MTC Regional Goods Movement Plan

Task 2c – Infrastructure, Services, and Demographics/Freight Flow Trends

Technical Memorandum

prepared for

Metropolitan Transportation Commission

prepared by

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1.0 INTRODUCTION

The nine-county Bay Area region is the center of Northern California economic activity with a complex and multifaceted goods movement system. The Bay Area was home to more than 7.1 million people in 2010 and provided jobs for almost 3.4 million people.[1] It also boasts one of the largest economies in the U.S. and ranked 19th in the world when compared to national economies, with a Gross Regional Product (GRP) of $539 billion in 2011.[2]

This report describes the Bay Area goods movement system and details historical and possible future performance. The report builds on Caltrans District 4's 2014 *Bay Area Freight Mobility Study (BAFMS)*, which documented the infrastructure, services, demographics, and freight flow[3] trends for the nine-county Bay Area. The regional and county-level economic and freight flow data presented in this report will continue to inform the analysis of freight movement patterns and describe how goods movement activity will affect freight infrastructure assets, related industries, and potential goods movement system investments.

In addition, this report details goods movement activity on eight regionally significant multimodal[4] goods movement corridors. These multimodal corridors, named after their main highway component, include:

1. Interstate 880 (I-880),
2. Interstate 80 (I-80),
3. Interstate 580 (I-580),
4. Interstate 680 (I-680)
5. United States Route 101 (U.S. 101),
6. State Route 12 (SR 12)/State Route 37 (SR 37),

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[1] *Plan Bay Area*, 2010 estimates developed by the Association of Bay Area Governments (ABAG), 2013.

[2] Ibid, ABAG.

[3] The movement of goods on transportation infrastructure, including highways, railroads, waterways, and by air.

[4] A multimodal goods movement system includes highways, railways, cargo airports, inland waterways, ocean shipment as well as other intermodal structures such as intermodal terminals, rail yards, warehouses, and logistics facilities.

7. State Route 152 (SR 152), and

8. State Route 4 (SR 4).

These corridors have the highest share of regional goods movement activity, are expected to serve the Bay Area's growing goods movement demand, and are critical to the region's existing and emerging industrial activity. These major corridors are supported by other critical goods movement infrastructure, including goods movement facilities, other highways, major arterials and local roads, and last-mile connectors, which together with the major corridors comprise the region's goods movement system. The corridors approach is used to focus the discussion around critical goods movement arteries, and the supporting infrastructure is discussed in each corridor description. The corridors are described by their role, the major industries they serve, infrastructure assets within the corridor, historical and future freight flows, traffic bottlenecks, and recommended improvement strategies identified in past plans or studies.

Each of the corridor profiles will serve as the basis for further needs identification in the Metropolitan Transportation Commission (MTC) Regional Goods Movement Plan.

2.0 GOODS MOVEMENT IN THE BAY AREA

According to the Bay Area Council Economic Institute, the region's population has grown from just more than 6 million persons in 1990 to about 7.2 million in 2011, which is a modest 0.78 percent per year growth and slower than the national average of 1.07 percent. According to forecasts by the Association of Bay Area Governments (ABAG), the Bay Area will add 2.1 million residents between 2010 and 2040, and will remain California's second largest population and economic center (see Table 2.1).

Table 2.1 Bay Area Population, Employment, and Housing Projections, 2010 to 2040

Category	2010	2040	Growth 2010-2040	Percent Change 2010-2040
Population	7,150,740	9,299,150	2,148,410	+30%
Jobs	3,385,300	4,505,220	1,119,920	+33%
Households	2,608,020	3,308,110	700,090	+27%
Housing Units	2,785,950	3,445,950[a]	660,000	+24%

[a] 2010 and 2040 values include seasonal housing units.

Source: ABAG, 2013.

Supporting the growth and shift in population, as well as other socioeconomic trends, is the goods movement system. The domestic goods movement system supports the large and growing consumer market, as well as involves in the movement of consumer products and industrial inputs that are produced or handled/processed elsewhere in the U.S. In addition, the goods movement system also helps with exporting goods to other countries, and importing goods to meet the demand of Bay Area residents, as well as residents of other domestic regions. By several measures, the San Francisco Bay Area is one of the most important international gateways in the United States (U.S.). In 2011, two-way trade valued at $119.1 billion moved through the San Francisco Customs District, making it the second most important gateway in California and 10th most important in the U.S.

2.1 Bay Area Economic Profile

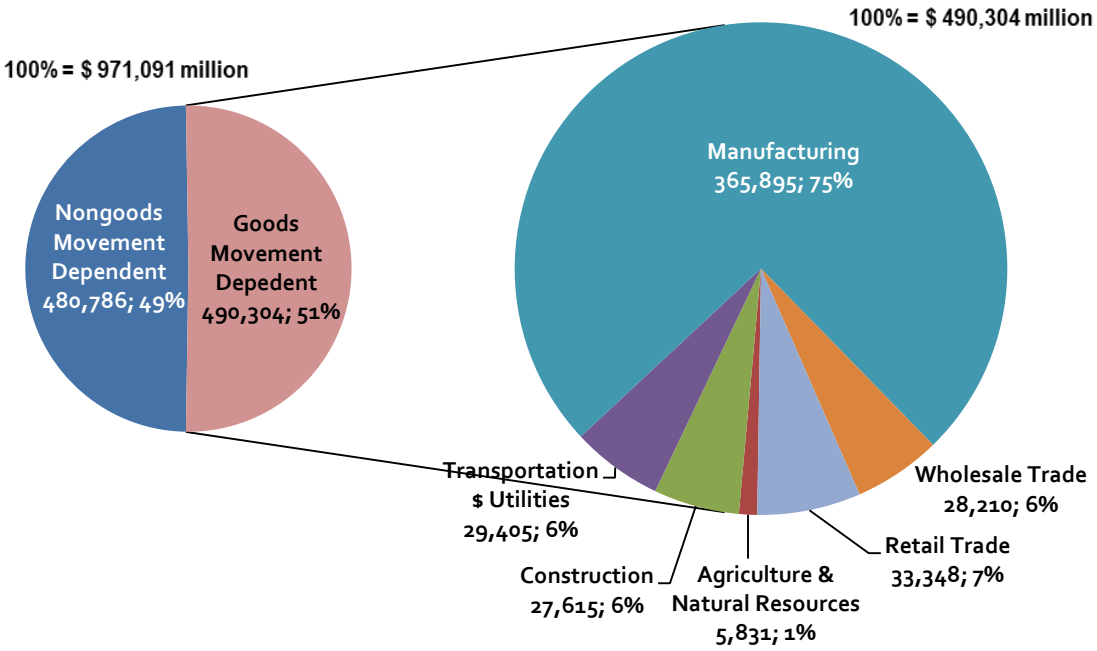
Table 2.1 also shows a 33-percent increase in Bay Area employment between the years 2010 and 2040, or 1.1 million jobs. The forecast highlights the Bay Area's concentration of knowledge-based industries, a highly educated labor force, expanding international networks, and overall economic diversity. *Plan Bay Area* forecasted that professional services, health and education, and leisure and hospitality sectors will make up more than 70 percent of the region's employment growth. Manufacturing jobs currently are projected to slowly decline from

336 million jobs to 311 million jobs in 2040, while transportation and warehousing jobs are projected to grow from 99 million to 127 million in 2040. Overall, jobs in the "goods movement-dependent" industries are projected to grow from 1,062 million in 2010 to 1,216 million in 2040.

The share of the economy associated with these "goods movement-dependent" industries can illustrate the importance of goods movement to a region's economy. Goods movement industries are those for whom moving goods to markets is a critical aspect of their business operations; as a result, transportation costs tend to form a relatively larger share of their total operating costs than for nongoods movement-dependent industries (e.g., service sector industries). These goods movement-dependent industries include manufacturing, retail trade, wholesale trade, construction, transportation/warehousing, and agriculture; and they rely heavily on the goods movement system. Nongoods movement-dependent industries also rely on the goods movement system, but transportation costs generally make up a smaller share of operating costs.

The importance of goods movement can be measured in terms of output and employment. Output measures the value of all goods and services delivered in the economy, including intermediate consumption (inputs). Total output from goods movement-dependent industries provides a good indicator of the total value of products transported in the goods movement system and, as such, is the best indicator of growth in demand over time. As shown in Figure 2.1 and Figure 2.2, goods movement-dependent industries account for $490 billion in total output (50 percent of total regional output) and provide more than 1.1 million jobs (31 percent of total regional employment). The explanation for the large difference between the share of industrial output that goods movement-dependent industries provides, as compared to their share of employment, is related to the nature of manufacturing in the Bay Area. Manufacturing comprises 38 percent of regional goods output, but only 10 percent of total regional employment. This is the result of two factors: 1) manufacturing in the Bay Area has shifted increasingly towards high-value products that are not labor intensive in their production processes (such as biotechnology products); and 2) many high-technology product manufacturers have shifted their production activities off-shore, but have kept their high value-added design and development activities in the Bay Area. The latter case suggests that the share of total regional output represented by goods movement-dependent industries may exaggerate the impact that these industries have on goods movement demand and the importance that goods movement plays in providing value to these critical Bay Area industries. The picture of manufacturing that this presents also explains the importance of high-cost, high-reliability, and high-speed goods movement modes (such as air cargo and trucking) in the Bay Area economy.

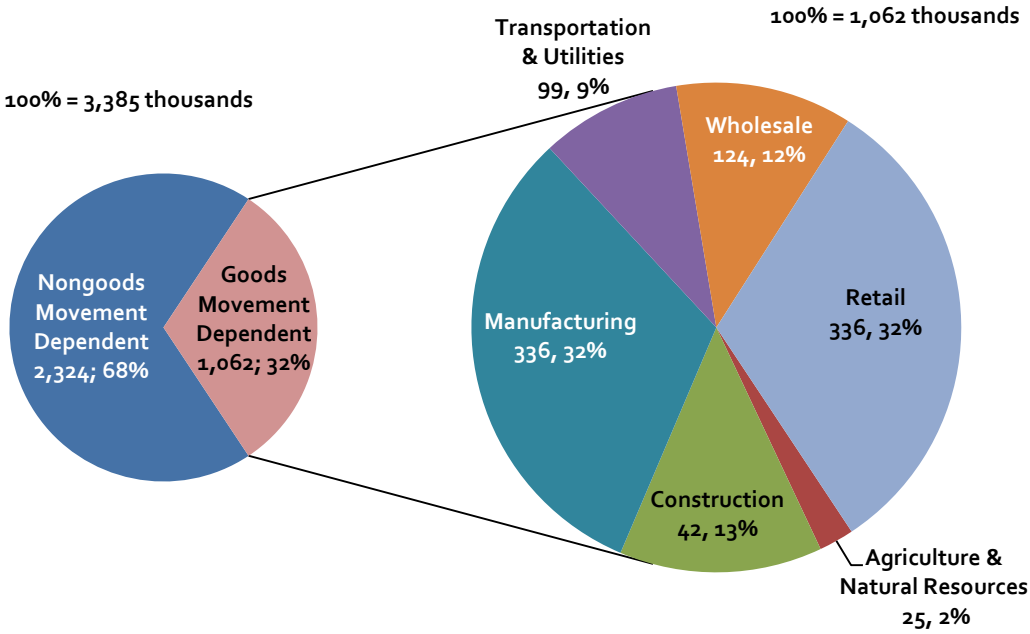
Figure 2.1 Output in Goods Movement-Dependent Industries in the Bay Area, 2011



Source: IMPLAN 2011 and Cambridge Systematics analysis.

Note: Mining is included in Agriculture and Nature Resources.

Figure 2.2 Employment in Goods Movement-Dependent Industries in the Bay Area, 2011



Source: ABAG (*Plan Bay Area 2013*), Center for Continuing Study of the California Economy (CCSCE), and Cambridge Systematics Analysis.

2.2 County – Level Economic Profiles

It is also useful to look at how each county contributes to the economy as relates to goods movement. At the county level, economic profiles and industry compositions are determined using a combination of data sources. Output data at the county level is provided through the IMPLAN 2011 data, which provides detailed breakdown of output within goods movement-dependent industries (Table 2.2). Since manufacturing is the largest sector within the goods movement-dependent industries, a more detailed breakdown of subsectors within manufacturing is provided in Table 2.3. Employment figures (Table 2.4) are determined using county-level totals from ABA (as seen in *Plan Bay Area*, 2013), with detailed industry breakdowns from CCSCE in an effort to be consistent with *Plan Bay Area*. Finally, Dun & Bradstreet[5] business

[5] Dun & Bradstreet provides information on establishments including number of employees and sales volumes, and is useful for looking at spatial patterns of individual businesses. However it is incomplete and doesn't provide 100 percent coverage of all businesses, and is thus not accurate for estimating the total number of establishment in a given area. Thus we use it for demonstration of spatial distribution among counties in our tech memo.

establishment data were used to determine the number of establishments in top goods movement-dependent industries in each Bay Area county (Figure 2.3).

Table 2.2 Output in Bay Area Goods-Movement-Dependent Industries, 2011

Millions of Dollars

Industries	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Regional Total
Agriculture and Natural Resources	$331	$1,341	$127	$864	$289	$273	$562	$610	$1,435	$5,831
Construction	$6,109	$3,701	$1,138	$545	$3,094	$3,287	$6,143	$1,478	$2,120	$27,615
Manufacturing	$37,549	$89,528	$718	$4,496	$3,458	$22,645	$187,731	$11,398	$8,373	$365,895
Transportation & Utilities	$6,761	$4,071	$723	$557	$6,019	$5,852	$2,706	$990	$1,720	$29,405
Wholesale	$7,616	$1,990	$629	$395	$2,679	$2,900	$9,661	$840	$1,500	$28,210
Retail	$6,629	$4,024	$1,342	$553	$4,677	$3,732	$8,722	$1,516	$2,153	$33,348
Goods Movement-Dependent Industries	$64,995	$104,655	$4,677	$7,410	$20,216	$38,689	$215,525	$16,832	$17,301	$490,304
Nongoods Movement-Dependent Industries	$80,830	$49,321	$17,379	$6,386	$108,518	$55,062	$129,130	$13,756	$20,404	$480,786
Total – All Industries	**$145,825**	**$153,976**	**$22,056**	**$13,796**	**$128,734**	**$93,751**	**$344,655**	**$30,588**	**$37,705**	**$971,090**
Goods Movement Industries % of Total County Output	**45%**	**68%**	**21%**	**54%**	**16%**	**41%**	**63%**	**55%**	**46%**	**50%**

Source: IMPLAN 2011; calculations by Cambridge Systematics.

Note: Mining is included in Agriculture and Nature Resources.

