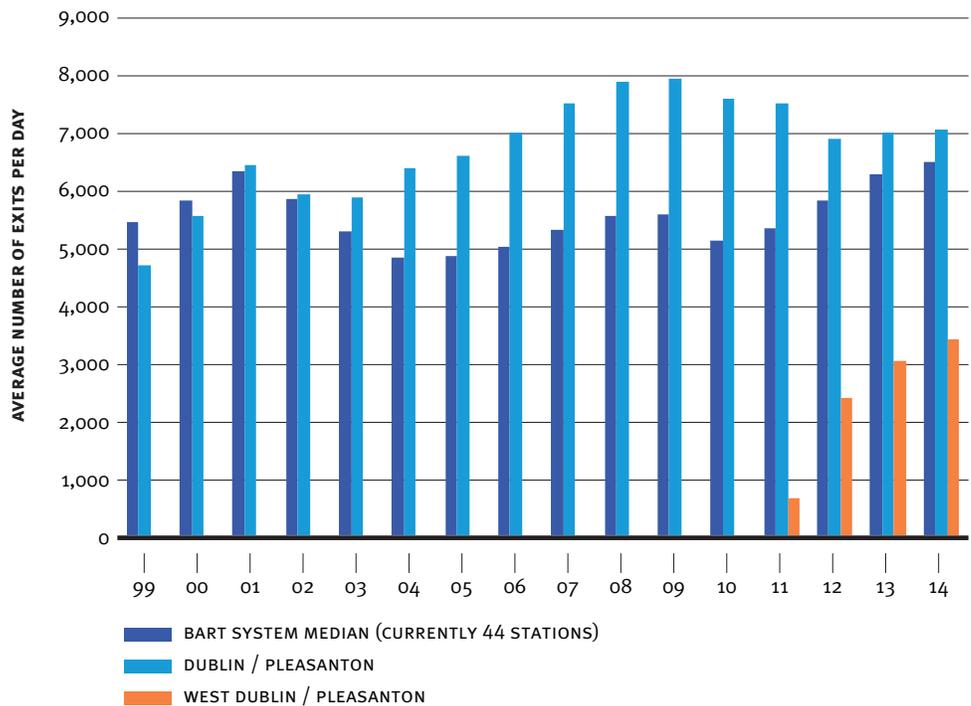
BAY AREA RAPID TRANSIT (BART)

The Tri-Valley is served by BART’s Dublin/Pleasanton-Daly City line, with two stops along I-580 that connect the area to the broader region. The Dublin/Pleasanton station currently anchors the system’s easternmost traveling line and straddles the border of Dublin and Pleasanton. The West Dublin/Pleasanton station—BART’s 44th and newest station—began operations in February 2011 and is located adjacent to Stoneridge Corporate Plaza.

The end-of-the-line Dublin/Pleasanton station is regionally significant in that it serves as a primary transfer point between BART and local and regional bus services. The station is fed by 20 bus lines from five different transit operators: Livermore Amador Valley Transit Authority, County Connection, San Joaquin Regional Transit District, Modesto Area Express, and Amtrak Thruway Motorcoach. Together, these connections can move passengers from Modesto, San Jose, and Stockton to all points within the BART system.

Daily BART exits in the Tri-Valley had been on the rise from 2003 to 2009, coinciding closely with increases in employment from independent business ventures in the region and population growth. Following the recession, ridership dipped by 4 percent between 2009 and 2010, though it has recovered with the opening of the West Dublin/Pleasanton station. With two stations in operation, the last two years have seen strong ridership growth within the Tri-Valley, most notably in 2012, when exits grew by 12 percent. In 2013, the Tri-Valley stations combined to record average daily exits of 10,000 people. The Dublin/Pleasanton BART station’s 6,972 daily exits also make it the ninth busiest stop of the 30 East Bay BART stations. Notably, approximately 66 percent of the riders who moved through Tri-Valley BART stations in December 2013 were traveling to or from San Francisco.³⁸

BART AVERAGE WEEKDAY EXITS BY FISCAL YEAR



Note: West Dublin/Pleasanton Station opened in 2011; the five stations of the SFO extension opened in 2003. Exit data take into account round trips made throughout the day.

Data Source: BART Monthly Ridership Report

Analysis: Bay Area Council Economic Institute

ALTAMONT CORRIDOR EXPRESS (ACE)

The Altamont Corridor Express (ACE) operates commuter rail service between Stockton and San Jose at peak hours during weekdays, serving the Tri-Valley area at three stations: Pleasanton (located on the edge of the city’s downtown district), Livermore (located in the city’s downtown core), and Vasco Road (located adjacent to Lawrence Livermore). Each of these stations provides commuter parking and connections to other transit options. The Livermore ACE station functions as a regional transit hub and facilitates connections between Amtrak California and the intercity bus service.

ACE is operated using diesel locomotives with bi-level coaches, and it currently operates four weekday round trips between Stockton and San Jose. In fiscal year 2012, ACE supported 787,000 trips, with an average weekday ridership of 3,123. ACE ridership has fluctuated over the past decade, though trips and passenger miles are rebounding after a post-recession drop. This increase is largely due to the introduction of a fourth daily round trip that has given current passengers more flexibility and provided another option to attract new riders. Growing ridership has also boosted the agency’s service effectiveness, which is defined as the ratio of passengers to number of hours vehicles are in service.

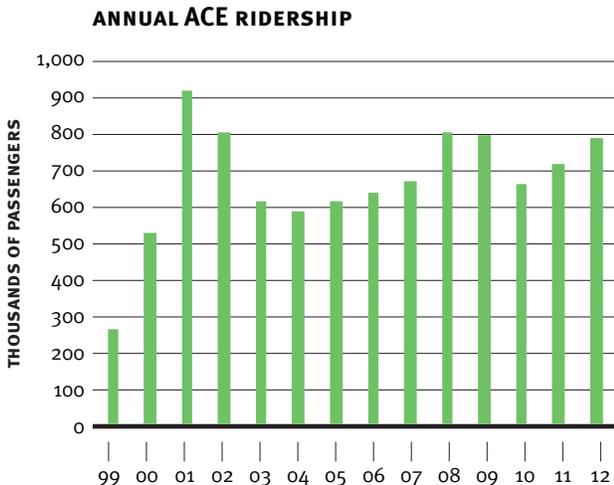
During the 2013 calendar year, ACE transported over one million passengers for the first time in its history. A portion of this growth has been the result of the agency working with transit partners to strategically adjust shuttle routes that connect ACE riders to corporate centers in both the Tri-Valley and Silicon Valley. As ACE continues to look into connectivity options with other transportation providers, the proposed BART extension to Livermore will provide an opportunity to better link passengers between the ACE and BART trains.

ACE also has goals to expand its role beyond a commuter rail, as it is now completing initial environmental and engineering work to improve service to six daily round trips by 2018 with 10 daily round trips expected to follow by 2022. Additionally, ACE has plans to extend its service to Merced by 2022, which would allow for a link to the initial segment of high-speed rail service and would provide an opportunity for a large increase in ridership.