Table 2.3 Manufacturing Detail – Output, 2011

Million of Dollars

Industries	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Regional Total
Food, Beverage, and Tobacco Products	$4,604	$1,694	$269	$3,727	$962	$1,298	$1,890	$1,281	$3,965	$731,791
Textile Products	$232	$105	$21	$3	$261	$104	$83	$17	$50	$712,101
Wood and Paper Products	$1,173	$300	$24	$59	$390	$267	$737	$23	$209	$711,225
Petroleum and Coal Products	$3,429	$82,911	$1	$1	$71	$215	$119	$6,116	$3	$708,043
Chemical Products	$4,691	$1,193	$138	$359	$346	$11,322	$2,919	$2,800	$360	$615,177
Plastics and Rubber products	$1,311	$188	$85	$116	$72	$115	$543	$235	$264	$591,049
Metal Products	$1,853	$1,267	$54	$41	$165	$1,271	$2,328	$440	$212	$588,120
Machinery	$2,534	$292	$19	$49	$49	$171	$4,297	$146	$457	$580,489
Computer and Related Equipment Products	$10,442	$381	$12	$7	$686	$4,436	$155,686	$10	$1,201	$572,475
Electronic Instrument Products	$3,419	$602	$49	$79	$120	$1,457	$12,020	$69	$911	$399,614
Motor Vehicle Products	$1,619	$44	$17	$1	$72	$1,634	$4,673	$148	$81	$380,888
Furniture and Related Products	$266	$147	$11	$8	$94	$64	$179	$20	$74	$372,599
Medical Equipment and Supplies	$1,529	$342	$4	$38	$21	$233	$1,979	$48	$523	$371,736
Other Miscellaneous Manufactured Products	$448	$61	$14	$8	$149	$58	$278	$43	$64	$367,019
Total	**$37,549**	**$89,528**	**$718**	**$4,496**	**$3,458**	**$22,645**	**$187,731**	**$11,398**	**$8,373**	**$365,896**

Source: IMPLAN.

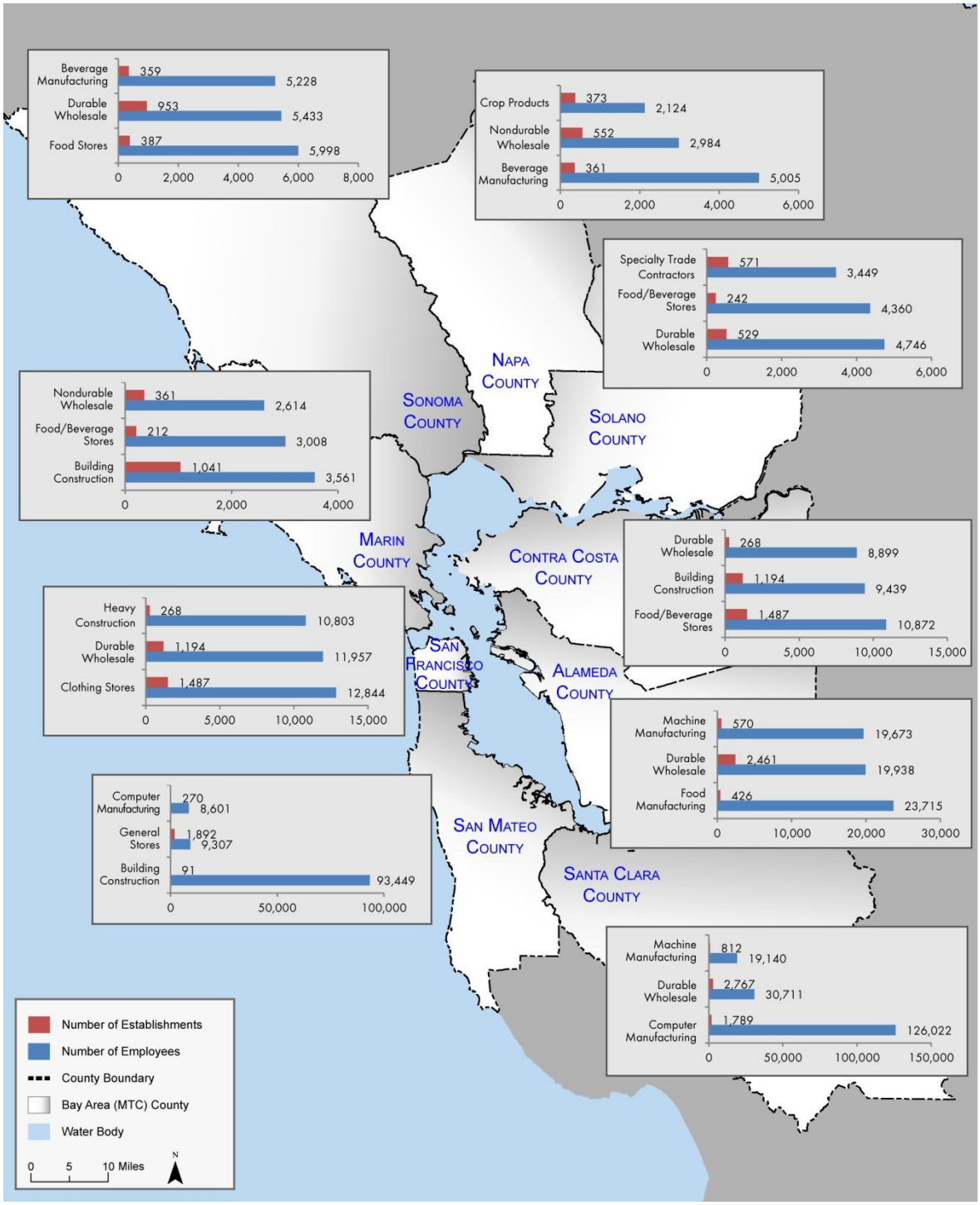
Table 2.4 Employment in Bay Area Goods Movement-Dependent Industries, 2010

Thousands

Industries	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Regional Total
Agriculture and Natural Resources	0.9	1.0	0.6	6.0	0.3	2.2	4.4	1.7	7.3	24.6
Construction	31.7	21.4	5.9	2.7	14.9	14.6	33.6	7.8	9.7	142.3
Manufacturing	66.4	19.8	2.2	11.7	10.0	28.8	165.9	9.8	21.7	336.3
Transportation & Utilities	26.0	8.9	1.2	1.6	12.1	26.7	13.0	4.9	4.3	98.7
Wholesale	27.8	14.2	4.5	2.2	15.3	12.7	32.9	6.1	8.2	123.9
Retail	75.5	38.4	12.2	5.9	41.5	34.5	89.3	16.4	22.2	335.9
Goods Movement-Dependent Industries	228.3	103.8	26.6	30.1	94.1	119.5	339.2	46.8	73.4	1,061.7
Nongoods Movement-Dependent Industries	461.4	240.2	83.5	42.6	479.3	224.5	586.6	85.8	119.8	2,323.5
Total – All Industries	**689.7**	**344.0**	**110.1**	**72.6**	**573.4**	**344.0**	**925.7**	**132.5**	**193.2**	**3,385.2**
Goods Movement Industries as % Total	**33%**	**30%**	**24%**	**41%**	**16%**	**35%**	**37%**	**35%**	**38%**	**31%**

Source: ABAG (*Plan Bay Area 2013*), CCSCE, and Cambridge Systematics Analysis.

Figure 2.3 Top Three Goods Movement Industries by Employment by County



Source: Dun & Bradstreet Business Establishment Data, 2014.

2.2.1 Alameda

Alameda County is one of the most important economic drivers in the Bay Area, with a mixed industry profile consisting of a large manufacturing base, with an output of more than $37.5 billion in 2011. Alameda County has a very diverse manufacturing sector, including both high-technology products and more traditional manufacturing (such as food processing, metal products, and machinery). But Alameda County also has relatively high contributions to total output from the trade sectors (wholesale and retail trade), construction, and the largest share of total output coming from the transportation sectors in the region. In terms of employment, retail has the largest workforce among goods movement-dependent industries, employing more than 75,500 people in 2010. This is closely followed by employment in manufacturing. As discussed in later sections, the presence of the Port of Oakland, the Oakland International Airport (OAK), and the geography (centrally located in the Bay Area) contributes to significant goods movement activities.

2.2.2 Contra Costa

Contra Costa County is one of the largest economies in the Bay Area in terms of total output, and has the highest share of goods movement-dependent activities in the Bay Area out of all counties. About 68 percent of the total output are from goods movement-dependent industries, equivalent to about $104.7 billion in 2011. Manufacturing industry makes up more than $89.5 billion of output, and the majority of this is from petroleum products manufacturing, as well as smaller amounts from food/beverage manufacturing. This is reflective of the presence of major oil refineries, chemical producers, and some food and beverage manufacturing businesses in the County; all contributors to goods movement demand, much of which are provided by nonhighway modes. The number of establishments found using Dun & Bradstreet data shows that Contra Costa County is dominated by large food and grocery stores and building construction companies, as well as wholesalers.

2.2.3 Marin

Marin County's economy is centered on service sectors, with goods movement-dependent industries making up only 21 percent of total output in 2011. However, it has a significantly active retail and construction industry, which contributed to $1.3 billion and $1.1 billion in terms of output in 2011. Food, beverage manufacturing, and chemical products manufacturing are key manufacturing sector activities in the County.

2.2.4 Napa

Napa County's economy consists of roughly even shares of goods movement-dependent and service industries, with the former making up about $13.8 billion in output in 2011. The

manufacturing sector is the largest contributor, making up about $4.5 billion of the output (and also employs the most number of people). Not surprisingly, beverage (wine) production is the most important manufacturing industry, followed by wholesale and crop production.

2.2.5 San Francisco

San Francisco County has an output of $128.7 billion in 2011, indicating its importance as an economic powerhouse in the Bay Area. With heavy and dense urban populations on a relatively small area, goods movement activities make up a relatively small share (16 percent) of total economic activity in San Francisco County. As Figure 2.3 shows, San Francisco County is dominated by clothing stores, wholesale and warehousing, and heavy construction activities, indicating the County's large population and role as a commercial (retail) center. The majority of employment in goods movement-dependent industries is in the retail sector.

2.2.6 San Mateo

San Mateo County, just south of San Francisco, is home to the San Francisco International Airport, which has significant import/export activities through its air cargo facilities. Since manufacturing activities dominate the County, products such as chemical manufacturing, computer and electronic manufacturing benefit from the proximity to the airport for shipping and receiving goods. In addition, San Mateo County has a diverse mix of establishments, including general merchandise (big box stores) and construction companies. These indicate a significant amount of goods movement activities in the County, which amounted to $38.7 billion in 2011, or 41 percent of total output.

2.2.7 Santa Clara

Santa Clara County is the largest economy in the Bay Area in terms of both output and employment. In fact, its output, at $344.7 billion in 2011, is more than twice as much as its next competitor, Contra Costa County. This largely reflects the presence of computer and high-technology companies, which are generally high-value companies. Most of these businesses, however, are not engaged in manufacturing activities within the County (as their manufacturing activities are mostly outsourced) and, therefore, utilize freight corridors to a limited degree. According to Figure 2.1, the output and employment numbers are attributed to only a few firms, indicating most of these firms are very large in size.

2.2.8 Solano

Solano County, though one of the smaller counties in the Bay Area in terms of economic contribution, has a significant share of goods movement-dependent industries (55 percent, $16.8 billion in output in 2011). Solano County goods movement-dependent industries are led by durable wholesale activities, food and beverage stores, and specialty trade contractors.

2.2.9 Sonoma

Sonoma County's has moderate levels of output in the Bay Area, with about $37.7 billion in output in 2011, of which 46 percent is from goods movement-dependent industries. The manufacturing sector makes up a large majority of the output, at $8.4 billion, with the most significant shares coming from food and beverage manufacturing (wine). This is also reflected in the high level of employment in the manufacturing sector. Retail employment, though forming smaller share of the total output, is the largest contributor to employment in the County.

2.3 Freight Flows

The Bay Area has significant goods movement activities, with more than 454 million tons, or $644 billion of goods moving into, out of, and within the nine-county region. An analysis is provided to articulate freight movement at the regional and county levels; and to answer questions, such as "how many and what type of goods are moving on my county's infrastructure? What industries are most critical for our local economy?" As local, county-level freight flow data is not readily available, the publicly available, Federal Highway Administration's (FHWA) Freight Analysis Framework (FAF) data were used as a base and disaggregated. FAF integrates a variety of freight movement data sources to provide information about freight flows among states and major metropolitan areas and for all modes of data. The FAF data were then combined with local economic data to develop information about county-level freight flows in the Bay Area.

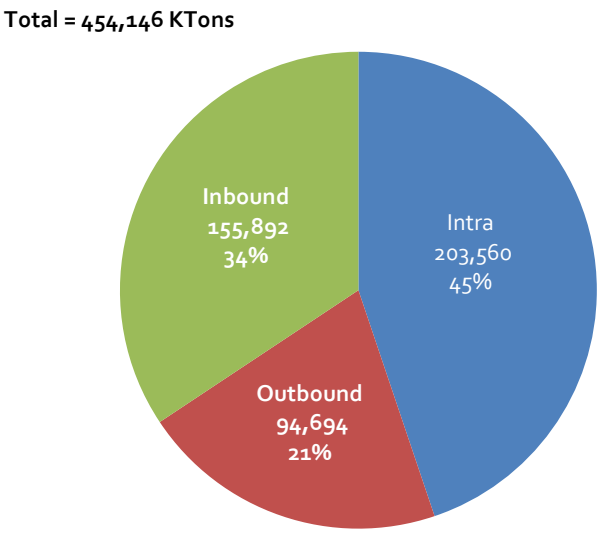
2.3.1 Freight Flows by Travel Direction

In 2012, the predominant commodity movements by weight in the Bay Area were intraregional, as seen in Figure 2.4 (203 million tons, or 45 percent of total tonnage). These short-haul freight movements include movements among manufacturers, local warehouse and distribution facilities, and retailers and wholesalers. Inbound flows include domestic inbound, exports that come from other regions to the ports in the Bay Area, and imports destined for the Bay Area – all of which are destined for the Bay Area. This accounts for 34 percent (155 million tons) by weight of total nonthrough flows[6]. On the outbound side, about 94 million tons (or 21 percent) of goods are transported, moving from Bay Area to areas outside of California. This is a combination of goods produced by local manufacturers and products moving through the region's international gateways, but destined for locations in other parts of the country. Based on the inbound and

[6] Through movements are those that neither originate nor terminate within our study region. Though they are not important for a region's economy, they are still important from a congestion and transportation investment perspective. While the data here does not include through-flow movements, discussions of truck volumes in subsequent sections will account for through flows.

outbound figures, there seems to be a roughly balanced directional movement of goods in the Bay Area. Figure 2.5 shows the same directional flows in terms of value, and it is clear outbound traffic occupies a much higher share of total flows. This is largely due to the high-value/low-weight export goods that are discussed in later paragraphs.