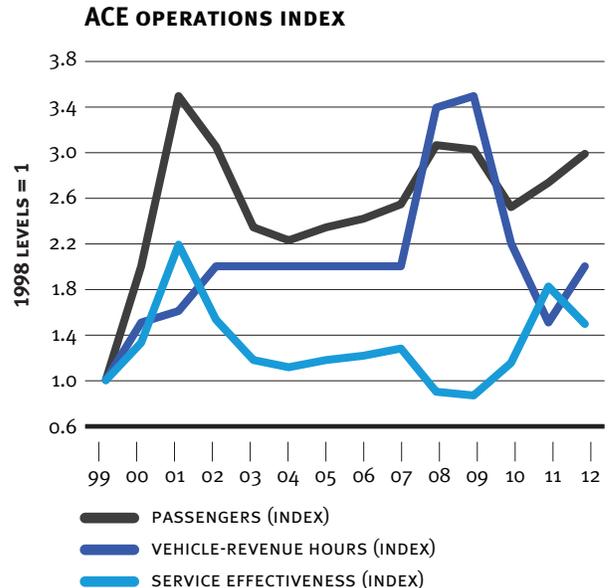
ACE SERVICE MAP



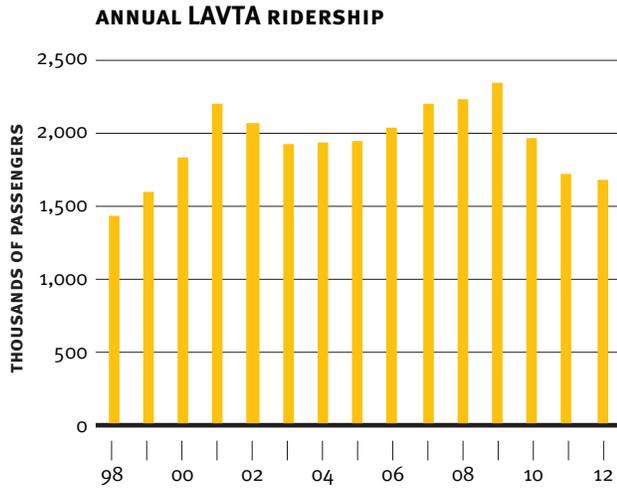
ANNUAL ACE RIDERSHIP AND SERVICE LEVELS



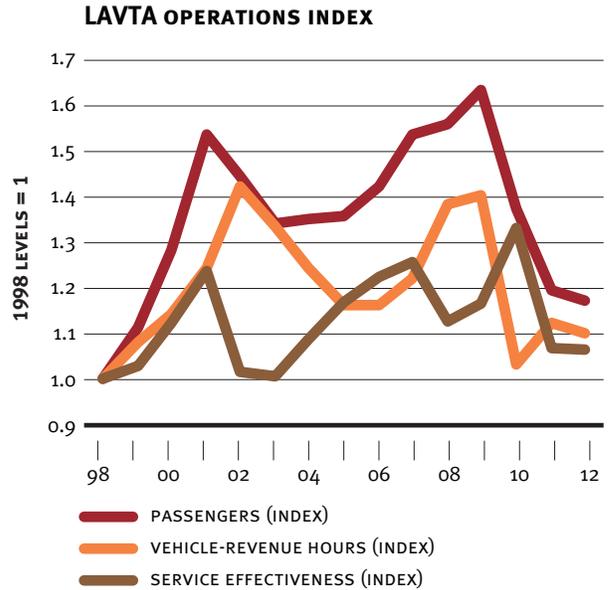
Data Source: MTC Transit Performance Reports
 Analysis: Bay Area Council Economic Institute



ANNUAL LAVTA RIDERSHIP AND SERVICE LEVELS



Data Source: MTC Transit Performance Reports
 Analysis: Bay Area Council Economic Institute



BUS SERVICES

Livermore Amador Valley Transit Authority (LAVTA) is the local public transit service provider to the cities of Dublin, Livermore, and Pleasanton, as well as to the adjacent unincorporated areas of Alameda County. It provides a fixed-route bus service called Wheels and a demand-responsive paratransit service. LAVTA structures its bus service around two primary transit hubs: the Dublin/Pleasanton BART station and the Livermore Transit Center/Livermore ACE Station. Eleven bus routes currently provide service to the BART station, and seven routes serve the Livermore Transit Center. Total annual ridership in 2013 was approximately 1.7 million. LAVTA's newest fixed-route service, Rapid, launched in January 2011 and features service in 15-minute intervals between major Tri-Valley employment, retail, medical, and civic locations, such as the BART stations, the national laboratories, and ValleyCare Medical Center.

In addition to LAVTA services, there are several bus systems that connect the Tri-Valley to other regions.

County Connection mainly serves Contra Costa County in and around Walnut Creek, though it does provide service with connections south through San Ramon and Danville. System-wide average weekday ridership was 11,400 during the 2011–2012 fiscal year. Additionally, it links to the Dublin/Pleasanton BART station and the Pleasanton ACE station.

Modesto Area Express (MAX) offers a nonstop, subscription-based service between downtown Modesto and the Dublin/Pleasanton BART station, making two trips each morning and each evening.

San Joaquin Regional Transit District operates Route 150 between the Dublin/Pleasanton BART station and Stockton and Manteca via Sandia, LLNL, and Tracy. Route 150 served 37,096 passengers in fiscal year 2013 and has experienced consistent growth.

CITY SPOTLIGHT: THE TRAFFIX BUS PROGRAM IN SAN RAMON AND DANVILLE

TRAFFIX is a privately provided school bus program funded by Measure J, the half-cent sales tax approved by Contra Costa County voters in 2004. Its purpose is to reduce traffic congestion caused by parents driving their children to and from school through some of the Tri-Valley's most congested intersections. The program began service in August 2009—after the San Ramon Valley Unified School District dropped its busing program in 2007—with a fleet of new clean-burning buses with state-of-the-art safety features. To encourage parents to sign up for the program, TRAFFIX provides this service at less than half the cost of traditional school bus programs, only \$275 for an entire school year. Addressing the worst congestion problems in the area, TRAFFIX currently maintains routes to nine schools in Danville and San Ramon, many of which are elementary schools.

LAND USE AND CAPACITY FOR DEVELOPMENT

The Tri-Valley's location makes it an attractive site for businesses, and the area's transportation infrastructure plays a key role in connecting these firms to the rest of the Bay Area. In addition, the availability of office and industrial space in the Tri-Valley offers potential tenants a number of development opportunities at affordable prices. The Tri-Valley currently offers 31.5 million square feet of commercial office space.³⁹ After falling for six consecutive quarters dating back to 2012, the office market vacancy rate in the Tri-Valley has ticked upward in the last two quarters, according to commercial real estate company Colliers International. As of the first quarter of 2014, the office vacancy rate sits at 12.8 percent. While the vacancy rate is comparable to the rate in the rest of the Bay Area, average rental prices are more affordable in the Tri-Valley. The average asking rent in the Tri-Valley for the fourth quarter of 2013 was \$1.93 per square foot for full-service space. Livermore is the most affordable city within the Tri-Valley, at \$1.36 per square foot. With an average rate of \$4.65, San Francisco has the highest office rental price in the Bay Area. Rents in other Bay Area metro centers remain higher than in Tri-Valley, with an average of \$3.84 on the peninsula, including the cities of Mountain View and Palo Alto, and \$3.48 in Silicon Valley.

In 2013, the industrial real estate market in the Tri-Valley witnessed increasing activity, with vacancy rates dropping from 11.1 percent to 7.4 percent over the course of the year. With these shifts in the vacancy rate came changes in pricing. During 2013, asking rents increased from \$0.52 per square foot to \$0.58, and they are expected to continue rising through 2014 as the Bay Area economy improves. For comparison, the I-80/I-880 industrial corridor in Alameda County reported vacancy rates of 6.8 percent in the first quarter of 2014, with average asking rents of \$0.53 per square foot.⁴⁰

TRI-VALLEY RISING: OPPORTUNITIES AHEAD

The Tri-Valley has become a vital node in the Bay Area innovation system. Tri-Valley residents, companies, and labs are deeply embedded in the high-value technology networks in the region, collaborating with partners in advancing technological breakthroughs, growing businesses, and generating new economic value. Maximizing the quality of life and the economic opportunities in the Tri-Valley and in the Bay Area as a whole will require investments in infrastructure to support the region's growing number of innovation assets. As the region's economic activity grows, the physical capacity for transporting people to and from the Tri-Valley will also need to grow, with improved transit, highways, surface streets, and parking. Furthermore, as the volume of agricultural goods transported from the Central Valley to the Port of Oakland (and likewise the volume of goods moving from the port to inland distribution centers) continues to fill the region's roadways, the Tri-Valley's transportation systems and highways will experience growing pressure.

A complex network of infrastructure, vehicles, and exchange points is necessary to encourage the flow of people and goods around the region. A smoothly running transportation system can expand labor pools by enabling the efficient movement of people across longer distances. It can also improve the quality of life, air quality, and productivity. Goods can be manufactured in one area, tested in another, and purchased in a third—taking advantage of the economic strengths of each place. Well-functioning transportation systems are critical to economic competitiveness in many ways:

Cost of Production. An efficient transportation system can lower the cost of goods movement and increase reliability. Studies have found a correlation between infrastructure investments and improved economic output.⁴¹

Productivity. When firms cluster, they can more easily share ideas, supply chains, and people, thus boosting productivity.⁴² This effect is even more pronounced in knowledge-intensive industries.⁴³ Reduced commute times also have a positive impact on productivity for workers and the companies that employ them; time lost in traffic, on the other hand, has a negative effect.

HALLMARKS OF SUCCESSFUL INFRASTRUCTURE PROJECTS

Maximizing the quality of life and economic opportunity in the Tri-Valley will require investments in social infrastructure—facilities for civic life, health care, education, and social services—as well as transportation infrastructure—transit, highways, surface streets, and parking. These projects entail considerable risks in design, approval, and execution, and must compete with investments elsewhere in the public and private sectors. Attracting economic and political support of all types for Tri-Valley infrastructure will be critical to achieving the potential of this region.

Bay Area Council Economic Institute trustee and infrastructure development lawyer Rob James, a partner in Pillsbury Winthrop Shaw Pittman LLP, identifies the following hallmarks of successful projects.

Alignment needs to be maintained among host governments, funding sources, and other participants. Tension among players is inevitable, as different groups will place different values on project locations, employment opportunities, costs (including initial costs versus life-cycle costs), alternative uses of land and capital, traffic effects, and environmental impacts. The critical test is whether players can resolve these differences in a principled manner and keep them resolved, rather than making expedient compromises that will not stand the test of time.

The siting of infrastructure should enhance its value to the community, enabling the project to capture some of the value being created. This capturing of value can occur either through development of the proponents' adjacent property for commercial, parking, and residential use, or through tax assessments on the larger neighborhood that is benefiting from the project. The most value may be realized in locations where costs and land use impacts are greater—where greater usage occurs, the parties and the community reap larger rewards.

A land assemblage plan needs to be accomplished while enlisting and retaining support from the necessary constituencies. Use of existing property rights may be attractive to some participants, while negotiated acquisition or exercise of eminent domain powers may be needed for other desirable locations.

A resilient and sustainable business model is one that is viable in all parts of the business and real estate cycles. In addition to taking into account macroeconomic changes, project sponsors should envision and manage the prospect of underuse, competing facilities, and transforming technologies.

An entitlements and communications strategy should anticipate the environmental, land use, community impact, and economic issues associated with the infrastructure and address them prospectively and effectively. Environmental impact studies and public outreach should face the genuine concerns early on and head on.

The best funding sources are either concentrated and resistant to changes in economic and political trends, or diversified and capable of being drawn on in different mixes.

A project structure should have powerful incentives for high quality performance, allocations of project risks to those parties best able to control and absorb them, and staged investments for responding to changed conditions. Carrots and sticks that are large can lead to “scorekeeping” and recurring disputes for owners and contractors, while standards and deductions that are modest may not lead to desired behaviors.

A rational procurement policy considers design-build, public-private partnerships, leasing, and other alternative project delivery methods, eliciting the interest of the best contractors, vendors, and funding sources. The goals wherever possible should address total cost of ownership over the long term, quality of service, and value for money, not only initial expense.

Expanded Labor Pool. Well-functioning transportation systems enable firms to access more workers. This supports economic growth and facilitates efficient labor matching, allowing firms to access the most talented workers in an area.

Real Estate Values. Alternative transportation infrastructure can boost local property values, especially near transit stations. For example, a 1996 study of the BART system found a \$34 per month rent premium for apartments located within one-quarter mile of a station.⁴⁴ Rail line extensions can also increase property values, as an analysis of the new Hiawatha Light Rail corridor in Minnesota found that residential property values increased by \$47 million along the segment of the corridor studied.⁴⁵ Transit time reductions can also improve property values. A 2012 study of a proposed modernization of the Caltrain system estimated increased residential real estate values of at least \$210 million.⁴⁶

TRI-VALLEY TRANSPORTATION INITIATIVES

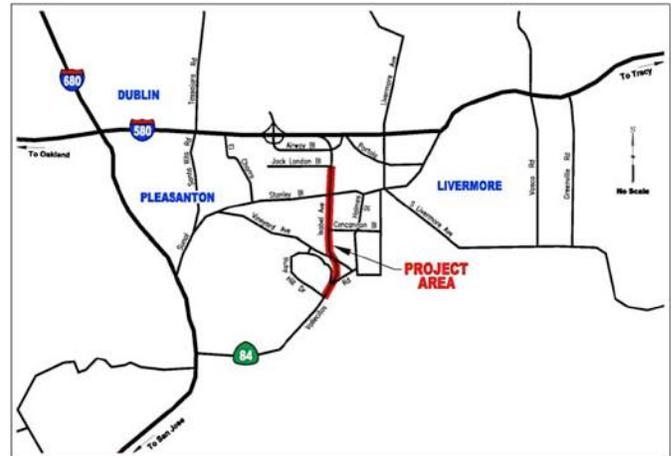
Numerous policies have been implemented in the Tri-Valley that will allow it to optimize its capacity for growth through improved movement of people and goods. Specific to the arena of transportation planning, the five local Tri-Valley governments and Alameda and Contra Costa Counties have come together to form the Tri-Valley Transportation Council (TVTC) to address regional transportation issues. Established in 1991, the TVTC was the product of the first joint powers authority agreement in California to cross county lines. The TVTC's Action Plan for Routes of Significance lists high-priority transportation improvement projects that will ease regional traffic congestion. These projects are partially funded by the Tri-Valley Transportation Development Fee (TVTDF), which seeds the initial engineering and environmental work on many major regional projects. Fees of \$2,313 per new residential unit, \$1,472 per new multifamily residential unit, and \$4.15 per square foot of office space are applied and collected by all of the TVTC jurisdictions.⁴⁷ Expected revenues for the 2013–2014 fiscal year are just short of \$9 million.

STATE ROUTE 84 EXPANSION

In an effort to address congestion on major regional routes, multiple projects to improve the capacity and traffic flow circulation of State Route (SR) 84 have moved through various stages of planning and construction. Currently, SR-84 connects I-680 from south of Pleasanton to I-580 in west Livermore. This configuration only occurred after the completion of the SR-84/I-580 Interchange Project in 2012, which included the construction of a new I-580 interchange at Isabel Avenue, as well as the realignment of SR-84 to meet the interchange. This project helped to shift some of SR-84's traffic flow out of downtown Livermore.

Commuters and truck traffic often bypass the I-580/I-680 interchange by taking SR-84 and arterial roads between Livermore and Pleasanton. In an effort to more seamlessly move this traffic onto and through SR-84, expansion and widening projects are being implemented that will allow speed limits to reach expressway standards of 55 miles per hour. The SR-84 expansion will be completed in multiple phases. The north segment between Concannon Boulevard and Jack London Boulevard near Livermore, which includes a truck climbing lane and signalized access, was completed in June 2014.⁴⁸ Construction on the south segment, connecting Ruby Hill Drive to Concannon Boulevard, will commence in 2015 and continue through 2017. In total, two additional lanes will be added to the four-mile stretch, and improvements will be made to increase safe pedestrian and bicycle access. Construction costs for these two phases of expansion are estimated at \$132 million, with the TVTC providing \$10 million. Additionally, a third segment of SR-84, from Pigeon Pass to I-680, is slated to receive \$122 million for a two-lane expansion in Alameda County's Transportation Expenditure Plan that will be voted on in the November 2014 ballot.

STATE ROUTE 84 EXPANSION PROJECT AREA



EXPRESS LANES

The Tri-Valley has also been at the forefront of the Bay Area's push to improve highway reliability and efficiency through the implementation of express, or high-occupancy toll (HOT), lanes. As regional planning agencies have shifted from meeting highway demand to improved demand management, HOT lanes have become the next logical extension of high-occupancy vehicle (HOV) lanes. Many economists advocate the use of tolls to ration limited space on congested roads.⁴⁹ Where existing HOV lanes have excess capacity, the conversion to HOT lanes gives individual drivers the option to pay an electronic toll while using the lane, while carpool drivers continue to ride at no cost. This choice can better match drivers and their use preferences—their willingness to pay for a faster trip—and maintain more rapid traffic flow in general purpose lanes.

The Bay Area's first HOT lane project opened in September 2010 on I-680 southbound over the Sunol Grade. The 14-mile stretch from SR-84 south of Pleasanton to SR-237 in Milpitas was designed to provide drivers with a new commute choice between the East Bay and Silicon Valley. An evaluation of the express lanes in 2012 showed that average travel times in the general purpose lanes were reduced by 13 to 22 percent (2.0 to 4.4 minutes) during the morning peak traffic period as compared to 2008 data. Dynamic pricing is also utilized, whereby the cost to use the HOT lane for individual drivers varies based on real-time traffic levels. Morning peak hour tolls in fiscal 2013 averaged \$2.35, and the number of monthly toll-paying users has grown by 58 percent between 2010 and 2013.

The I-680 southbound express lane is the first of an extensive express lane network envisioned throughout the Bay Area. California's AB 1467, approved in 2006, originally authorized limited HOT lane projects in Northern and Southern California. This authority was granted to the Sunol Joint Powers Authority,⁵⁰ Alameda County Transportation Commission (ACTC) for a second corridor in the county, and Santa Clara Valley Transportation Authority for any two transportation corridors.⁵¹

ACTC chose the portion of I-580 running through the Tri-Valley as the location for its second express lane project. For much of the last five years, there has been ongoing construction to add HOV lanes to the I-580 corridor between Livermore and Dublin/Pleasanton. Construction on 11 miles of an eastbound HOV lane from Hacienda Drive (Dublin/Pleasanton) to Greenville Road (Livermore) was finished in 2010, while completion of the 13-mile westbound lane between Greenville Road and San Ramon Road (on the western side of I-680) is scheduled for 2015. TVTC has contributed \$1 million of the \$145.2 million projected total costs for the westbound lane, and funded \$8 million of the costs of the eastbound HOV lane. Work is also planned to convert the new HOV lanes on I-580 to HOT lanes, which will be open for use in late 2015.

Following the passage of AB 1467, the Metropolitan Transportation Commission (MTC) has led an effort to receive approval for a build-out of the express lane system. Today, regional planning agencies across the Bay Area are intending to implement a total of 550 miles of express lanes by 2035. The Metropolitan Transportation Commission will operate 270 miles of these lanes; 150 miles of existing HOV lanes will be converted, and 120 miles of new lanes will be added to close system gaps.