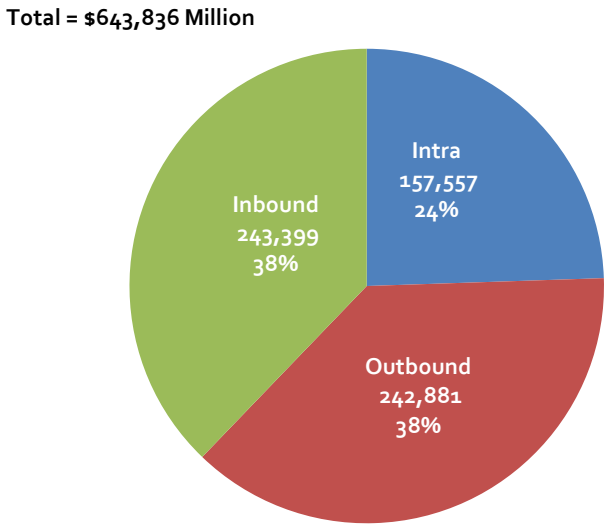
Figure 2.4 Bay Are Freight Flows by Direction, 2012
Thousands of Tons



Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

Figure 2.5 Bay Are Freight Flows by Direction, 2012

Millions of Dollars



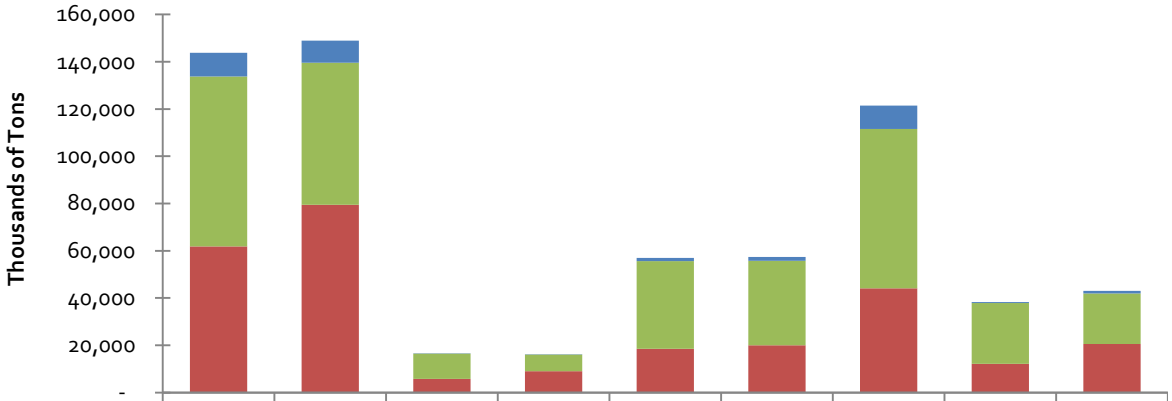
Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

On the county level, Figure 2.6 shows intracounty, and inbound and outbound inter-county goods movement by weight for each Bay Area County. Intracounty travel tends to be better served by arterials and local streets (i.e., last-mile connectors). Intracounty travel is typically between wholesale and retail stores, or short-distance movements between industrial support services, or from distribution centers to local customers. When compared to regional level flow patterns, there is a large difference in terms of the contribution of intra-level flows. While the region's goods movement needs are dominated by intraregional travel, each county's goods movement needs is dominated by intercounty flows. In fact, intracounty flows make up only 5 percent of total flows on average, and ranges from 1 percent in Napa County to 10 percent in Alameda, Contra Costa, and San Francisco Counties. This helps explain why goods movement is a critical issue, as the vast majority of travel happens between counties, and not within counties. Since intercounty movements are served largely by arterials, freeways and interstates, and freight rail lines, maintaining the well-being of these facilities (both in terms of operations and infrastructure) is critical to the efficient movement of goods in the region and to the economy in the region and the counties.

Alameda County has the highest share of inbound freight flows in the Bay Area (21 percent), excluding through movements. It also has the highest share of intracounty flows and the second highest share of outbound flows. This is due in part to its location near major freight generators and the Port of Oakland, and its high-density population centers that help drive regional demand

for goods. The County also holds 28 percent of total freight movements by value, representing significant goods-movement-dependent activity as a major regional employment center. Alameda's high-value outbound movements are reflective of some of its manufacturing activity. Santa Clara County's high value of goods movement is indicative of its most dominant industry (computer electronics and machinery).

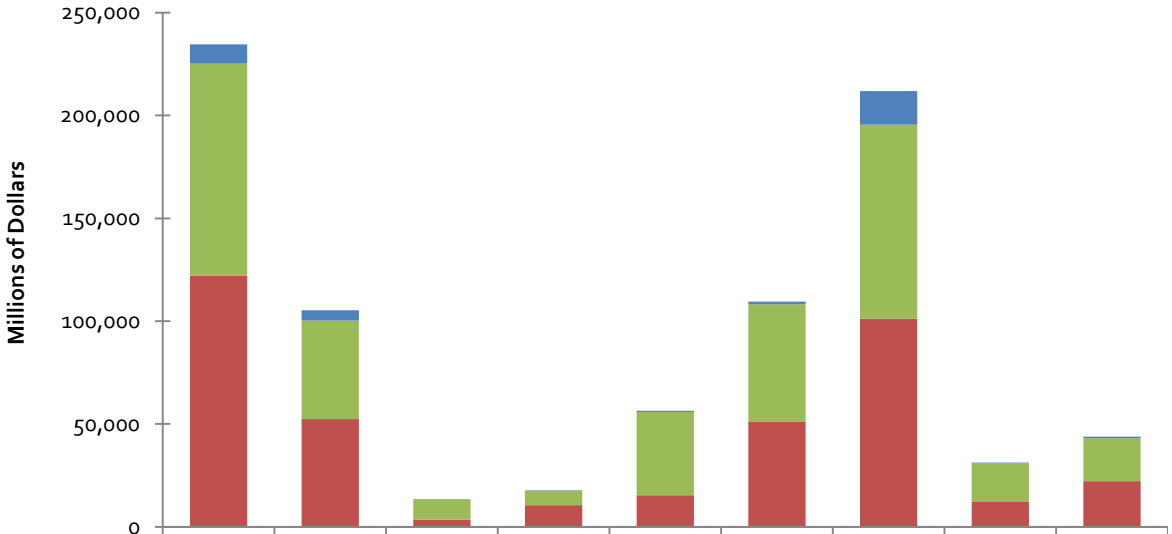
Figure 2.6 Bay Area Counties Freight Flows by Direction, 2012
Thousands of Tons



	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
Intra	10,059	9,308	169	163	1,316	1,614	9,845	505	1,094
Inbound	71,895	60,088	10,626	7,087	37,083	35,741	67,479	25,698	21,414
Outbound	61,909	79,505	5,806	9,025	18,547	20,045	44,099	12,138	20,581

Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

Figure 2.7 Bay Area Counties Freight Flows by Direction, 2012
Millions of Dollars



	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
Intra	9,475	4,967	47	158	674	1,310	16,355	287	719
Inbound	103,022	48,016	9,918	7,088	40,441	57,264	94,405	18,543	20,830
Outbound	122,169	52,323	3,488	10,601	15,387	50,915	101,195	12,361	22,208

Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

2.3.2 Freight Flows by Trade Type

Another way of looking at freight flows is by trade type. The Bay Area has significant export, import, and domestic trade activities, though the majority of freight flows is still domestic. As shown in Figures 2.8 and 2.9, domestic flows represented 85 percent of flows by tonnage and 75 percent by value. Exports represented 6 percent of total freight movement in the Bay Area in terms of tonnage and 9 percent in terms of value; imports represented 9 percent of total freight movement in the Bay Area in terms of tonnage and 15 percent in terms of value.

Figure 2.8 Bay Area Freight Flows by Trade Type, 2012
Thousands of Tons

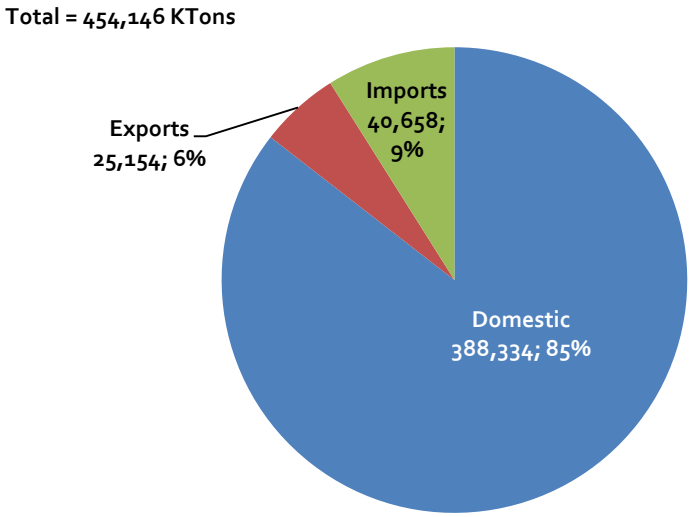
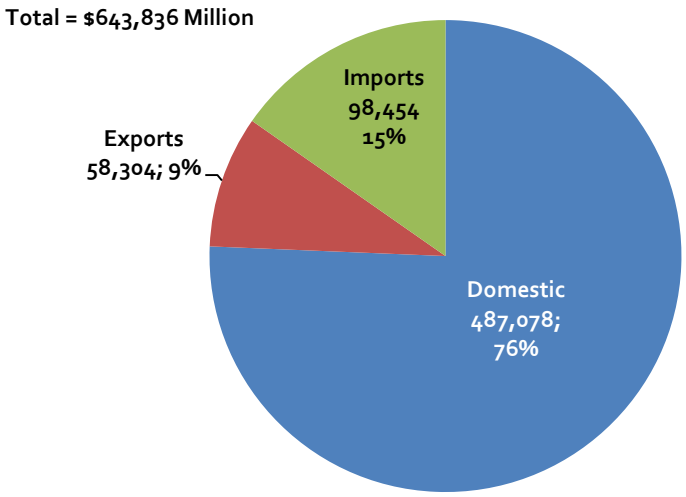


Figure 2.9 Bay Area Freight Flows by Trade Type, 2012
Millions of Dollars



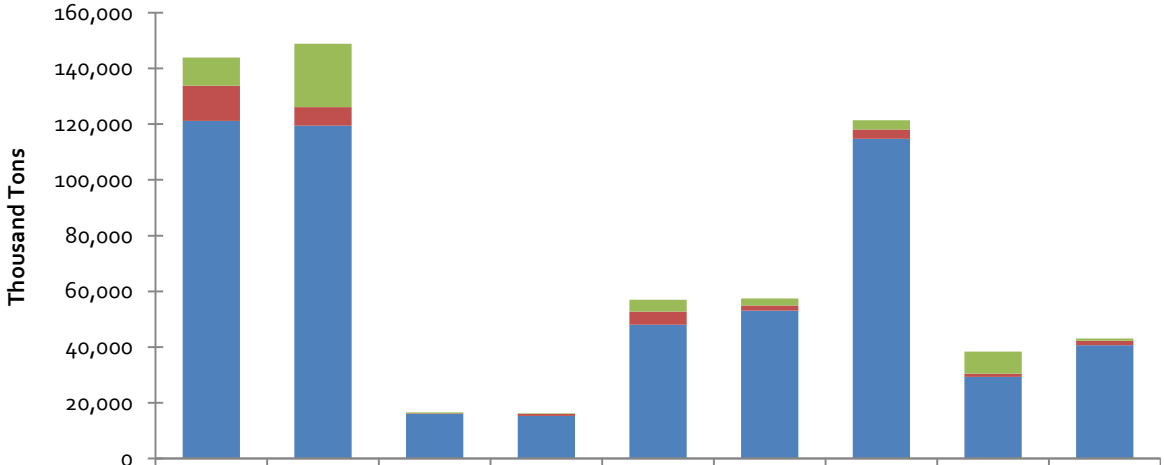
Figures 2.10 and 2.11 show how county freight movements compare in terms of goods shipped for domestic markets, imports or exports. Imports and exports are related to international gateways, while domestic goods are shipped to and from locations in the U.S.

These figures show that imports and exports are higher value than domestic goods. For instance, in Alameda County, while imports and exports make up only 16 percent of total freight flows by tonnage, they make up 25 percent of total freight flows by value. This difference is even more evident in San Mateo County, where the imports and exports make up 8 percent of total flows by

tonnage, and 49 percent of total flows by value. The County's businesses are known for providing high-value products, including chemical products and computer products. Other counties with similar international trade flow patterns include Santa Clara, Contra Costa, and San Francisco Counties.

Counties with the highest domestic flows include Alameda, Santa Clara, and Contra Costa; all with significant consumer populations, as well as industrial activities. Counties with the highest imports include Contra Costa, Alameda, Santa Clara, and San Mateo. These include imports of consumer goods, as well as materials needed for assembly of machinery and high-technology products. Finally, counties with the highest exports include Alameda, San Mateo, and Santa Clara.

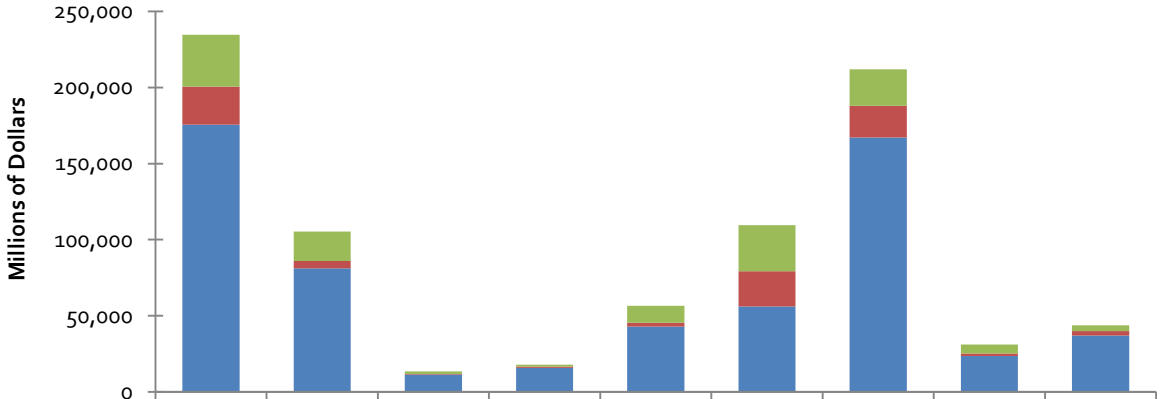
Figure 2.10 Bay Area Counties Freight Flows by Trade Type, 2012
Thousands of Tons



	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
Imports	10,082	22,821	391	312	4,216	2,500	3,401	7,850	817
Exports	12,611	6,600	212	657	4,735	1,807	3,251	1,137	1,617
Domestic	121,169	119,480	15,999	15,307	47,995	53,092	114,771	29,354	40,655

Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

Figure 2.11 Bay Area Counties Freight Flows by Trade Type, 2012
Millions of Dollars



	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
Imports	33,955	19,323	1,729	1,235	11,117	30,157	23,873	5,873	3,755
Exports	25,129	4,762	351	823	2,565	23,192	20,800	1,814	3,070
Domestic	175,582	81,221	11,374	15,789	42,819	56,140	167,282	23,505	36,932

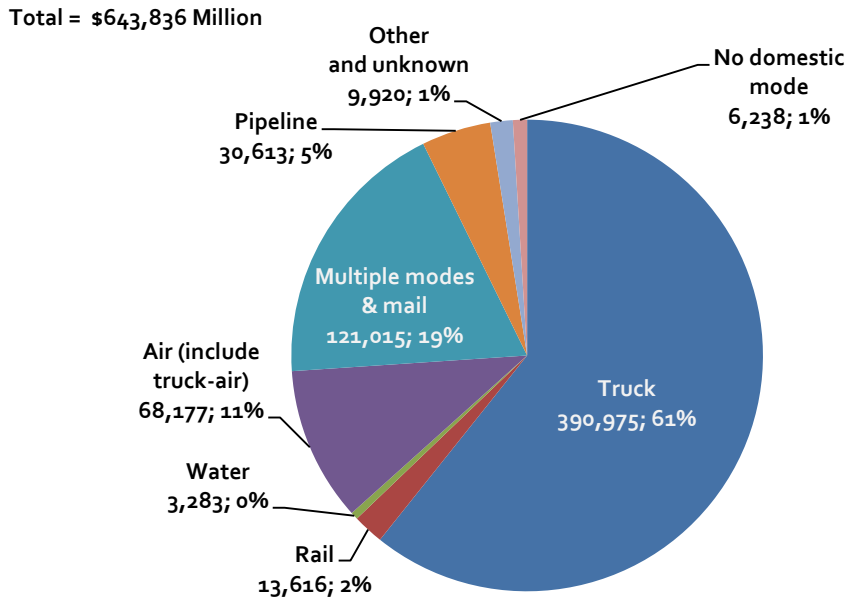
Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

2.3.3 Freight Flows by Mode

In terms of freight flows by tonnage, trucks carry the largest share of total trade at 72 percent (Figure 2.12). The pipeline mode (carrying mostly petroleum) and the multiple modes/mail mode[7] (carrying mostly containers) also make up significant shares of freight flows, at 11 percent and 6 percent, respectively. As described in the footnote, FAF reports all commodity flows that use more than one mode from origin to destination as "multiple modes." In the Bay Area, a large fraction of these movements appears to be intermodal rail. In terms of value, the multiple modes and mail makes up a much larger share of total freight flows, at 19 percent, due to the high-value nature of the intermodal goods carried. In addition, air cargo carries 11 percent of all freight flows in terms of value, indicating the importance of the air mode to the regional economy despite the fact that air freight constitutes an insignificant share of freight flows in terms of weight.

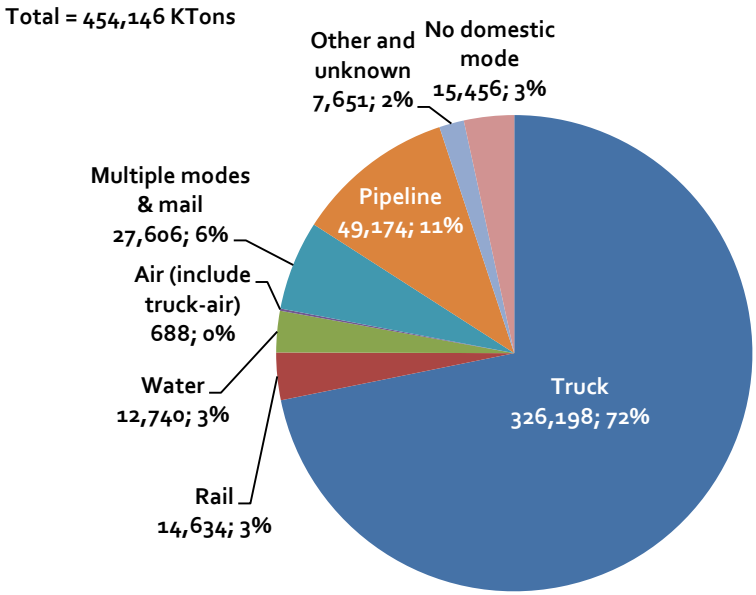
[7] The FAF3 and the Commodity Flow Survey use Multiple Modes and Mail, rather than intermodal, to represent commodities that move by more than one mode. Intermodal typically refers to containerized cargo that moves between ship and surface modes, or between truck and rail; and repeated efforts to identify containerized cargo in the Commodity Flow Survey have proved unsuccessful. Shipments reported as Multiple Modes can include anything from containerized cargo to coal moving from mine to railhead by truck and rail to harbor. The "Mail" component recognizes that shippers that use parcel delivery services typically do not know what modes were involved after the shipment was picked up. (Source: Freight Analysis Framework 3 User Guide.)

Figure 2.12 Bay Area Freight Flows by Mode, 2012
Thousands of Tons



Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

Figure 2.13 Bay Area Freight Flows by Mode, 2012
Millions of Dollars

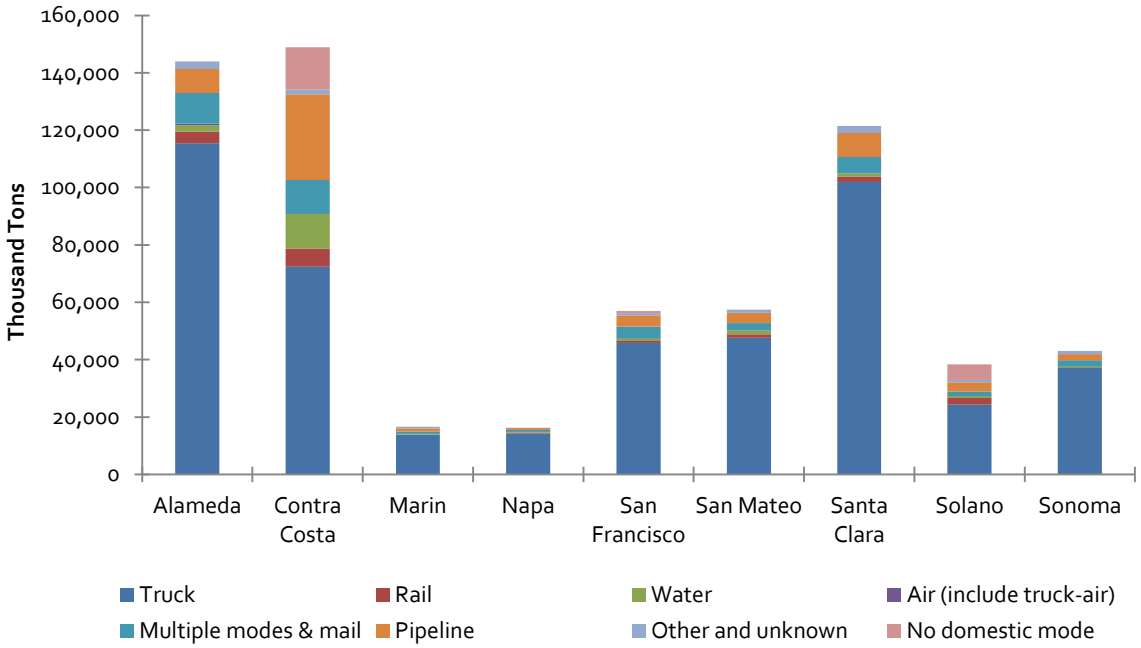


Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

At the county level, trucking is still the dominant mode for most, both by tonnage and by value (Figures 2.14 and 2.15). The two counties that has the highest share of trucking activities out of Bay Area totals is Alameda County (24 percent by tonnage, 25 percent by value); and Santa Clara County (22 percent by tonnage, 26 percent by value); both indicating the continued importance of key highway freight corridors in the East Bay. Trucking provides not only long-haul transportation functions, but also important last-mile delivery and drayage functions.

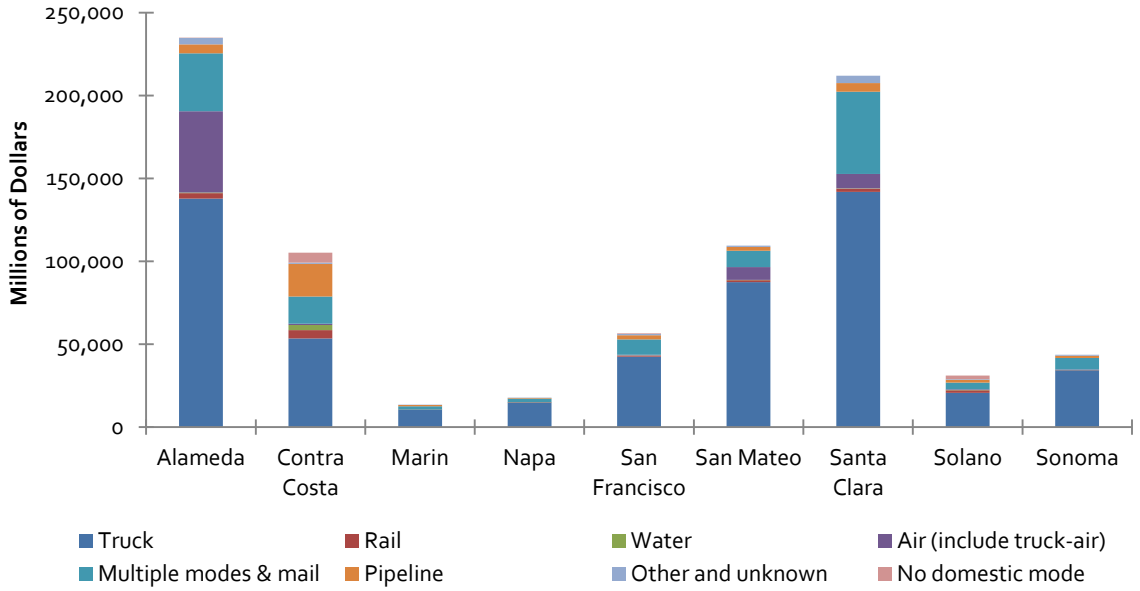
Alameda County also has high tonnages from multiple modes/mail mode, due to the presence of the Port of Oakland that utilizes rail and intermodal rail shipments. It also has high air cargo volumes due to the OAK. Contra Costa and Solano Counties have atypical mode splits due to presence of crude oil refineries and auto part import facilities that are suited to rail transport.

Figure 2.14 Bay Area Counties Freight Flows by Mode, 2012
Thousands of Tons



Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

Figure 2.15 Bay Area Counties Freight Flows by Mode, 2012
Millions of Dollars



Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

2.3.4 Freight Flows by Commodity

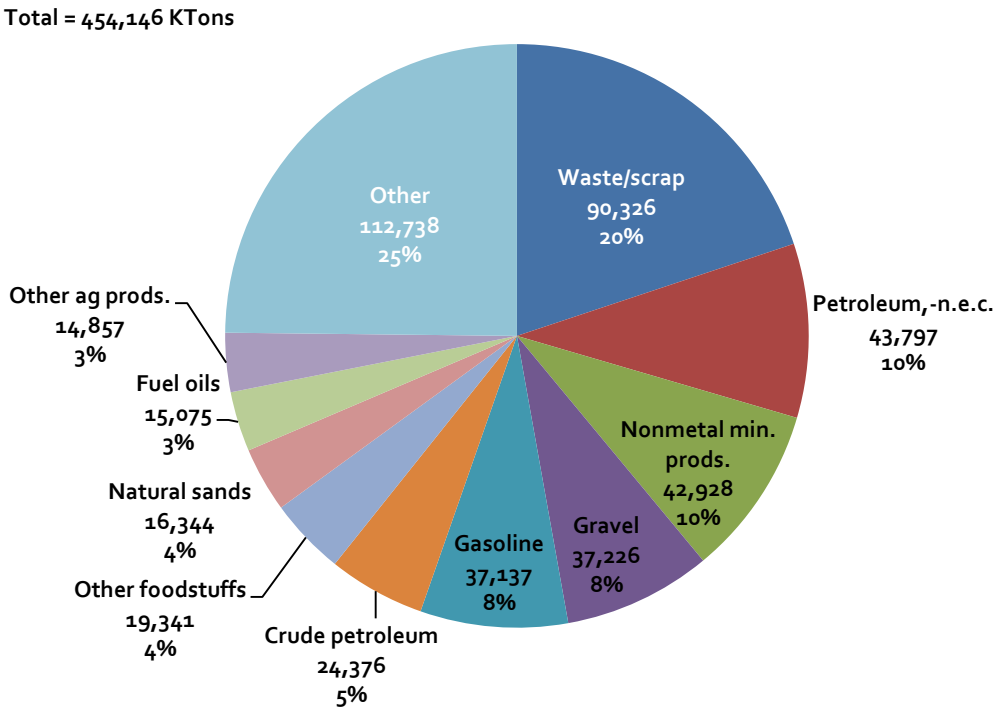
Commodity movements, when looked at in conjunction with mode and trade type, provide the most complete story of what drives goods movement. In the Bay Area, as we see in Figure 2.16, the largest flow in terms of tonnage is waste/scrap, which, while growing in large part as a result of the growing consumer base, also is becoming a significant export commodity. In fact, in 2011, scrap metal was the Port of Oakland's biggest export product by tonnage, followed by waste paper. Processing scrap and waste materials alone generated about 866 port jobs in 2010, and some $161 million in local tax revenue.[8] The largest trading partner for waste and scrap exports from the Port of Oakland is China, where the materials are recycled for local manufacturing.[9] Petroleum n.e.c. (not elsewhere classified) represents petroleum products from the refining process, and the 10 percent of such products in the Bay Area indicate the significance of the petroleum refining industry in the region. Other top commodities include various bulk commodities that are inputs for construction.

[8] http://www.nbcbayarea.com/news/local/At-Port-of-Oakland-Garbage-is-a-Moneymaker-125034739.html.

[9] Ibid.

In terms of value, the freight flows are dominated by electronics, machinery, autos, and other products from biotech industries (Figure 2.17) – further evidence of the importance of these industries to the economy.

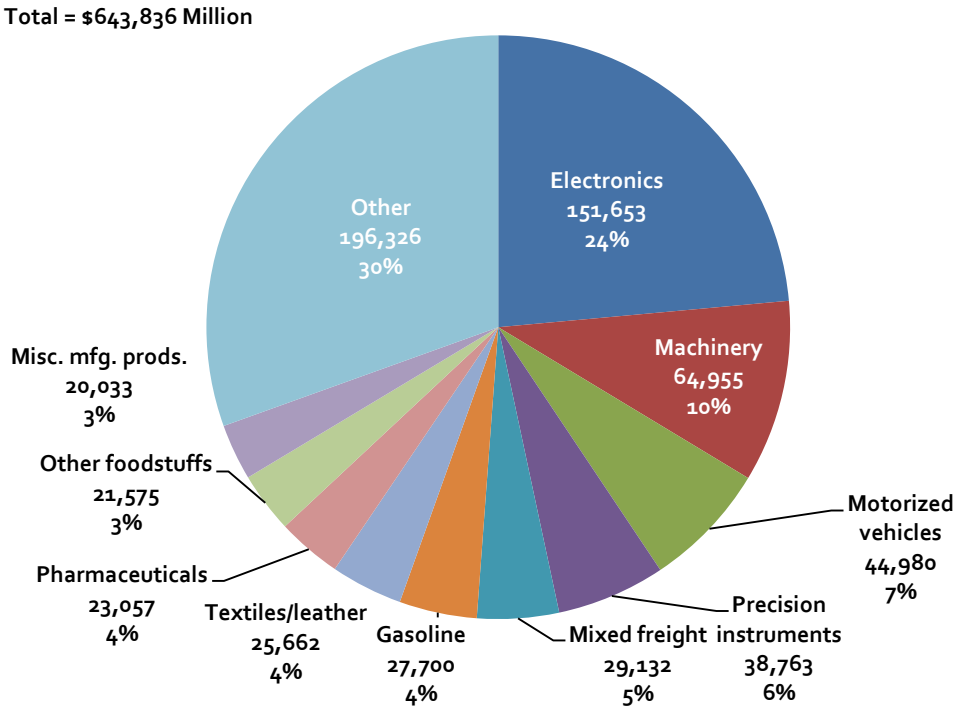
Figure 2.16 Bay Area Freight Flows by Commodity, 2012
Thousands of Tons



Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

Figure 2.17 Bay Area Freight Flows by Commodity, 2012

Millions of Dollars



Source: Freight Analysis Framework Data; Analysis by Cambridge Systematics, Inc.

At the county level, each of the Bay Area counties has freight flow patterns that represent a unique mix of commodities that is either produced or demanded within the county. Table 2.5 highlights the top five commodities by tonnage within each county (including outbound, inbound, and intracounty flows), reflective of the key industries discussed in Section 2.2.