As a part of the MTC network, HOV lanes on southbound I-680 from Walnut Creek to the Contra Costa-Alameda County line are being converted to HOT lanes. This project—estimated to open in 2016—will connect to new lanes being designed over Alameda County’s portion of I-680 south to SR-84 that will be developed if sufficient funding can be secured. When all proposed HOT lane projects on I-680 are complete, they will create a continuous southbound express lane network from the Martinez-Benicia Bridge to San Jose, and I-680 will become one of the most heavily technology-instrumented corridors in the country. It is envisioned that this new demand management approach on both I-580 and I-680 will ease a portion of the highway traffic congestion experienced in the Tri-Valley, and could provide initial funding for future improvements in these corridors.⁵²

I-680 AUXILIARY LANES BETWEEN DANVILLE AND SAN RAMON

One of TVTC’s high-priority projects that will soon be completed is the addition of auxiliary lanes to I-680 between Danville and San Ramon. This area is a common entry point for residents of the two communities driving into San Francisco, Oakland, or Silicon Valley via I-580. The auxiliary lanes ease traffic congestion on highways by connecting the on-ramp of one interchange with the off-ramp at the next interchange, thereby giving drivers the ability to more safely enter and exit the freeway. The project is being completed in three sections, with the final segment between Sycamore Valley Road in Danville and Crow Canyon Road in San Ramon connecting two previously completed sections. This final road widening project will add 12 feet of highway in both directions, stretching 2.1 miles between exits, and will be available to drivers beginning in mid-2014. Approximately 10 percent of the total project cost of \$34 million was funded by TVTC funds; the remainder is made up of a mix of federal, state, and county funds.

Over this same stretch of I-680, Contra Costa Transportation Authority is planning a transportation project that will better link carpool riders to their work destinations. Inside, direct access carpool ramps will allow HOV users to easily enter and exit the highway at Bishop Ranch in San Ramon without having to cross over multiple lanes. As some drivers will not utilize HOV lanes to avoid movement between lanes, an HOV ramp could increase use of the lanes and limit highway weaving that can cause congestion. This project is currently funded through the environmental review and design phases. Alameda County Transportation Commission is also exploring similar direct access HOV ramps at the I-580/I-680 interchange.

I-680 AUXILIARY LANES PROJECT AREA



Source: Contra Costa Transportation Authority

COMPREHENSIVE LAND USE DEVELOPMENT STRATEGIES

The Tri-Valley's growth in both population and jobs over the last decade has made new transportation projects necessary. Housing and corporate campuses have been built, but the transportation infrastructure needed to fully support them has lagged behind. This problem is not specific to the Tri-Valley; it has permeated the entire Bay Area. In response to this trend and the requirements of Senate Bill 375—California's Sustainable Communities and Climate Protection Act of 2008—Bay Area municipal governments have taken steps to better integrate their transportation, land use, and housing strategies by identifying Priority Development Areas (PDAs). They are now being used in Plan Bay Area, which was adopted as the region's long-range integrated transportation, land use, and housing strategy in 2013.⁵³ PDAs are locally designated areas within existing communities that have been identified for future growth. Plan Bay Area facilitates implementation of PDA projects by expanding funding opportunities available to local jurisdictions while also eliminating inefficiencies in the development process.

Over 70 local governments have voluntarily designated nearly 170 PDAs, which are proposed to absorb approximately 80 percent of new housing and over 60 percent of new jobs. The plans of three Tri-Valley municipalities are highlighted below.

DUBLIN—MULTIPLE PDAS

The opening of the West Dublin/Pleasanton BART station in February 2011 has brought many changes to the City of Dublin. The first high-density residential project broke ground in 2012 and will bring over 300 new residential units to downtown Dublin. The West Dublin BART Station Area is one of the three PDAs planned in Dublin, showcasing how the city has embraced growth in a way that will maintain its current one-to-one ratio of jobs to housing. The Dublin Transit Center PDA, on the north side of I-580 adjacent to the Dublin/Pleasanton BART station, has also undergone immense change. The Alameda County Surplus Property Authority had owned approximately 1,000 acres of land near the BART station, which was entitled for 1,800 units of high-density housing and two million square feet of office space in Dublin's specific plan for the area. Over the last 15 years, Alameda County has parceled off and sold 950 acres to developers; today, 1,250 units have been built or are currently under construction.

Dublin still has a significant amount of developable land near both of its BART stations, with 60 to 70 acres of under-built or underdeveloped parcels within a quarter mile of its transit centers. The city is looking to utilize these highly valuable assets in a way that incorporates a mix of uses—both residential and commercial—to accommodate people across the income spectrum. Specifically, the city hopes to capture the next wave of office development with an approach that includes the identification of opportunity sites and flexible zoning requirements in those areas.

LIVERMORE—DOWNTOWN PDA

New development in the Downtown Livermore PDA will take advantage of the existing ACE train and LAVTA Wheels bus service, as well as LAVTA's new Rapid route service that links LLNL, downtown Livermore, and the Dublin/Pleasanton BART station. Execution on the plan has already produced substantial increases in moderate- to high-density housing, as well as commercial, office, and performing arts square footage. Plans also include a pedestrian link between the downtown core and the transit center, a public plaza, and improved signage and wayfinding. Additionally, Livermore has identified potential PDAs at I-580/Isabel Avenue and at an East Side location near the national laboratories that coincide with potential future transit stations. At Isabel Avenue, development would be planned in close proximity to the proposed BART extension to Livermore.

SAN RAMON—CITY CENTER PDA

The City Center project area and the larger PDA have long been recognized as an ideal site for developing a downtown to serve as the heart of San Ramon—the area is a strategic location to focus future growth. Development of the new City Center project will involve the expansion of public transportation facilities and services to the area within a new regional transit center to bring frequent, efficient, cost-effective, and convenient public transit to the area and allow for greater levels of mobility among residents, workers, and visitors alike. Initial concept plans propose over 2 million square feet of new development, including 488 new housing units, a commercial/retail complex, a new city hall and library, and a new hotel. The City of San Ramon also has a proposed PDA adjacent to I-680 called North Camino Ramon, which calls for a relocated transit center and new transportation infrastructure to support pedestrians, bicyclists, and carpooling.

PLEASANTON—HACIENDA PLANNED PDA

While Pleasanton does not have an officially approved PDA, it does have general plan policies that support transit-oriented development, and the city has identified portions of Hacienda for future development near the Dublin/Pleasanton BART station. Pleasanton has recently re-zoned 70 acres for high-density housing and five new development projects have been approved within Hacienda. In aggregate, these projects will add 1,195 units to Pleasanton's housing stock. Additionally, a nine-acre site within Hacienda and an existing BART surface parking lot provide opportunities for future mixed-use development.

FUTURE INFRASTRUCTURE TO SUSTAIN THE REGIONAL ECONOMY

The Tri-Valley Transportation Council estimates that the region’s population will expand by 35 percent by 2040, while employment growth will exceed 30 percent.⁵⁴ Given the suburban development pattern of the Tri-Valley, it is likely that continued growth will further stress roads and highways. In fact, travel demand models predict that the growth in peak traffic volume on the region’s main highways will range from 23 to 59 percent under current infrastructure conditions.⁵⁵ In addition to moving its own residents and workers, the Tri-Valley also serves as an essential gateway between the Central Valley and the Bay Area. Metropolitan Transportation Commission projections show travel volumes crossing San Joaquin and Alameda Counties growing by 90 percent from 2000 levels by 2030.⁵⁶ While the number of people commuting to, from, and through the Tri-Valley will grow, highway capacity will not. The Tri-Valley Transportation Plan of 1995 calls for gateway roads—I-680 and I-580 from both directions and Vasco Road—to remain constrained; that is, they will not be allowed to exceed a pre-specified number of traditional lanes. With limited ability to expand highway capacity, investments in transit infrastructure provide another option for improving commute times and reducing roadway congestion.

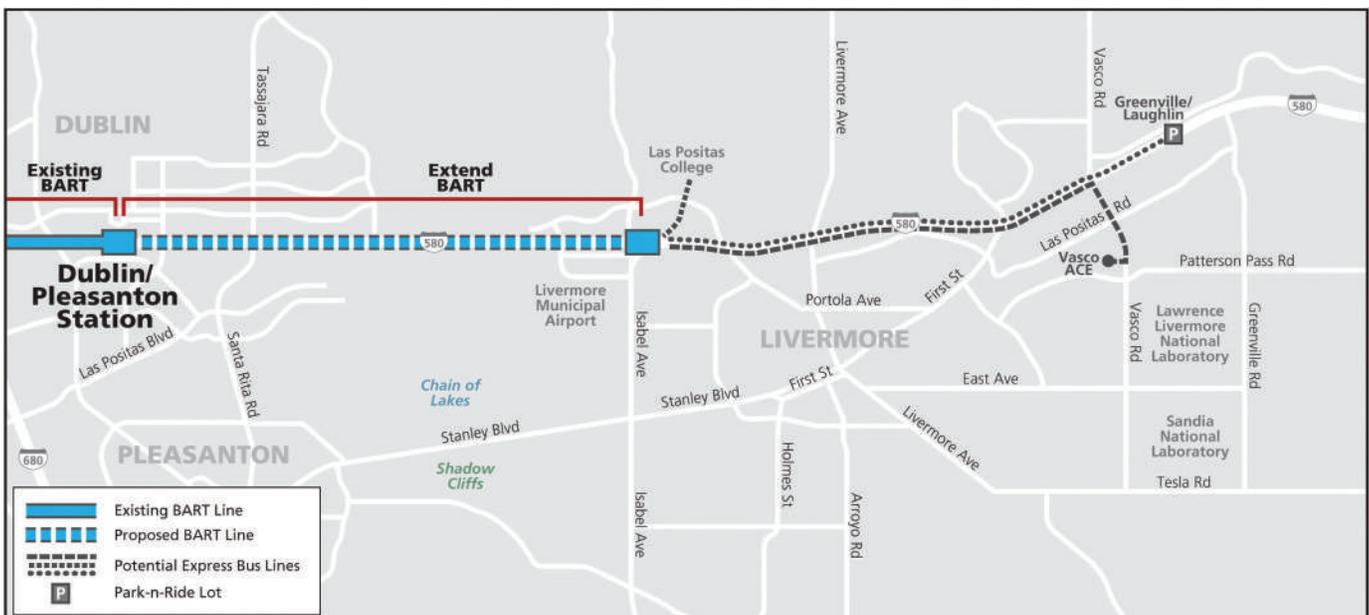
The congestion management and housing-related projects currently being planned will help alleviate pressure on Tri-Valley’s transportation infrastructure by allowing freer flow of traffic by placing more residential units in close proximity to transit. However, the plans presented previously may not be sufficient to bring the long-term solutions needed to seamlessly connect the region’s burgeoning business activity and growing population with the rest of the Bay Area. The following transportation initiatives represent significant opportunities for the Tri-Valley to address its future infrastructure needs.

BART EXTENSION TO LIVERMORE

BART is currently undertaking or analyzing several projects that will create a more extensive regional transit network connecting all corners of the Bay Area. One of those projects, the extension to Livermore, was first proposed in 1976, just four years after BART service opened. Since that time, the Livermore extension has remained only an idea, although hopes for a Livermore BART station gained steam in 2007 after the transit agency began looking into alignment alternatives for extending track to the eastern end of the Tri-Valley.

In February of 2012, the BART Board of Directors voted unanimously to advance the plan to extend BART to Livermore to the next phase of project development, which includes completing conceptual engineering and a project specific environmental analysis. Multiple options have been considered in the past, including a station with a parking structure at Greenville Road near I-580, and a station on Vasco Road, offering a connection with the ACE train. The current analysis considers four alternatives: a 4.8-mile extension of BART to Isabel Avenue in the I-580 median, with a bus-to-BART transfer service providing express bus service to Livermore’s Priority Development Areas, the Vasco ACE Station, and possible off-site parking facilities; a diesel or electric train system between the Dublin/Pleasanton BART station and Isabel Avenue; an express bus or bus rapid transit system with an in-line station at the Dublin/Pleasanton station; and enhancements to existing bus services. The environmental review is scheduled for completion in 2016.

PROPOSED BART EXTENSION TO LIVERMORE



Source: BART

CONCEPTUAL TRANSIT-ORIENTED DEVELOPMENT DESIGN AT THE EAST SIDE PRIORITY DEVELOPMENT AREA IN LIVERMORE



Source: City of Livermore

An extension of BART to Livermore would create an opportunity to improve the intermodal link from the BART system to interregional ACE rail service. This connection has been identified as an important link for the broader Bay Area's transportation system, especially in light of the heavy traffic on I-580, the growing flow of workers out of the Central Valley, and the importance of the corridor to agriculture and shipping. To support transit ridership, the City of Livermore is also looking at multiple land use scenarios with increased employment and housing in the area surrounding the proposed station.

A new BART station would create opportunities for transit-oriented development around the Isabel Avenue/I-580 interchange. The vision for this area includes a mix of housing types (in close proximity to transit and multi-use trail connections), an existing and expanding employment center, and Las Positas College—the Tri-Valley's community college with an enrollment over 9,000. This area could provide commuters, new residential developments, and the college with a transit link to other corners of the Bay Area.

Livermore also envisions other opportunities for transit-oriented development as it faces the possibility of rapid population growth. A planned priority development area adjacent to the national laboratories and Vasco Road has been identified for its potential as an integrated research and technology center with affordable housing of varied types and commercial services for both the daytime population and the residential community. Although this idea remains in the conceptual stage, this growing research area could provide a complete regional transit corridor with jobs accessible by ACE, bus rapid transit, and/or high-speed rail.

Extending BART would benefit not only the City of Livermore but also the broader Tri-Valley region, most notably the drivers on I-580, as it will likely cause the number of vehicles traveling to the Dublin/Pleasanton BART station to decrease. The Dublin/Pleasanton BART parking lot is frequently full at peak commuting hours; with some portion of its users shifting to Livermore, there will be a better ridership balance across BART stations in the Tri-Valley region. An extension of BART would also benefit the workers commuting in from other parts of the Bay Area as well as the trucking and shipping industries, as reduced congestion on I-580 will lead to faster goods movement.

TRILINK HIGHWAY

First identified in 1959, State Route (SR) 239 is a legislatively designated but unconstructed route. SR-239 is a potential multimodal link between SR-4 near Brentwood and I-205 west of Tracy in San Joaquin County. While the route has not been adopted, Contra Costa County was awarded \$14 million for initial study and planning under the federal transportation bill in 2005. Administration of the study of the route, now called TriLink, was transferred to the Contra Costa Transportation Authority in January 2012. Finalized feasibility studies were released in mid-2014.

The study area is outside of the Tri-Valley boundaries, but a route between Tracy and eastern Contra Costa County could help to alleviate some of the truck traffic that currently travels through the Tri-Valley on I-580 and on Vasco Road in Livermore. With communities in San Joaquin County increasingly planning for growth, it is expected that the manufacturing, wholesale, and warehousing industries will take on greater importance in the region. These industries rely heavily on the existing transportation infrastructure—most notably I-580—to move their goods to their final destinations. Tri-Link would provide an alternative for trips ending or originating north of the Tri-Valley. It is estimated that time savings on trips between Tracy and Martinez could reach 16 minutes, while overall vehicle miles traveled in the area are estimated to fall by 3.4 percent.⁵⁷ Initial projections also show a 10 percent reduction in average daily traffic volume over the Altamont Pass on I-580 in 2040 versus the no-build scenario.

Initial studies of the area have defined five possible corridor elements. The North Link and I-580 Link would comprise a freeway connection between SR-4 and the I-580/I-205 interchange west of Tracy. The Airport Connector, for Byron Airport, and South Link would provide improvements to existing infrastructure and support local connectivity and mobility. Three different options for a Transit Link are also being studied, which could provide transit connections via express bus service, the future eBART system, or ACE rail. The total capital cost to complete the TriLink project is estimated to exceed \$750 million, though tolling and public-private partnerships have been identified as possible innovative financing solutions.

The TriLink remains in extremely preliminary stages, as no project initiation documents have been filed and no dedicated funding exists. If the project is implemented, current estimates put construction as far away as 2024 or beyond; however the TriLink highway has already become a priority for many regional leaders, as it will serve to connect areas of the Bay Area where housing and job growth are expected to accelerate.

TRILINK STUDY AREA AND POSSIBLE DESIGNS



Source: Contra Costa Transportation Authority

MOVING TRANSPORTATION IN THE TRI-VALLEY FORWARD

Traffic—most notably the congestion on I-580—is often cited as the biggest constraint for continued business development in the Tri-Valley. Its impacts reach well beyond the Tri-Valley and pose constraints to the Bay Area economy, especially due to slowing goods movement from the Central Valley. If the Bay Area is to further leverage the Tri-Valley’s high-value contribution to economic growth, the transportation projects proposed can serve as important steps in building out the required infrastructure to meet increased demand. These projects will enable the region to benefit from greater connectivity and allow the Tri-Valley to blossom further as a vital node in the Bay Area’s innovation ecosystem.

While many of these improvements will take years—if not decades—to be realized, initial funding sources can be put in place today to spur projects toward completion. Contra Costa County has successfully utilized revenues generated through its Measure J, a 25-year, half-cent sales tax passed in 2004. Measure J will provide an estimated \$2.5 billion for countywide and local transportation projects through 2034. Funds have already been successfully deployed to improve the I-680 corridor, to maintain local streets and roads, and to begin construction on eBART—an extension of BART to eastern Contra Costa County utilizing smaller diesel multiple-unit trains.

Alameda County has benefited from similar sales tax measures, which date back to 1986 when the Measure B half-cent sales tax was first passed. In 2000, 82 percent of Alameda County voters approved the extension of Measure B for 20 years and the spending plan that accompanied it. Since that time, Measure B funds have been used to enhance local streets and mass transit operations, improve the SR-84/I-580 interchange, bolster transit-oriented development plans, and extend BART south to Warm Springs. The Measure B sales tax has also been integral in acquiring state and federal matching transportation funds. Measure B projects—including those within the I-580 corridor—have leveraged almost \$3 billion from external funding sources, nearly four times the funding dedicated to capital projects from Measure B.