Table 2.5 Bay Area Freight Flows by County by Commodity, 2012

Thousands of Tons

Commodity	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Bay Area
Alcoholic beverages	2,176	669	178	2,060	841	546	1,175	335	1,945	7,272
Animal feed	1,012	641	69	328	178	216	491	182	675	3,002
Articles-base metal	2,568	378	45	69	275	571	2,220	265	194	4,731
Base metals	2,629	827	36	45	137	298	1,802	368	266	5,518
Basic chemicals	1,894	456	11	146	369	1,615	223	572	91	4,491
Building stone	409	324	131	27	306	285	489	128	229	1,594
Cereal grains	3,916	1,134	140	370	795	1,572	1,204	831	1,391	11,066
Chemical prods.	1,321	381	46	125	153	1,388	444	413	141	3,754
Coal	21	79	12	1	51	11	18	20	18	139
Petroleum-n.e.c.	8,610	25,093	1,175	643	4,971	3,662	8,853	2,236	2,253	43,797
Crude petroleum	8	22,965			891			6,886		24,376
Electronics	1,133	278	72	50	390	397	1,663	87	200	3,540
Fertilizers	981	397	77	98	259	926	582	333	176	2,399
Fuel oils	3,387	12,742	430	232	1,922	1,382	3,267	1,068	825	15,075
Furniture	917	230	64	30	273	213	490	124	159	1,962
Gasoline	7,332	31,723	871	464	2,980	2,887	6,777	1,665	1,670	37,137
Gravel	10,908	9,588	2,861	792	4,055	5,517	10,984	4,481	5,206	37,226
Live animals/fish	34	13	3	22	11	22	27	7	52	180
Logs	358	172	95	145	51	154	256	155	423	1,273
Machinery	2,314	412	58	265	231	631	2,644	324	499	4,881
Meat/seafood	1,776	319	98	120	526	548	663	196	434	3,449
Metallic ores	103	131	3	0	1	124	10	33	5	406
Milled grain prods.	1,193	277	88	85	454	391	589	148	291	2,760

Commodity	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma	Bay Area
Misc. mfg. prods.	1,167	358	106	57	342	328	1,238	155	319	2,881
Mixed freight	2,648	1,097	355	229	1,403	1,296	2,476	507	698	8,893
Motorized vehicles	2,605	693	92	58	797	368	2,592	119	239	6,216
Natural sands	4,569	3,530	1,397	307	1,829	2,458	5,004	1,690	2,545	16,344
Newsprint/paper	1,055	232	81	81	276	356	417	110	154	2,445
Nonmetal min. prods.	21,164	5,700	2,254	4,135	4,136	5,694	13,349	4,348	4,578	42,928
Nonmetallic minerals	3,592	6,586	607	337	1,446	2,326	1,531	908	1,051	11,899
Other ag prods.	6,140	1,707	364	482	1,539	2,310	2,655	960	1,969	14,857
Other foodstuffs	7,172	2,398	470	689	2,364	4,527	3,319	1,517	1,965	19,341
Paper articles	892	190	198	63	266	286	537	58	159	2,155
Pharmaceuticals	117	37	7	9	24	100	62	29	17	323
Plastics/rubber	1,942	357	118	107	227	363	772	311	421	3,759
Precision instruments	273	40	13	8	61	73	242	14	51	619
Printed prods.	526	124	65	46	292	255	406	28	101	1,393
Textiles/leather	914	217	78	24	598	156	437	108	115	2,165
Tobacco prods.	51	7	2	121	6	8	16	11	112	227
Transport equip.	48	11	4	2	20	13	40	4	6	129
Waste/scrap	31,807	15,546	3,572	3,008	20,259	12,555	39,336	6,287	9,995	90,326
Wood prods.	2,181	840	253	395	943	573	2,122	321	1,451	7,218
Total	**143,863**	**148,901**	**16,602**	**16,276**	**56,946**	**57,399**	**121,423**	**38,340**	**43,089**	**454,146**

Source: FAF3, Cambridge Systematics analysis.

Note: Green highlights indicate the top commodities within each county/region.

To help link the commodities to the highway corridors, Figure 2.18 illustrates the top commodities shipped in each Bay Area County by truck. Waste/scrap materials are the leading commodity by weight in all counties. Waste/scrap movements include municipal waste and, to a large extent, export recycling material to countries such as China. Other commodities that are high volume include petroleum products, gasoline and construction material (gravel and nonmetallic minerals). Outbound wine, nonmetallic minerals, and inbound gravel to San Mateo and Alameda Counties represent the agriculture and construction industry activities in these counties. In terms of value, machinery and electronic equipment dominate truck movement in most counties. More specialized products include auto movements in Alameda, San Francisco, and Santa Clara Counties; and export wine and textiles from Napa County. These commodities move on all of the key highway corridors in each county, as shown in Table 2.6. The county-level assessments further indicate the relevance of the key goods movement corridors to serve both heavy goods, as well as more valuable and time-sensitive goods.

Table 2.6 Goods Movement Corridors Used by County

County	Truck Corridors
Alameda	I-880, I-580, I-680, I-80
Contra Costa	I-80, SR 4, I-680
Marin	U.S. 101
Napa	SR 12
San Francisco	U.S. 101, I-80 (Bay Bridge)
San Mateo	U.S. 101
Santa Clara	U.S. 101, I-880, I-680, SR 152
Solano	I-80, SR 12
Sonoma	U.S. 101, SR 12

Source: Cambridge Systematics, Inc.

Figure 2.18 Top Truck Commodities by County in the Bay Area

Source: FAF3 Data Disaggregated by Cambridge Systematics, Inc.

3.0 GOODS MOVEMENT CORRIDORS

The regional goods movement system supports global supply chains and regional industries that trade in international, domestic, and local markets. These industries require efficient and high quality goods movement services to remain competitive. Inefficiency in the goods movement system can result in higher cost goods for Bay Area consumers and businesses, and can put the region at a competitive disadvantage.

The goods movement system in the Bay Area consists of private and public sector modal elements that, in many cases, are also used for the movement of passengers. Goods movement activities are carried out via multimodal corridors that serve three primary functions:

- **Global Gateways.** This function is the 'region's role as a major conduit for international trade. The primary global gateways in the region include the major maritime facilities at the Port of Oakland, Oakland International Airport (OAK), and San Francisco International Airport (SFO). At the regional scale, there also are several smaller ports in Contra Costa, Solano, San Francisco, and San Mateo Counties that also serve as global gateways and support local economies.

- **Interregional Corridors and the Intraregional Core System.** A number of highway routes and parallel rail routes in the region are classified as interregional corridors because their primary, though not exclusive, function is to move freight between regional economic centers. The intraregional core network serves areas with the highest concentration of population, and subsequently highest share of demand for goods movement. This core network also provides primary access to major facilities, such as the Port of Oakland, rail yards, warehouse/industrial districts, and connections to the interregional corridors. The intra- and interregional corridor functions are necessarily intertwined, as many intraregional movements occur on the interregional corridors.

- **Urban Goods Movement System and Last-Mile Connectors.** The urban goods movement system refers to networks of city streets that move freight to or from its origin or final destination. Last-mile connectors are local truck routes within the urban goods movement system and include connections between major freight facilities (such as seaports, airports, intermodal terminals, industrial parks, and major warehousing clusters) and the rest of the transportation system.

The Bay Area's freight system needs each of the functional elements to be effective. These functions are performed by a collection of multimodal goods movement corridors, which are based around individual highway corridors in this document. These corridors also include parallel rail networks and key freight facilities (airports, seaports, intermodal terminals). All of the corridors are connected to the local urban goods movement system and supported by last-mile

connectors that help support distribution of goods to consumers. The corridors described in this report are presented in Table 3.1 and are each discussed in greater detail in the following sections. Figure 3.1 shows the 2+ axle truck volumes on all the major corridors in the Bay Area in 2012 to offer an order of magnitude comparison for all the corridors. Figure 3.2 shows the rail lines as well as major subdivisions within Bay Area to help guide the corridor level discussions.

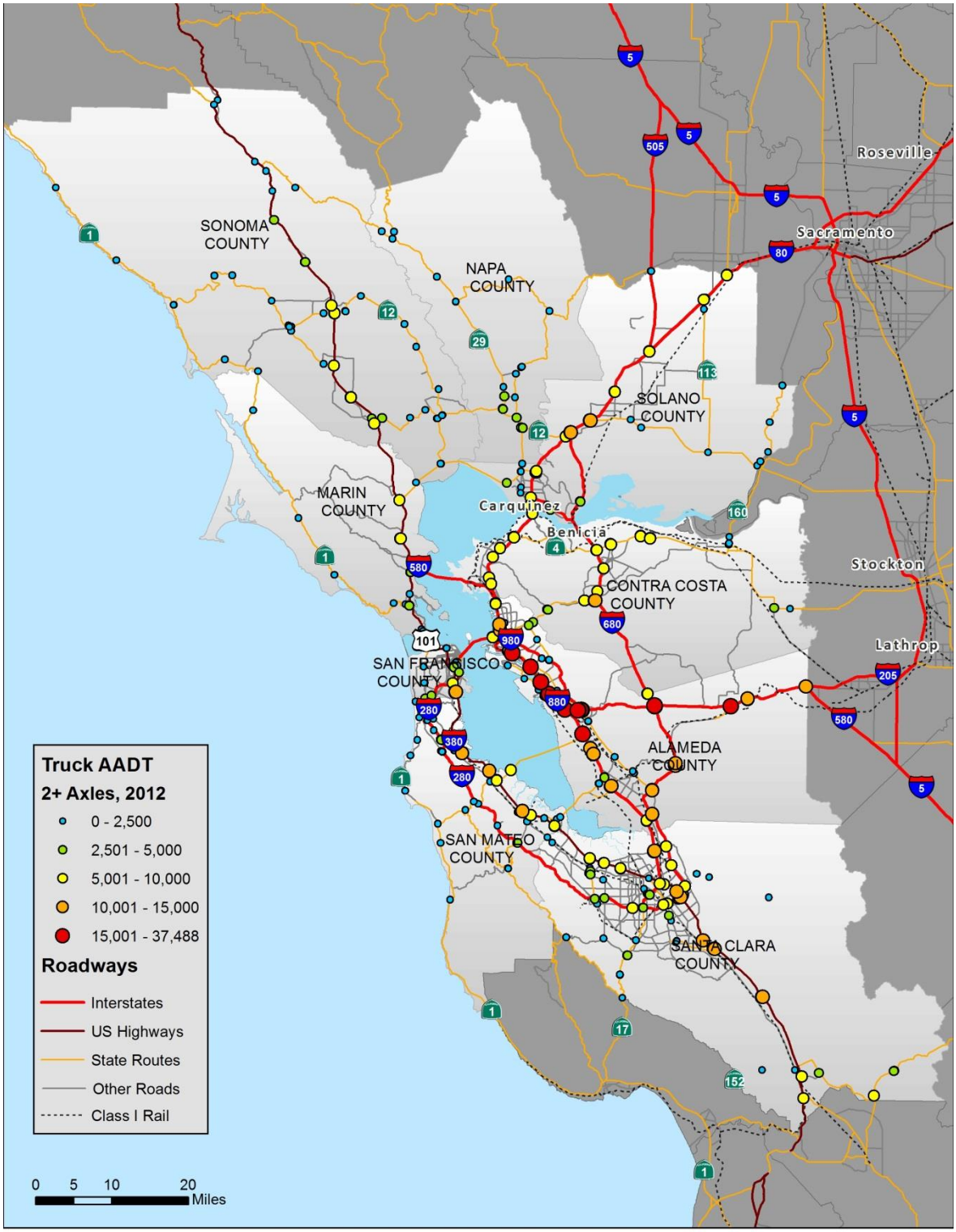
Table 3.1 Goods Movement Corridors in the Bay Area

Counties in Bay Area	Corridor	Other Key Corridor Elements	Functions of the Corridor	Corridor Description
Alameda, Santa Clara	I-880	• UP Rail Lines (Niles, Oakland, Coast Subdivisions) • Port of Oakland • UP Railport, BNSF Oakland Intermodal Gateway • Oakland International Airport • San Jose Mineta International Airport	Global Gateway, Interregional, Intraregional	Major North-South truck corridor supporting East Bay. One of the region's primary international gateway corridors and intermodal rail terminals. Major industrial corridor with much of the region's historic industrial core.
San Francisco, Alameda, Contra Costa, Solano, Napa	I-80 (Central Corridor)	• UP Martinez Subdivision • Port of Benicia • Travis Air Force Base • Cordelia Truck Scales • Major Interchange at I-80/I-680/SR 12	Interregional, Intraregional	Primary corridor connecting Bay Area to Sacramento and northern tier states across the U.S. Also connects Bay Area counties.
Contra Costa, Alameda	I-580/SR 238 (Altamont Corridor)	• UP Oakland Subdivision • M580 Marine Highway • Port of Richmond (including Richmond Pacific Rail) • BNSF Rail Yard	Interregional	Primary truck corridor connecting the Bay Area to the rest of the U.S. to the continental U.S. Secondary freight rail line that is expected to grow increasingly important with expansion of rail terminal at the Oakland Army Base.
Santa Clara, San Mateo, San Francisco, Marin, Sonoma	U.S. 101	• SFO • Port of San Francisco (including San Francisco Bay Railroad) • Port of Redwood City • Transbay bridges	Global Gateway, Interregional, Intraregional	Major goods movement corridor serving the Peninsula in the Bay Area. Also connects agriculture shippers on North Bay (Sonoma), Central Coast, and North Coast with markets in Bay Area. Also primary access to SFO.

Counties in Bay Area	Corridor	Other Key Corridor Elements	Functions of the Corridor	Corridor Description
		• SMART rail on NWP Line		
Santa Clara, Alameda, Contra Costa	I-680	• Port of Benicia • Valero Oil Refinery	Global Gateway, Intraregional	Serves trucks moving from South Bay and Fremont and connecting to and from the warehouses in the San Joaquin Valley via connections with I-580.
Sonoma, Napa, Solano	SR 12/SR 37	• SMART Rail on NWP	Interregional, Intraregional	Helps connect North Bay to the Port of Oakland, San Joaquin Valley, and rest of the region.
Santa Clara	SR 152		Interregional, Intraregional	Important connection providing link that connects the San Joaquin Valley to the coast. Recently selected as a Caltrans Focus Route[a].
Contra Costa	SR 4	• BNSF and UP Lines from Stege/Port Chicago to Stockton • UP MOCOCO Line (Martinez to Lathrop)	Intraregional, interregional	Serves refineries and chemical manufacturers in CCC, provides connections to Central Valley