An extension of Measure B for 30 years has been proposed in Alameda County in order to continue to address the county’s transportation needs. The 2014 Transportation Expenditure Plan (TEP) will be brought to voters for approval in November. The TEP lays out \$8 billion in transportation spending over the next 30 years, spread across transit, road maintenance, traffic management technology, and bicycle and pedestrian improvements.

Projects impacting the Tri-Valley have strong representation in the TEP. In all, Tri-Valley transportation investments are slated to receive over \$840 million in funding from the 2014 TEP. Specifically, \$400 million has been carved out to fund the first phase of a BART extension to Livermore. This funding could be used to leverage other federal and state funds that would be necessary to cover estimated expenditures. The Tri-Valley’s highway infrastructure takes center stage in the TEP, with \$132 million for SR-84 improvements from I-580 to I-680; \$48 million for I-580 corridor investments focused on bottleneck relief;

and \$60 million for I-680 high-occupancy lanes from Dublin south to the Santa Clara County line. Tri-Valley governments are projected to receive \$162 million over 30 years that can be used for local street improvements, bicycle and pedestrian paths, and paratransit for seniors and people with disabilities. LAVTA will also obtain \$38 million from the 2014 TEP for its bus operations. Gap closure and access projects on the Iron Horse Trail, freight corridor improvements on I-580, and enhancements to support transit-oriented development at Tri-Valley BART stations receive special mention in the TEP, though they remain discretionary projects that are not included in the \$840 million of Tri-Valley projects and programs.

Much of the Tri-Valley transportation spending associated with the 2014 TEP is in new construction. These expenditures will create new jobs, the earnings from which will then be recycled back into the regional economy.⁵⁸

To highlight the economic impacts, the case of spending to improve roadway conditions provides a useful example. First, there is a direct effect: the number of jobs and dollars in tax revenue that are directly linked to the original expenditure. Second, there is an indirect effect: when a contractor is hired to repave a road surface, this stimulates activity directly related to this contractor, but also indirectly stimulates activity at the concrete and asphalt companies that supply the materials. Finally, there is also an induced effect that results from the employees at the construction and concrete companies spending their increased take-home pay.

The total projected economic impact of the \$840 million investment in Tri-Valley transportation programs and projects associated with the 2014 TEP exceeds \$1.5 billion. Additionally, over 8,350 new full-time equivalent jobs will be produced from spending related to construction, maintenance, and operation of these transportation programs.

ECONOMIC IMPACTS OF TRI-VALLEY TRANSPORTATION PROGRAMS AND PROJECTS

Tri-Valley Spending	\$841,350,000
Economic Output	\$1,532,696,067
Full-time Equivalent Jobs Created	8,353

Note: Total Tri-Valley spending is likely to be higher as discretionary projects are not included in this analysis.

Data Source: These figures were calculated using the 2012 IMPLAN database
Analysis: Bay Area Council Economic Institute

Passage of the November ballot measure would mark an important step toward ensuring the necessary infrastructure to sustain economic growth in the Tri-Valley, and the impacts will benefit the wider Bay Area. Local leaders can also continue cultivating economic vitality by taking a comprehensive approach to development. By focusing on connections between public transit and employment hubs, leveraging the economic potential of transit centers, and broadening planning goals to take into account the area’s growth, the value of the Tri-Valley’s assets to the Bay Area economy can be enhanced and the Tri-Valley’s highly productive economic connections to the region strengthened.

APPENDIX A: METHODOLOGY

SECTION 1

Business Base: Diversity, Concentration, and Trends

Employment by Sector: Historic records of employment and firm establishments in the Bay Area and Tri-Valley were found using the 2012 National Establishment Time Series Database. Businesses are grouped by their NAICS sector designation. Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514.

Top Ten Tri-Valley Industries by Employment: Historic records of employment and firm establishments in the Bay Area and Tri-Valley were found using the 2012 National Establishment Time Series Database. Industries are ranked by their 2012 employment. Businesses are grouped at the six-digit NAICS level. Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514.

Business Size (Employment and Establishments in Tri-Valley and the Bay Area): Historic records of employment and firm establishments in the Bay Area and Tri-Valley were found using the 2012 National Establishment Time Series Database. Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Talent Development

Percentage of Adults with a Master's Degree or Higher: Data covering location, age, and educational attainment are compiled from the U.S. Census Bureau's 2000 Decennial Census and American Community Survey three-year estimates. Adults are defined as anyone over the age of 25. The term "master's degree or higher" includes three ACS categories: "master's degrees," "professional degrees," and "doctorate degrees." The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. Silicon Valley includes all the PUMA codes of Santa Clara County, all the PUMA codes of San Mateo County except the area covering Daly City, and two PUMA areas in Alameda County covering Union City and Fremont.

Educational Attainment: Data covering location, age, and educational attainment are compiled from the U.S. Census Bureau's 2000 Decennial Census and the American Community Survey three-year estimates. Adults are defined as anyone over the age of 25. The term "some college and associates" is a combination of the educational designations: "some college, but less than one year," "1 or more years of college

credit, no degree," and "associate's degree." The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. Silicon Valley includes all the PUMA codes of Santa Clara County, all the PUMA codes of San Mateo County except the area covering Daly City, and two PUMA areas in Alameda County covering Union City and Fremont.

Foreign-Born Workforce in the Bay Area and Tri-Valley: Data covering current location of residence, occupation, and place of birth are from the American Community Survey three-year estimates and the 2000 U.S. Decennial Census. The term "workers" excludes all census records that had no occupational code or were coded with the "unemployed" designation. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. Silicon Valley includes all the PUMA codes of Santa Clara County, all the PUMA codes of San Mateo County except the area covering Daly City, and two PUMA areas in Alameda County covering Union City and Fremont. Science, technology, engineering, and mathematics professions are defined by U.S. Census occupation codes (OCCP). These include all occupations with the three-letter prefix CMM, ENG, SCI, and MED, as well as four managerial professions: computer and information systems managers, architectural and engineering managers (engineering managers before 2010), medical and health services managers, and natural science managers.

Preparing Youth for Success: Data covering location, graduation, and course completion status are compiled from the California Department of Education IPEDs database. The Tri-Valley region has a unique definition in this analysis. It is defined as the San Ramon Valley Unified School District, the Livermore Unified School District, the Dublin Unified School District, and the Pleasanton Unified School District. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. Silicon Valley is defined as the counties of San Mateo and Santa Clara.

SECTION 2

Character of Commute Flows

Means of Commute: Data covering employment status, number of passengers, location, and means of commute were provided by the U.S. Census Bureau's American Community Survey three-year estimates and the 2000 Decennial Census. In defining the universe of workers, all jobs were included. The term "carpool" refers to vehicles with more than one passenger. "Other means" includes motorcycles, taxis, bicycles,

and the census category "other means." Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. Silicon Valley includes all the PUMA codes of Santa Clara County, all the PUMA codes of San Mateo County except the area covering Daly City, and two PUMA areas in Alameda County covering Union City and Fremont.

Tri-Valley Commuters by Destination County: Data covering employment status, place of residency, location, and commute destination were provided by the U.S. Census Bureau's American Community Survey three-year estimates. In defining the universe of workers, all jobs were included. Counties are ranked by their 2012 commute destination value. Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305.

Tri-Valley Commuters by Destination and Educational Attainment: Data covering employment status, place of residency, location, educational attainment, and commute destination were provided by the U.S. Census Bureau's American Community Survey three-year estimates. In defining the universe of workers, all jobs were included. Counties are ranked by their 2012 commute destination value. The top five counties by volume of commuters are presented in the figure. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305.

The Tri-Valley's Innovation System

Patent Registrations in the Tri-Valley and Bay Area: Patent registration information covering location and inventor sequence number was provided by the U.S. Patent and Trademark Office. Patent counts refer to utility patents only. A patent registration was only counted if the first named inventor was from the Bay Area or Tri-Valley. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Patent Registrations by Technology Area (Tri-Valley): Patent registration information covering location, patent type, and inventor sequence number was provided by the U.S. Patent and Trademark Office. Patent counts refer to utility patents only. A patent registration was only counted if the first named inventor was from the Tri-Valley. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305.

Concentration by Technology Area Relative to the Bay Area: Patent registration information covering location, patent type, and inventor sequence number was provided by the U.S. Patent and Trademark Office. Patent counts refer to utility patents only. A patent registration was only counted if the first named inventor was from Tri-Valley. Location quotients are based on the number of patent registrations in each category. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Collaboration Patterns with the Bay Area (Patents with Co-Inventors from Tri-Valley and the Rest of the Bay Area): Patent registration information covering location, patent type, and inventor sequence number was provided by the U.S. Patent and Trademark Office. Patent counts refer to utility patents only. Analysis includes all patents with an inventor from Tri-Valley and the Bay Area regardless of inventor number, and at least one from a foreign country. Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Investment in the Tri-Valley by Region of Origin: Investment data from Thomson Reuters include annual private equity and venture capital totals invested in area code 925 (the Tri-Valley region). The sum of equity is reported as all investment originating in each of the geographic regions specified in the chart. The Bay Area is defined as U.S. area codes 408, 925, 707, 415, 510, and 650. The Tri-Valley is defined as U.S. area code 925.