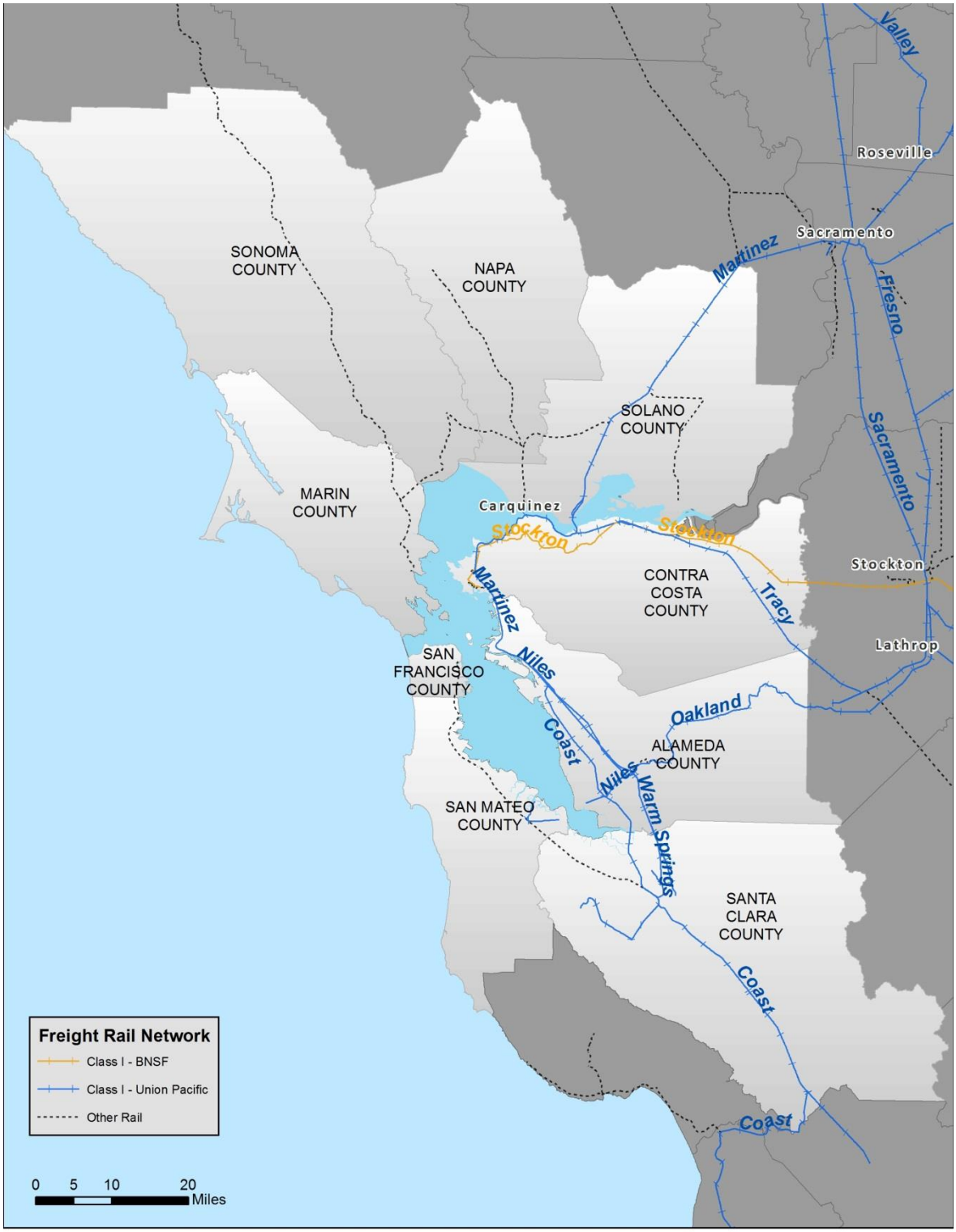
[a] Focus routes are a set of 10 corridors designated by Caltrans that are of the highest priority for completion to at least minimum facility concept standards over the next 20 years. Completion of these routes will help ensure that a statewide system is in place that can accommodate higher-volume interregional trip movements. http://www.dot.ca.gov/hq/tpp/offices/oasp/ITSP_document_11_25_2013_rev1.pdf#zoom=75.

Figure 3.1 Bay Area Truck Volumes (Two plus Axle), 2012



Source: Caltrans 2012 GIS truck count data, Cambridge Systematics.

Figure 3.2 Freight Rail Network in the Bay Area



Source: Rail lines data obtained from Caltrans Office of Systems and Planning; Caltrans District 4 Geographic Information System (GIS) Dataset, as of July 2013.

Note: Subdivisions names are shown in the map (Blue = UP, Yellow = BNSF)

3.1 The I-880 Corridor

The I-880 corridor is the core north-south intraregional freight corridor that supports a variety of manufacturing, logistics and value added industries in the East Bay from San Jose to Oakland. The highway component of I-880 is about 42 miles long, beginning at the I-280 interchange and ending around 7th street in Oakland near the Bay Bridge approaches. The facility ranges from four to 10 mixed flow lanes. The I-880 corridor also is supported by a network of parallel arterial routes and access routes to various important freight facilities along it, including OAK and the Port of Oakland. I-880 also provides access to the interregional network of I-580/I-238 and for industrial areas along the I-880 corridor, as well as serving as the East Bay entry point for the three Transbay bridges: the Bay Bridge, the San Mateo Bridge, and the Dumbarton Bridge. Because of its regional importance, I-880 has some of the highest heavy truck volumes in the region. The I-880 corridor also contains the following multimodal elements (Figure 3.1):

- **The UP rail lines from Oakland to San Jose.** UP has the largest presence in the Bay Area region, with several subdivisions that parallel the I-880 interstate corridor. These include 1) the Coast Subdivision (Elmhurst to the boundary of Santa Clara County via Newark); 2) the Niles Subdivision (West Oakland to Newark via Niles Junction); and 3) the Oakland Subdivision (Melrose to the boundary of Alameda County via Niles Junction).

- **Port of Oakland.** The Port of Oakland is the largest container port in the region and currently is the firth busiest container port in the U.S.[10], handling more than 2.3 million twenty-foot equivalent units (TEU) in 2012. It also handles break bulk cargo. The Port has a channel depth of 50 feet (dredged annually), and it differs from California's other two large container ports (the Ports of Los Angeles and Long Beach) because it handles more exports than imports. The Port currently has 8 container terminals, 18 deepwater berths, and 36 container cranes; 30 of which are Post-Panamax[11] size.[12] The Port is served by I-880 and I-80; the two Class I railroads (UP and BNSF); and 10 miles of short line track, warehouses, and two nearby intermodal terminals. The Port also has a break bulk terminal located in the Outer Harbor waterway, which facilitates break bulk general cargo.[13] Freight rail customers

[10] Port of Oakland, *Maritime Comprehensive Truck Management Program*, adopted on June 16, 2009.

[11] Post-Panamax is the size of a ship that is more than 13 containers, but less than 18 containers wide. A Post-Panamax crane can service a ship of this size. Source: Port of Oakland, *2013-2014 Adopted Operating and Capital Budgets*, Part G: Glossary. Available at: www.portofoakland.com/about/investors.aspx (last accessed on January 3, 2014).

[12] http://www.portofoakland.com/maritime/operations.aspx (last retrieved on January 3, 2014).

[13] World Port Source: http://www.worldportsource.com/ports/commerce/USA_CA_Port_of_Oakland_231.php (last retrieved on October 15, 2013).

in the Bay Area access the freight rail system through the intermodal terminals of UP's Railport–Oakland and BNSF's Oakland International Gateway (OIG). The Port of Oakland's role as a key international gateway is influenced heavily by factors, including the population and general economy of Alameda County, the Bay Area, and neighboring regions (which drives demand for containerized consumer imports and supplies). Understanding a combination of local economic and demographic trends, as well as general trade and logistics trends, is important to understanding how international trade will impact the region's freight transportation system in the future.

- **UP Railport – Oakland Intermodal Terminal**. Railport is a 110-acre intermodal terminal located near the Port of Oakland. The UP Railport handles intermodal containers at the Port, and with the use of drayage trucks, offers connections to regional warehouse facilities, where containers are unloaded, sorted, consolidated, and sometimes stored for short periods of time. Railport's current capacity is 450,000 lifts annually.

- **BNSF Oakland International Gateway (OIG) Intermodal Terminal**. OIG is an intermodal terminal completed in 2002, located near the Port of Oakland. OIG for BNSF also performs a similar function of handling intermodal containers and offering connections to regional warehouse facilities as Railport–Oakland for UP. OIG has a current capacity of 300,000 lifts annually. The construction of OIG eliminated the 12-mile trip over local roads between the Port and BNSF's former intermodal terminal at Richmond.

- **Oakland International Airport (OAK).** OAK is a domestic air cargo gateway located on the east side of San Francisco Bay in Alameda County. The Airport is owned and operated by the Port of Oakland. The Airport has four runways; and the longest runway is 10,001 feet long. The largest carrier, Federal Express (FedEx), occupies 250,000 square feet of sorting, distribution, and warehouse space at OAK. U.S. Customs and Border Protection officials are located on-site. Oakland's Federally designated Foreign Trade Zone is located one and one-half miles away and consists of 500,000 square feet of buildings with direct highway access. In 2012, OAK handled about 41 percent of Bay Area air cargo by tonnage.[14] The FedEx regional hub processes up to 100,000 pounds (280,000 packages) of freight each day. Primary air freight destinations for air cargo shipped from OAK are domestic with high frequency along the U.S. West Coast and transcontinental to cargo hubs – Memphis (FedEx) and Louisville (United Parcel Service (UPS)), and international service to Asia/Pacific. Air

[14] Caltrans, California Air Cargo Groundside Needs Study, July 2013.

cargo to and from the airport has to traverse various last-mile access streets, as well as I-880.[15]

- **The Mineta San Jose International Airport (SJC).** SJC is located northwest of downtown San Jose at the southern tip of the San Francisco Bay in Santa Clara County. The airport has three runways, and the longest runway is 11,000 feet long. In 2012, SJC handled about 4 percent of the Bay Area's air cargo.[16] The City of San Jose owns and operates SJC, which provides service on two runways. There are seven freight-only and three cargo or freight carriers at SJC. The 2011 Airport Master Plan amendment identifies all-cargo as occupying 300,000 square feet at SJC and belly-cargo taking up 85,000 square feet. U.S. Customs and Border Protection officials are located on-site. The General Purpose Foreign Trade Zone is located approximately seven miles south of SJC in San Jose's Monterey Corridor Industrial area. Cargo operations are handled by FedEx and UPS. U.S. 101 and I-880 serve the airport.[17]

Together, the multimodal facilities of the I-880 corridor serve critical goods movement roles in the region, linking Central Valley and the Port of Oakland, as well as connecting the South Bay with the East Bay. The corridor components perform global gateway functions through direct ground links to the Port of Oakland, and the International airports of OAK and SJV; provide interregional connectivity to I-580 and I-80; and provide essential intraregional connectivity moving goods within the region and supporting major population centers along East Bay.

[15] Caltrans District 4 Fact Sheet on Oakland International Airport, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

[16] Caltrans, California Air Cargo Groundside Needs Study, July 2013.

[17] Caltrans District 4 Fact Sheet on Mineta San Jose International Airport, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

Figure 3.3 I-880 Corridor Map with Daily Total and Truck Counts

Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.1.1 Current Freight Flows and Future Trends

The I-880 corridor, apart from serving interregional and intraregional goods movement functions, also supports international trade through its global gateways. For the Port of Oakland, import and export volumes are growing in tandem. From 1990 to 2012, full import

containers grew from 254,000 twenty-foot equivalent units (TEU)[18] to 792,000 TEUs, a 212-percent increase. The volume of loaded export containers increased from 600,000 TEUs to 986,000 TEUs in the same time period, indicating a slower growth rate. These historic trends of high import growth reflect a pattern that was characteristic of all West Coast ports during the same period as overall U.S. imports outpaced exports, there was significant offshoring of consumer goods manufacturing, and the dollar remained strong. This pattern began to shift towards the end of the last decade when imports actually dropped during the recession and it's immediate aftermath, while export growth at the Port of Oakland continued strong growth. Contributing to the export growth at the Port of Oakland is the agricultural and prepared food commodities produced in the San Joaquin Valley and Central Coast regions of California. Imports at the Port of Oakland are a mix of supplies (e.g. machinery, plastics) to critical industries and consumer products that are consumed in California and other states, mostly in the Mountain West.

There continues to be uncertainty about the path of future growth at the Port of Oakland and this makes planning difficult for infrastructure in the I-880 corridor. The last formal forecast of growth at the Port of Oakland was prepared by The Tioga Group in July 2009. This forecast anticipated a resumption of high import growth at the port with import loads forecasted to triple and export loads forecasted to double between 2009 and 2030. This would result in import volumes that considerably exceed export volumes, altering historic trends. The Tioga forecast also indicated that achieving this level of growth could be constrained by intermodal rail terminal capacity at the Port (indicating a need for construction of the Outer Harbor Intermodal Terminal), mainline rail capacity on the Martinez Subdivision, and roadway congestion on the I-880/I-580 corridors and local access roads. The FAF forecasts were prepared more recently and reflect recent trends in U.S. import/export mix and anticipate slower overall growth in trade and higher export growth as compared to import growth. This export growth for the Port of Oakland will be a mix of higher value technology products (e.g., precision instrumentation) and agricultural products and bulk export products. This picture of more modest growth as compared to forecasts prepared before 2010 and that reflects continued balance between imports and exports and an expanding bulk export sector is consistent with the Port of Oakland's recent Strategic Plan and the forecasts used in the 2012 addendum to the Oakland Army Base Environmental Impact Report (EIR). Even with these more modest and balanced growth forecasts, there will be an increasing contribution of port trucking to congestion in the I-880 corridor and connecting last-mile connectors. Intermodal terminal capacity will also constrain growth without construction of the new OHIT and bulk rail facilities that are planned for the

[18] The twenty-foot equivalent unit (TEU) is an inexact unit of cargo capacity often used to describe the capacity of container ships and container terminals. It is based on the volume of a 20-foot-long (6.1 m) intermodal container, a standard-sized metal box which can be easily transferred between different modes of transportation, such as ships, trains and trucks.

Oakland Army Base redevelopment, although intermodal terminal capacity is unlikely to present a constraint until after 2020.

In 2011, OAK's total cargo tonnage was about the same as it was in 1995, and about 65 percent of the peak year in 2000. Although the reduced volumes alone would indicate substantial available capacity for the next decade, the airport has earmarked the North Field for long-term growth. Air cargo volumes at OAK are forecast to increase from 501,813 metric tons in 2012 to 778,900 metric tons by 2040, with a Compound Annual Growth Rate (CAGR) of 1.6 percent. Despite a decline in volume from 2003 to 2008, the cargo volumes seem to have stabilized and are expected to rise in the future. SJC has seen its cargo volumes fall dramatically over the last decade, consistent with the overall decline in air cargo in the Bay Area. Although capacity may not be an issue, there seems to be limited growth potential for SJC in the future due to competition from SFO and OAK. To a large extent this is a reflection of the overall service profiles of the three Bay Area airports and how supporting cargo facilities have developed. With SFO offering substantially greater levels of international passenger service than SJC and OAK offering higher levels of domestic service, the opportunities for belly cargo movements at SFO and OAK continue to much greater than at SJC. This has led to the development of substantial air cargo support space for international trade at SFO and the development of domestic air freight hubs at OAK, such as the West Coast hub facility that FedEx has developed at OAK.

With forecast growth in imports and exports, combined with an increasing local consumer market, traffic on I-880 will continue to grow into the future. As shown in Figure 3.3, the I-880 highway corridor has very high total traffic volumes, experiencing between approximately 155,000 to 223,000 average vehicles per day in 2012, with the highest traffic volumes experienced around Oakland. Truck traffic (2+axles) on this corridor range from less than 4,000 trucks per day to more than 21,000 trucks per day, with the number of trucks steadily increasing from south to north. The truck volumes make up as much as 7 percent of total vehicle traffic. Traffic exiting I-880 connecting to the Central Valley via 238/I-580 results in the decrease in traffic volumes south of I-580.

In addition, heavy trucks (5+) axles make up a significant percent of the total truck volume. Heavy trucks have a greater impact on highway congestion, create unique operational challenges, and create more damage and wear on pavement. In 2040, the percent of heavy trucks as a share of total trucks will likely grow, as the supply chain moves towards increased consolidation. Consolidation is a supply chain practice to build efficiency into shipping using enhanced planning techniques to join shipments with common origins or destinations. By joining what may have been multiple trips, firms can share larger long-haul trucks. This will have consequences on roadway infrastructure and operations, both positive and negative.