SBIR and STTR Awards in the Tri-Valley Region in 2012: Records of 2012 small business innovation awards, funding agencies, recipient firms, and award values were provided by the U.S. Small Business Administration, Office of Technology. Business locations were based on the zip code reported at the time the award was provided. The Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94506, 94506, 94586, and 94514.

SECTION 3

Business Characteristics

Growth in Employment and Establishments: Historic records of employment and firm establishments in the Bay Area and the Tri-Valley were found using the 2012 National Establishment Time Series Database. Changes in the number of establishments and employment from year to year may result from firms opening, closing, moving into or out of the area, or expanding or reducing employment. The Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583,

94582, 94526, 94506, 94586, and 94514. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Business Churn in the Tri-Valley (entrances, exits, openings, and closings): Historic records of firm establishments in the Tri-Valley were found using the 2012 National Establishment Time Series Database. Closings are only considered if they occurred in the region of observation, regardless of whether the firm was or was not founded in the region. Companies that moved out of the region and then closed are counted as an “exit” in this analysis. The Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Tri-Valley Establishments and Employment in Multi-Establishment and Independent Firms: Historic records of employment and firm establishments in the Bay Area and Tri-Valley were found using the 2012 National Establishment Time Series Database. Independent firms are those with HQ Duns Numbers (the Dun & Bradstreet Data Universal Numbering System) that are the same as their establishment Duns Number. Changes in the number of establishments and employment from year to year may result from firms opening, closing, moving into or out of the area, or expanding or reducing employment. The Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

SECTION 4

Economic Outcomes

Productivity (GDP per Worker): GDP and payroll data for the United States, the Bay Area, and the Tri-Valley were provided by Moody’s Economy. GDP for the Tri-Valley region is an estimate. It is defined here as all payments to Tri-Valley employees multiplied by the quotient of the total Bay Area GDP divided by all payments to Bay Area employees. The Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514. The GDP data for the Bay Area are a summation of the four metropolitan statistical areas: San Francisco-Oakland-Hayward, Sunnyvale-Santa Clara-San Jose, Napa, and Vallejo-Fairfield.

Median Household Income: Data covering location and median income were compiled from the U.S. Census Bureau’s 2000 Decennial Census and the American Community Survey three-year estimates. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012

data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano. Silicon Valley includes all the PUMA codes of Santa Clara County, all the PUMA codes of San Mateo except the area covering Daly City, and two PUMA areas in Alameda County covering Union City and Fremont.

Livability

Housing Cost Burden for Homeowners (Households Spending More Than 30% of Income on Housing): Data covering location, select monthly housing costs, and household income were compiled from the U.S. Census Bureau’s 2000 Decennial Census and American Community Survey three-year estimates. Housing costs for homeowners include mortgages, real estate taxes, various insurances, utilities, fuels, mobile home costs, and condominium fees. The Tri-Valley is defined as the California public use micro area regions coded 2105 and 2410. This code changed for 2012 data to 110 and 1305. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

Protected Land in the Bay Area and the Tri-Valley: GreenInfo Network provided land protection status and access type data, which was compiled from USGS and NOAA databases. Geoprocessing was performed using ESRI Arc GIS 10.2. Mixed access protected land includes “open access,” “restricted access,” “unknown access,” and “no public access” land. The Visit Tri-Valley organization’s definition of the Tri-Valley region was used as a reference to create a GIS map of the borders of the Tri-Valley.

Hospitality and Leisure Employment and Establishments (Tri-Valley): Historic records of employment, industry sector, and firm establishments in the Bay Area and the Tri-Valley were found using the 2012 National Establishment Time Series Database. Changes in the number of establishments and employment from year to year may result from firms opening, closing, moving into or out of the area, or expanding or reducing employment. Sectors are defined using two-digit NAICS codes. The Tri-Valley is defined as the following zip codes: 94566, 94550, 94551, 94568, 94588, 94583, 94582, 94526, 94506, 94586, and 94514. The Bay Area is defined as the nine California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano.

SECTION 5

Highways

Vehicle Volumes on I-580 in the Tri-Valley, 2012: Data for vehicle and truck annual average daily traffic are taken from the Caltrans Traffic Data Branch. The mileposts selected are all of the highway sections where sensors have been placed by Caltrans within the Tri-Valley region as defined in this report.

Average Daily Vehicle Hours of Delay in the Tri-Valley: Data covering time of day, vehicle miles traveled, vehicle hours traveled, vehicle hours delayed, and highway/freeway boundaries are from the Caltrans Mobility Performance Report using the Performance Monitoring System. Vehicle hours delayed are defined as the number of additional hours vehicles spent on freeways while traveling less than 60 miles per hour. Vehicle hours traveled without delay is defined as the total vehicle hours traveled minus vehicle hours delayed.

Bay Area Rapid Transit (BART)

BART Average Weekday Exits: Historic data of total annual exits were derived from BART ridership reports. The median is compiled from BART average weekday exits for all 44 stations in 2011–2013, 43 stations in 2003–2010, and 39 stations in 1999–2002. Millbrae, San Bruno, San Francisco International Airport, and South San Francisco stations opened on June 22, 2003. Service for the West Dublin/Pleasanton station commenced on February 19, 2011. The data are based on the time period when the extension was in service.

Altamont Corridor Express (ACE)

Annual ACE Ridership and Service Levels: Data covering service effectiveness, number of passengers, and vehicle-revenue hours for the ACE system were provided by the MTC Transit Performance Reports. This chart presents system-wide data.

Bus Services

Annual LAVTA Ridership and Service Levels: Data covering service effectiveness, number of passengers, and vehicle-revenue hours for the LAVTA system were provided by the MTC Transit Performance Reports. This chart presents system-wide data.

SECTION 6

Moving Transportation in the Tri-Valley Forward

Economic Impacts of Tri-Valley Transportation Programs and Projects: The IMPLAN modeling system combines the US Bureau of Economic Analysis' Input-Output Benchmarks with other data to construct quantitative models of trade flow relationships between businesses, and between businesses and final consumers. The IMPLAN input-output accounts capture all monetary market transactions for consumption in a given time period and are based on industry survey data collected periodically by the US Bureau of Economic Analysis and follow a balanced account format recommended by the United Nations.

IMPLAN's Regional Economic Accounts and the Social Accounting Matrices are used to construct region-level multipliers that describe the response of the relevant regional economy to a change in demand or production as a result of the activities and expenditures related to Tri-Valley transportation projects in Alameda County's 2014 Transportation Expenditure

Plan. Each industry that produces goods or services generates demand for other goods and services and this demand is multiplied through a particular economy until it dissipates through "leakage" to economies outside the Bay Area.

Impact studies operate under the basic assumption that any increase in spending then has three effects. First, there is a direct effect on that industry itself. Second, there is a chain of indirect effects on all the industries whose outputs are used by the industry under observation. Third, there are induced effects that arise when employment increases and household spending patterns are expanded.

APPENDIX B: STAKEHOLDER INTERVIEWS

David Ackerman, Livermore Premium Outlets

Newell Arnerich, *Councilmember and five-term Mayor*, Town of Danville

Stephanie Beasley, *Community Relations Officer*, Sandia National Laboratories

Steve Bestolarides, *District 3 Supervisor*, San Joaquin County Board of Supervisors

Troy Brown, *Acting City Manager*, City of Livermore

Betsy Cantwell, *Director for Mission Development*, Lawrence Livermore National Laboratory

Brandon Cardwell, *Senior Management Analyst*, i-Gate

Ross Chittenden, *Deputy Executive Director of Projects*, Contra Costa Transportation Authority

Stuart Cook, *Director*, Alameda County Surplus Property Authority

Brian Dolan, *Director of Community Development*, City of Pleasanton

Elizabeth Donald, *Senior Scientist and Science Education Program Leader*, The Clorox Company

Martin Engelmann, *Deputy Executive Director of Planning*, Contra Costa Transportation Authority

Lynn Fischer, *CEO*, Title21 Software

Chris Foss, *City Manager*, City of Dublin

Scott Haggerty, *Supervisor*, Alameda County Board of Supervisors

Cynthia Hibbard, *Marketing Director*, HealthTell

Maria Hurtado, *Interim City Manager*, City of Tracy

Randell H. Iwasaki, *Executive Director*, Contra Costa Transportation Authority

Robert A. James, *Partner*, Pillsbury Winthrop Shaw Pittman LLP

Dale Kaye, *CEO*, Innovation Tri-Valley Leadership Group

Karen Knowles, *Associate Medical Group Administrator*, Kaiser Permanente

Dan Leavitt, *Manager of Regional Initiatives*, San Joaquin Regional Rail Commission

Crystal Lu, *Head of North America Media Relations*, SAP Americas

Andrew Malik, *Director of Development Services*, City of Tracy

John Marchand, *Mayor*, City of Livermore

Harry Mavrogenes, *Airport Director Stockton Metropolitan Airport*, San Joaquin County

Mike McAleavey, *Senior Director Equipment Engineering*, FormFactor

Liz McElligott, *Assistant Planning Director*, Alameda County Community Development Agency

Stewart Ng, *Deputy Director of Programming and Projects*, Alameda County Transportation Commission

Ray O'Connor, *President and CEO*, Topcon Positioning Systems Inc.

James Paxson, *Hacienda Business Park*

Tim Sbranti, *Mayor*, City of Dublin

Linda Smith, *Assistant City Manager*, City of Dublin

Jerry Thorne, *Mayor*, City of Pleasanton

Mark Triska, *Senior Vice President*, Colliers International

Bob Vinn, *Assistant City Engineer, Community & Economic Development*, City of Livermore

Ronald A. Wetter, *Community & Government Relations Manager*, Kaiser Permanente

Linsey Willis, *Director, External Affairs*, Contra Costa Transportation Authority

Phil Wong, *Planning and Building Director*, City of San Ramon

Liza Wood, *Business Development Manager*, Chevron Energy Solutions

ENDNOTES

1. East Bay Economic Development Alliance, "East Bay Largest Employers." Available at http://www.eastbayeda.org/research_facts_figures/charts/largest_employers_East_Bay.htm.
2. Livermore Valley Chamber of Commerce, "Livermore Large Employers." Available at <http://www.livermorechamber.org/doing-business/large-employers.aspx>.
3. Lawrence Livermore National Laboratory, "Industry Partnering and Technology Transfer." Available at <https://www.llnl.gov/news/presskit/techtransfer.pdf>.
4. Calculations are based on employment estimates from the National Establishment Time Series database.
5. The second-largest industry grouping in the Tri-Valley falls into the category of "all other support services," which generally encompasses small companies that perform a range of business-related activities. One of the larger firms in this group (employing 85 people) is a branch of RGIS Inventory Specialists, which offers a range of services, including store mapping, merchandising, staffing solutions, and compliance audits. This industry also includes smaller companies such as Point 1 (employing 10 people), a company that offers electrical integration services for businesses' audio-visual systems.
6. Firms with fewer than 20 workers made up 89.7 percent of all businesses as of 2009, according to the Small Business & Entrepreneurship Council.
7. Silicon Valley is defined here as Santa Clara County, southwestern Alameda County, and the Highway 101 corridor of San Mateo County.
8. The California Department of Education revised its method for calculating graduation rates; therefore, comparable data is not available for earlier years.
9. The Academic Performance Index (API) is a measurement of academic performance and the progress of individual schools in California. Each annual API reporting cycle includes a Base and a Growth API. The state has set 800 as the API target for all schools.
10. Henry S. Farber, "Job Loss and the Decline in Job Security in the United States," in *Labor in the New Economy*, National Bureau of Economic Research (Chicago: University of Chicago Press, 2010), 223-262.
11. AnnaLee Saxenian, *The New Argonauts: Regional Advantage in a Global Economy* (Cambridge: Harvard University Press, 2007).
12. Pete Carey, "High Prices Sending Bay Area Renters and Homebuyers to Outlying Communities," San Jose Mercury News, February 8, 2014. Available at http://www.mercurynews.com/business/ci_25095612/high-prices-sending-bay-area-renters-and-homebuyers.
13. Adie Tomer et al., "Missed Opportunity: Transit and Jobs in Metropolitan America," Metropolitan Policy Program at Brookings, May 2011.
14. Steven G. Wilson et al., "Patterns of Metropolitan and Micropolitan Population Change: 2000 to 2010," 2010 U.S. Census Special Reports, September 2012.
15. The Tri-Valley straddles both Alameda and Contra Costa Counties. San Ramon and Danville are in Contra Costa County, while Dublin, Pleasanton, and Livermore are in Alameda County.
16. Data taken from the U.S. Department of Energy, Energy Information Administration; California Air Resource Board, EMFAC 2011; and icommutesd.com.
17. E. Eric Boschmann, "Job Access, Location Decision, and the Working Poor: A Qualitative Study in the Columbus, Ohio Metropolitan Area," *Geoforum* 42, no. 6 (2011):671-682.
18. Figure calculated based on data from the U.S. Census Bureau.
19. Marc Lifsher, "Stockton emerges as state's leading contender for Tesla battery factory," Los Angeles Times, July 27, 2014.
20. Patent concentrations are defined as the ratio of specific sector patents to total patents in an area. To find a relative concentration, patent concentrations for the Tri-Valley were divided by patent concentrations for the Bay Area. A 1.00 relative concentration means there is an equal ratio of patents in a sector registered in the Tri-Valley and the Bay Area as a proportion of the total number of patents in each area.
21. PricewaterhouseCoopers and National Venture Capital Association, "MoneyTree Report Q4 2013/Full-year 2013." Available at www.pwcmoneytree.com.
22. National Venture Capital Association, "Yearbook 2013," prepared by Thomson Reuters.
23. Richard Florida, "America's Leading Venture Capital Area Codes," *The Atlantic Cities*, July 18, 2013.
24. Richard Florida, "Why San Francisco May Be the New Silicon Valley," *The Atlantic Cities*, August 5, 2013.
25. Because of data limitations, total earned income is used as a proxy for GDP for the Tri-Valley area. See Appendix A for methodology details.
26. The estimate of GDP in the Tri-Valley is based on multiple steps. Estimates from Moody's for Bay Area GDP and Bay Area total payroll were used to find a payroll coefficient: total GDP as a ratio to total payroll. This coefficient for the Bay Area was used as a proxy for the Tri-Valley under the assumption that the Tri-Valley economy operates similarly to the region as a whole. The coefficient was multiplied by the Tri-Valley's total payroll to arrive at a GDP estimate for the area.
27. Figures based on the 2008–2012 American Community Survey five-year estimates.
28. The Tri-Valley's hospitality and leisure sector location quotient (a measure of relative concentration) against the Bay Area was 1.06 in 2012, showing strong similarity.
29. Sector concentrations are defined as the ratio of specific sector businesses to total businesses in an area. To find a relative concentration, sector concentrations for the Tri-Valley were divided by sector concentrations for the Bay Area. A 2.46 relative concentration means there are 2.46 times more businesses in the Tri-Valley as a proportion of the total number of businesses in each area.
30. City of Livermore. Available at <http://www.cityoflivermore.net/visitors/places/winereries.asp>.
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40. Figures for this section are based on Colliers International Research & Forecast reports.
41. See "A New Economic Analysis of Infrastructure Investment," U.S. Department of the Treasury with the Council of Economic Advisors, 2012.
42. Patricia Melo and Daniel Graham, "Agglomeration, Accessibility, and Productivity: Evidence for Urbanized Areas in the U.S.," Transportation Research Board, Annual Meeting, 2013.
43. American Public Transportation Association, "The Role of Transit in Support of High Growth Business Clusters in the U.S.," December 2013.
44. Robert Cervero, "Transit-Based Housing in the San Francisco Bay Area: Market Profiles and Rent Premiums," *Transportation Quarterly*, Vol. 50, No. 3, pp. 33 – 47, 1996.
45. Edward G. Goetz et al., "The Hiawatha Line: Impacts on Land Use and Residential Housing Value," Minneapolis: Center for Transportation Studies, University of Minnesota, 2010.
46. Bay Area Council Economic Institute, "The Economic Impact of Caltrain Modernization," June 2012.
47. The fee is adjusted each year based on a construction cost index.
48. Alameda County Transportation Commission Highway Improvement Capital Projects Fact Sheet, "Route 84 Expressway—North Segment," June 2014.
49. Kenneth A. Small, Clifford Winston and Jia Yan, "Differentiated Road Pricing, Express Lanes and Carpools: Exploiting Heterogeneous Preferences in Policy Design," AEI-Brookings Joint Center for Regulatory Studies, March 2006.
50. A Joint Powers Authority was formed because the Sunol Express Lane project spans two counties: Alameda County and Santa Clara County. The JPA's board consists of four voting members from Alameda County and one from Santa Clara County.
51. Santa Clara Valley Transportation Authority began operating HOT lanes over 8.5 miles on the State Route 237/I-880 corridor in March 2012.
52. Within Alameda County, toll revenue from HOT lanes must stay within the corridor in which it was collected and be used for future maintenance and technology or to enhance transit accessibility in the corridor.
53. One Bay Area, "Plan Bay Area." Available at <http://onebayarea.org/regional-initiatives/plan-bay-area.html>.
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55. Contra Costa County Transportation Authority, Travel Demand Model, Projections 2013.
56. Metropolitan Planning Commission, Transportation 2030 Plan for the San Francisco Bay Area, 2005.
57. "TriLink (State Route 239) Feasibility Study Draft Report," prepared by Parsons for the Contra Costa Transportation Authority, September 12, 2013.
58. The Bay Area Council Economic Institute completed an analysis for the Alameda County Transportation Commission, entitled *In The Fast Lane*, which found that Alameda County's 30-year, \$8 billion 2014 Transportation Expenditure Plan will yield \$20 billion in economic activity and 150,000 jobs for the region. The report can be accessed at <http://www.bayareaeconomy.org/>.

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