Like highways, carload and intermodal freight trains share tracks with passenger trains. Passenger rail train volumes are significant in this corridor and must be taken into consideration

when looking at total train volumes and freight forecasts. Train volumes on the UP Oakland subdivision was made up of 4 freight trains and 8 passenger trains, and train volumes on the UP Niles subdivision included 8 freight trains and 16 passenger trains[19]. According to the California State Rail Plan, in 2025, overall freight rail demand is anticipated to grow moderately on those two lines, especially the portions from San Jose to Fremont. Neither the Oakland/Niles subdivision nor the Coast subdivision are major freight routes today. However, there are several trends which could increase their use as freight routes in the future. First, as will be noted later, there could be future capacity constraints on the Martinez subdivision (see I-80 Corridor) due to growth in international and domestic intermodal trains and passenger trains that could cause UP to re-route some of its freight traffic to the Oakland/Niles subdivision. Second, there are new sources of freight rail traffic that could come to the Bay Area as a result of growth in freight rail at the former Oakland Army Base. This traffic, which would likely be primarily bulk exports, might be routed on the Oakland/Niles subdivision to ovoid scheduling conflicts with passenger and premium freight rail services that will be operating on the Martinez subdivision. Finally, the Altamont Commuter Express (ACE) passenger service, which operates on the Oakland/Niles subdivision, is hoping to expand its operation.

3.1.2 Major Existing Bottlenecks/Issues

The I-880 corridor handles a substantial amount of intra- and interregional traffic, as well as traffic related to the international gateways. Though intraregional traffic will likely grow more slowly than interregional traffic in the future, it will still contribute significantly to higher total truck traffic on this corridor. As such, the region will continue to see conflicts between trucks and automobiles on I-880.

[19] Sources: Freight train counts based on 2010 BNSF and 2008 UPRR train count data. Passenger train counts based on weekday published timetables for summer 2014.

According to *the I-880 Corridor Systems Management Plan (CSMP)*[20], and analysis performed by Cambridge Systematic as part of the *San Francisco Bay Area Freight Mobility Plan*, several bottleneck locations exist along I-880. These locations are shown in Table 3.2 below, along with other top bottleneck locations in the Bay Area. A more comprehensive delay analysis will be conducted as part of *Task 3C: Needs, Issues and Opportunities.*

In addition, I-880 both in the northbound and southbound directions has the highest average collision rate of any interstate truck route in the Bay Area.[21] The short distance between exists, the short merge and weave sections, and the large amount of pavement damage all contribute to making this a high needs corridor. Caltrans already has been actively engaged in implementing projects to address such issues.

As part of the corridor infrastructure, the Port of Oakland faces potential constraints tied to land availability and deficiencies in cargo-handling equipment. The current Oakland Army Base Redevelopment project will improve the terminal handling capacity, cargo-handling equipment, and the port rail infrastructure. The Port also needs to have continued dredging of its harbors in order to meet the channel depth requirements of post-Panamax container ships. In addition to the Port's needs to support its import business, the Port of Oakland continues to look at improvements to its export capacity. All of these challenges will have significant impacts on highway and rail volumes.

[20] http://www.dot.ca.gov/hq/tpp/corridor-mobility/CSMPs/d4_CSMPs/i880/d4_csmp_i880_info.html.

[21] *San Francisco Bay Area Freight Mobility Study.*

Table 3.2 Key Bottlenecks on Major Truck Routes in the Bay Area by Highway Segment, Direction, and Level of Daily Total Truck Delays

Number	Hwy	Direction	Description and Cause of Bottleneck	Level of Daily Total Truck Delays
1	I-80	W	Bay Bridge toll plaza in the AM and PM peak periods due to high volumes, lane changing disruption, and stops at toll plaza	S (Severe)
2	I-80	W	Heavy traffic to the I-580E/I-880S split in the AM and PM peak periods due to many major merging and diverging points close to each other in the vicinity of this complex interchange	S
3	I-80	W	Downstream of Gilman Street on-ramp in the AM peak period due to the mainline plus on-ramp traffic and short weave between the on-ramp at Buchanan Street and the off-ramp at Gilman Street	S
4	I-80	W	Downstream of San Pablo Dam Road on-ramp in the AM peak period due to mainline plus on-ramp traffic, short weave between the on-ramp from Sam Pablo Dan Road to McBryde Avenue, and sharp curve in the roadway east of the San Pablo Dam Road interchange	S
5	I-880	N	Tennyson Road in the AM and PM periods due to two side by side on-ramps	S
6	I-880	N	Davis Street in the AM period due to two side by side on-ramps	S
7	I-880	N	23rd Avenue in the AM period due to too closely spaced on-ramps	S
8	I-580	E	From Hopyard Road to west of El Charro Road; I-880 E during PM period (“Altamont Corridor”)	S
9	I-580	E	Santa Rita Road to Fallon Road off-ramp in the PM period due to over-capacity	S
10	I-580	W	From North Flynn Road to Airway Boulevard (“Altamont Corridor”)	S
11	I-580	W	From East of Livermore Avenue to East of Greenville Road during PM period (“Altamont Corridor”) (Note: Contained within the I-580 W bottleneck from North Flynn Road to Airway Boulevard (“Altamont Corridor”)	S
12	I-580	W	Airway Boulevard on-ramps to Tassajara Road off-ramp in the AM period due to over-capacity	S
13	I-238/I-880 Interchange	X	In particular the single lane of I-238 as it merges onto I-880 causes backups (“Altamont Corridor”)	S
14	I-238	N	I-580 EB on to I-880 SB off-ramp in the AM and PM period due to insufficient capacity	S

Number	Hwy	Direction	Description and Cause of Bottleneck	Level of Daily Total Truck Delays
15	I-238	S	I-880 NB on to Lewelling off-ramp in the PM period due to insufficient capacity lane drop	S
16	I-880	N	Brokaw Road interchange in the AM period due to ramp merge at crest of grade	H (High)
17	I-880	S	Dixon Landing Road in the AM and PM periods due to on-ramp traffic merges	H
18	I-880	S	98th Avenue in the PM period due to eastbound and westbound on-ramps being too close	H
19	I-880	S	Marina Boulevard in the AM and PM periods due to on-ramp traffic merges	H
20	U.S. 101	S	Brokaw Road to Bowers Avenue (new)	H
21	U.S. 101	S	Broadway to Poplar Avenue in the AM period	H
22	U.S. 101	S	Poplar Avenue to 3rd Avenue in the AM period	H
23	U.S. 101	S	Hillsdale Loop to Hillsdale Diagonal in the AM period	H
24	U.S. 101	S	E Washington Street – Kastania Road in the AM period	H
25	U.S. 101	S	SR 110/SR 116 Junction – SR 12/U.S. 101 Junction in the AM and PM periods	H
26	I-680	N	SR 262 to SR 238 (new)	H

Source: Corridor System Management Plans for I-580/I-238, I-80, I-880, U.S. 101, and SR 4, 2010 to 2011; Cambridge Systematics' Bottlenecks Assessment.

3.1.3 Improvement Strategies

The I-880 Corridor System Management Plan also listed several I-880 improvement strategy categories, including advanced ramp metering, interchange improvements, auxiliary lanes, and other lane improvements that are supposed to improve efficiency and throughput for truck movement. *Plan Bay Area*[22] included I-880 improvement strategies in its project list as well. These strategies will not only improve efficiency, but also help the corridor reach other goals, including improved safety and access. Some of these projects include interchange reconfiguration, truck climbing lanes, traditional lane widening, realignments and new alignments, and traditional operational improvements. Bottlenecks should be eliminated on the freight rail mainlines, though most of these are likely to be addressed through investments by the Class I railroads as they are privately owned.

Strategies to improve the Port of Oakland, including the expansion and modernization of transload facilities and distribution centers are already planned and would help improve access to the Oakland Army Base and to OAK.[23] For cargo moving through the Port of Oakland that is destined for the Bay Area, having warehouses and distribution centers closer to the Port has advantages in terms of the potential to reduce truck vehicle miles traveled (VMT) on I-880, I-238, and I-580. Further, having more local warehousing space for transloading could make the Port of Oakland a more attractive import port and increase business. Increased business at the Port will support regional goals related to job diversification opportunities. The reclamation of the Oakland Army Base through the Outer Harbor Intermodal Terminal (OHIT) project will provide additional warehouses adjacent to the Port. Other strategies include terminal development and modernization, deepwater channel dredging and maintenance.

3.2 The I-80 Corridor

I-80 is a major interregional freight corridor connecting the Bay Area to Sacramento and northern U.S. states. I-80 also performs functions as an intraregional corridor in Solano, Alameda and Contra Costa Counties, as well as along the San Francisco-Oakland Bay Bridge.

1. **Segment 1.** The portion from the northern boundary of Solano County approaching the Carquinez Bridge. This portion has lower overall traffic volumes as it serves less populated areas, but heavy truck volumes are relatively high in many locations because this segment performs important interregional functions providing connections to Sacramento and beyond.

[22] http://www.onebayarea.org/plan-bay-area/final-plan-bay-area.html.

[23] San Francisco Bay Area Freight Mobility Study, Caltrans, 2014.

2. **Segment 2.** The portion between the San Francisco Bay Bridge and the Carquinez Bridge. This section of the corridor has three mixed flow lanes between the Carquinez Bridge and I-580 and five mixed flow lanes between I-580 and Power Street in Emeryville. This portion of the I-80 corridor is the busiest segment although truck volumes are generally not that high, except for the segment moving through Berkeley.

3. **Segment 3.** The Bay Bridge portion of this corridor provides important intraregional transbay linkages with U.S. 101.

Other freight infrastructure located along the corridor includes the following:

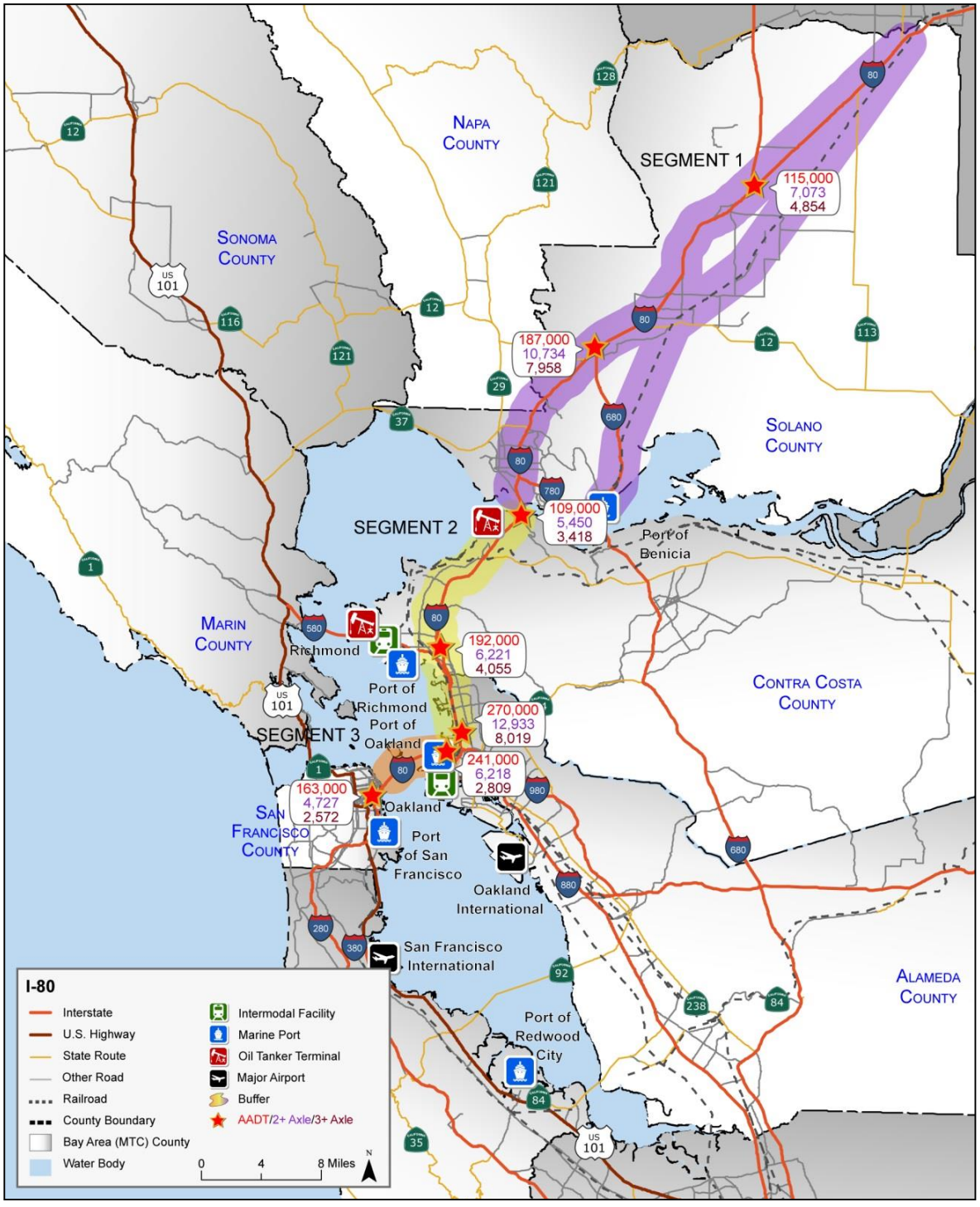
- **The UP rail connections along the Martinez Subdivision.**[24] Note that the BNSF Subdivision to Stockton is not included as part of the I-80, but rather is included in the SR 4 Corridor, as it better follows that alignment.

- In addition, the **Shore marine oil terminal at Carquinez, the Valero marine oil terminal at Benicia, and the Tesoro marine oil terminals in Martinez** also rely on the I-80 corridor for distribution of petroleum products. The I-80 interstate highway contains several different segments as shown in Figure 3.4, each with distinct truck flow patterns.

Other corridor elements include the Port of Benicia (discussed in more detail in Section 3.5), Travis Air Force Base, Cordelia Truck Scales as well as the interchange at I-80/I-680/SR 12 is a major interchange that is undergoing significant improvements as discussed in this section.

[24] UP Martinez Subdivision is UP's mainline track running from Richmond north to Roseville.

Figure 3.4 I-80 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.2.1 Current Freight Flows and Future Trends

I-80, as an interregional corridor, is especially important because interregional freight movements represent a higher share of commodity value movements in the Bay Area than any other movements. Trucks will continue to serve the majority of demand for interregional freight movement in the I-80 corridor, but international intermodal rail cargo is expected to experience high levels of growth associated with imports leaving the Port of Oakland by rail for destinations in the interior U.S. UP also expects domestic intermodal shipments and auto trains to increase train volumes on this route. Solano County also has a number of industrial shippers that would like to increase their rail freight movements over the next 10 years. Passenger rail service, largely dominated by the Capitol Corridor service, is close to capacity in terms of passenger slots along the corridor.

While most of the focus in recent years on the Central Corridor has been on growth in international intermodal rail traffic on the Martinez Subdivision (from Oakland to Richmond via Martinez) and potential passenger rail conflicts with expanded services on the Capitol Corridor and the Amtrak San Joaquin service, more recently there has been growth in movement of crude oil from Canada into the region's oil refineries along the northern Contra Costa waterfront and Benicia. This shift in crude oil movement has created a new source of growth in rail traffic on the Martinez Subdivision, and is impacting the lesser used UP Tracy (between Martinez and Tracy) and BNSF Stockton (Richmond to Fresno) Subdivisions.

Traffic flows on I-80 vary significantly by highway segment, ranging from about 100,000 daily vehicles in 2012 in the northern portion of Solano County to 270,000 daily vehicles in Emeryville, with trucks (2+ axles) making up between three to seven percent of total traffic. Truck volumes are highest along Segment 2 of the corridor, from Emeryville to Richmond, where there are locations with more than 12,000 trucks daily. The truck volumes drop after crossing the Carquinez Bridge, but pick up again near I-680 to almost 11,000 trucks daily. Because of the congruence of traffic, the I-80/I-680/SR 12 interchange is an important interchange. The truck scales at Cordelia in the vicinity of this interchange also experience a high level of use. Beyond Fairfield, the truck traffic volumes are relatively steady, comprised primarily of interregional traffic to/from Sacramento and the interior U.S. Trucks traveling along the corridor are made up of almost exclusively heavy trucks with 5+ axles, indicating the long-haul (interregional) nature of the truck trips.

Freight train volumes on the UP Martinez Subdivision average around 18 to daily trains currently, the highest in the Bay Area, as this is the portion that carries traffic into/away from the Port of Oakland. Passenger trains on the same line vary between 34 to 42 trains daily. Combined, the

Martinez Subdivision has between 60 to 64 trains running through it daily.[25] In 2025, overall freight rail demand is anticipated to grow, thereby, exacerbating existing issues and conflicts. Train volumes will increase further on the UP Martinez Subdivision, making it the largest bottleneck on the freight rail system in the Bay Area.

3.2.2 Major Existing Bottlenecks

As a major regional and interregional route for both freight and commuters, I-80 has not only major bottlenecks, but also faces operational difficulties created by high volumes of mixed traffic. Specifically, I-80 has high levels of truck delay between the Bay Bridge and Albany, but mostly because this is one of the most congested commuter corridors. I-80 westbound at University Avenue is the worst delay hotspot on the corridor, according to the Performance Measurement System (PeMS) analysis conducted in the *San Francisco Bay Area Freight Mobility Study*. In addition, Table 3.2shows the other major bottlenecks on I-80.

In terms of rail, the 2013 *California State Rail Plan* has identified a major bottleneck on the UP Martinez Subdivision between the Port of Oakland and Martinez. This is the busiest rail segment in Northern California with UP and BNSF traffic and the Amtrak San Joaquin and Capitol Corridor. The projections in the *California State Rail Plan* suggest that there will be a need for increased track capacity along this segment of the Martinez Subdivision in order to meet future demand for both freight and passenger services.

There also are concerns about grade crossings and impacts on communities. A number of crossings in the Martinez Subdivision are noted as locations with high potential for accidents at crossings. Looking at the data for rail traffic growth, the Martinez Subdivision will have the greatest rail traffic volumes. When the traffic splits between the BNSF TRANSCON line at Richmond, and the UP Martinez going north, this becomes less of an issue as it moves away from population centers. Another potential issue on this corridor is growth in traffic and demand for oil trains coming to the oil refineries in Contra Costa and Solano County. The *Draft Task 3 Technical Memorandum (Demand for Freight Rail in Solano)* prepared by Menzies and McCrossan as part of the Solano Rail Facilities Plan Update (May 2014) states that as of May 2014, there was no crude by rail in traveling through Solano County on the Martinez Subdivision and that plans to bring crude by rail to the Valero Refinery in Benicia would be transporting crude from Canada not from North Dakota's Bakken fields. This is significant because the Bakken crude is more volatile and has been involved in major explosions. Safety concerns have been raised by a number of communities in the Bay Area and there is likely to be continuing focus and regulatory action requiring greater transparency about what specific products are being transported and increased requirements for tanker car safety. For example, the Federal Railroad Administration did

[25] Sources: Freight train counts based on 2010 BNSF and 2008 UPRR train count data. Passenger train counts based on weekday published timetables for summer 2014.

recently publish new requirements for tank car construction and safety and has been examining regulations on the speeds at which trains carrying crude can move through communities. It should also be noted that the Class I railroads carry a substantial amount of hazardous materials and are already subject to safety regulation of these movements. In general, railroad safety records have been very good with regard to hazardous materials transport and both Class I railroads continue to work with emergency response units at the local level to ensure that these materials are transported in a manner that meets or exceeds regulatory standards.

3.2.3 Improvement Strategies

Improvement strategies on this corridor as outlined in various documents include relieving freight highway and rail bottlenecks (reducing delay), preserving highway infrastructure, improving and separating at-grade highway-rail crossings, as well as providing ITS strategies to improve interregional corridor freight system efficiency.

Freeway delay reduction strategies are not limited to expanding capacity, but also include comprehensive strategies that also can help reach other goals. For instance, the I-680/I-80/SR 12 interchange improvement project, a seven-phase project that just began construction, will relieve congestion, improve safety, and provide easier access. Further, right-of-way needs with in the corridor should be periodically reviewed, particularly in light of the projected growth in interregional truck traffic.

In addition to infrastructure improvements, ITS strategies should be adopted to get the most out of the overall transportation system to reduce delay, reduce nonrecurring congestion, and improve overall operations of the corridor. The Bay Area has made significant investments in a variety of ITS and operations improvements. Beyond the traditional field device deployments of detection, surveillance, and dynamic message signs (DMS) by Caltrans, MTC also has heavily invested in the Freeway Performance Initiative, including a large-scale ramp metering program, as well as building and maintaining the largest 511 traveler information system in the country. There currently are several projects planned that will implement Integrated Corridor Management (ICM) strategies along I-80, including Adaptive Ramp Metering (ARM) and Active Traffic Management (ATM). At its heart, ATM strives to actively manage the system in real-time while leveraging advanced simulation models to project traffic conditions into the future 20 minutes. By providing operators in a traffic management center (TMC), small tailored simulation traffic models with which they can project out in time the impacts of an incident, they can better manage the system by not only ensuring the correct first responding vehicles get to the scene, but they can provide better traveling information to the public as well.

Strategies to help relieve rail bottlenecks can include rail track addition and improvement, signal improvement, , additional tracks and connectors, adding or lengthening sidings, and positive train control. Improvements on both freight-only lines and shared-used corridors will benefit

freight movement as well as passenger movement. Future growth in freight and passenger rail volumes will place additional trains on rail lines, creating delays and increased safety concerns at at-grade rail crossings. Strategies to improve safety and reduce delays at these locations can range from grade separations, consolidations of crossings, and improved signalization along all routes, especially those with the highest risk for accidents and delay.

3.3 The I-580 Corridor

I-580 corridor is the most heavily used interregional truck corridor in the Bay Area, and connects with I-205 to distribution warehouses in Tracy (south San Joaquin County) that serve the Bay Area and is the primary route for agriculture exporters in the San Joaquin Valley. The I-580 highway corridor, shown in Figure 3.4 comprises three segments based on their traffic characteristics:

1. **Segment 1.** This segment begins at the Alameda County line at the I-580/I-205 interchange, and ends at the I-880/I-238 interchange. This is the main segment of I-580 that is heavily traversed by trucks.

2. **Segment 2.** This segment begins at the I-880/I-238 interchange and ends at the interchange with I-80 in Emeryville. This contains the truck-restricted portion of I-580 from the border of San Leandro to the Grand Avenue exit in Oakland.

3. **Segment 3.** This segment contains the shared segment with I-80 from Emeryville to Albany, and the portion that continues on to Richmond, including the Richmond-San Rafael Bridge, and ending at its junction with U.S. 101 in San Rafael. The segment facilitates the movement of trucks between North Bay and East Bay and is a preferred route to movements through San Francisco.

In addition to the highway corridor, this route also contains the following freight infrastructure:

- **UP Oakland Subdivision rail line from Niles junction to Stockton**, supporting movement of international cargo, though this line is not used extensively for freight transport.

- **The M 580 Marine Highway** between the Ports of Oakland and Stockton provided an interregional alternative to ship via barge particular bulk goods that would otherwise travel by highway or rail. While this service is currently suspended pending additional funding, the pilot demonstrated the operational feasibility of the service. Attracting sustainable levels of customers is an ongoing challenge for alternative modes particularly when goods must be transferred from one mode to another on each end of a short haul movement. This adds cost to the overall movement and with short hauls there is not sufficient distance over which to spread these higher fixed costs.

- **The Port of Richmond** is an important element along this corridor. A deepwater seaport with channel depth of 38 feet, it is California's third largest port in terms of annual tonnage, handling more than 19 million short tons of cargo. Currently, the Port ranks at the top in liquid bulk and automobile tonnage among the ports in the San Francisco Bay. The main exports include scrap metal, coke, coal, aggregate, zinc, and lead; and the main imports include petroleum, bauxite, magnetite, vegetable oils, and vehicles. The Port is owned by the City of Richmond and is governed by the State Tidelands Trust.[26] I-580 passes through the port area, which connects with I-80 and U.S. 101. The Port of Richmond is served by UP and BNSF.[27]

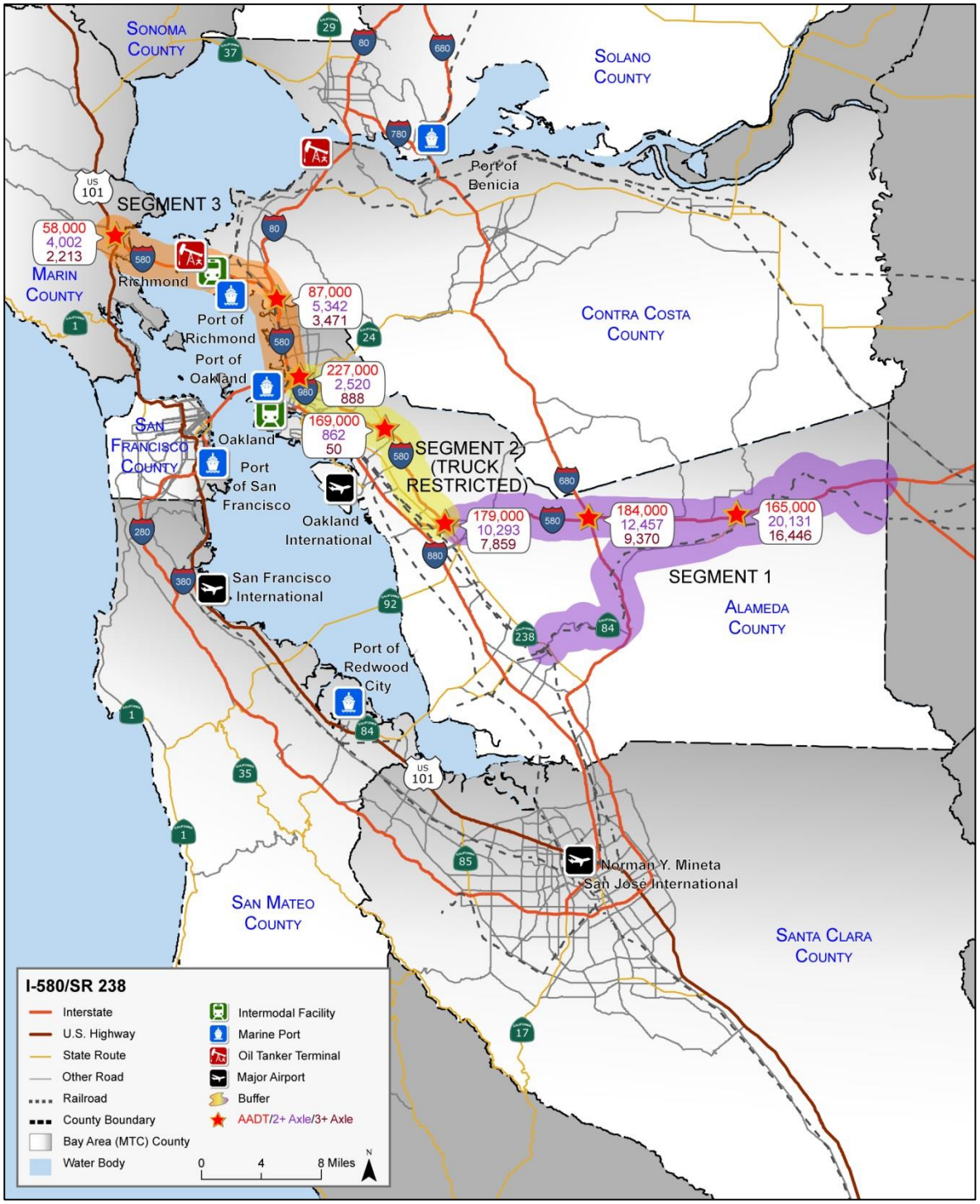
- **The Richmond Pacific Railroad (RPRC)**, a subsidiary of Levin-Richmond Terminal Corporation, is located at the Port of Richmond, providing switching services of dry-bulk cargo for UP and BNSF.

- **The BNSF Richmond rail classification yard** also is located near the Port of Richmond. Prior to the construction of BNSF OIG intermodal terminal, this rail yard played the role of an intermodal terminal, and for a while also supported the BNSF OIG facility. However, due to consolidation of intermodal facilities in Northern California by BNSF, the Richmond rail yard is now limited to automobiles imported through Point Potrero Marine Terminal of the Port of Richmond and carload traffic.

[26] Caltrans District 4 Fact Sheet on Port of Richmond, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

[27] http://www.ci.richmond.ca.us/index.aspx?NID=323 (last retrieved on October 15, 2013).

Figure 3.5 I-580 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.3.1 Current Freight Flows and Future Trends

The continued relocation of distribution facilities outside of the Bay Area to regions such as the San Joaquin Valley, and the flow of products from these distribution facilities to the Bay Area by truck will continue to put pressure on already congested I-580. In the case of imported products destined for Bay Area consumers, distribution from San Joaquin Valley centers means that there is both a truck move to the distribution centers from the Port of Oakland, as well as a second truck move back into the region for distribution, thus putting additional traffic and pressure on I-580 corridor. Figure 3.5 shows that the traffic on I-580 is highest in major population centers such as Oakland and Dublin/Pleasanton. However, truck volumes are significantly higher on I-580 East (Segment 1), where truck volume (2+ axles) can go as high as 20,000 a day, and heavy trucks (5+ axles) comprise the vast majority of those truck trips. The number of trucks between Emeryville and San Rafael is significantly less in comparison, with only about 5,000 trucks per day.

In the future, the Port of Richmond will see growth of petroleum and petroleum product imports and exports but growth will be at a slower rate than in the past as the U.S. markets continue to emphasize energy efficiency and alternative fuels. Automobile imports will continue to represent a strong market also but will grow more slowly as compared to their historic rates of growth. The Port of Richmond would need to expand beyond its current facilities to accommodate higher levels of growth in the automobile import and export markets.

3.3.2 Major Existing Bottlenecks

The I-580 Corridor carries the greatest volume of interregional truck traffic as this is the primary east-west access route to the Central Valley and beyond. Expansion of export cargoes, particularly agricultural products from the Central Valley, along with the growth in distribution of imports from inland warehouses, will continue to strain capacity on I-580. I-580 highway corridor has the worst areas of high-truck delay in the region, directionally, depending on the time of day. I-580 eastbound at El Charro Road and I-580 westbound at SR 84 have the worst truck delays in the Bay Area, with average daily total truck hours of delay of 155 hours and 134 hours, respectively.[28] Table 3.2 also shows these key bottleneck locations. In terms of rail, the 2013 California State Rail Plan has identified bottlenecks between Elmhurst (near Union City) and Newark on the UP mainline, where the Oakland Subdivision (Melrose to Niles Junction) connects with the Coast Subdivision.

[28] San Francisco Bay Area Freight Mobility Study, Caltrans, 2014.

3.3.3 Improvement Strategies

Strategies to improve I-580 are similar to that of I-80, and include ITS improvements, freeway capacity improvements, and ramp-metering. Because of the limited number of options for making interregional connections in the Bay Area, several new alternatives have been discussed over the years. These include short-haul rail connections, and the M 580 Marine Highway mentioned earlier, recently began operations to create a shipping connection between the Port of Stockton and the Port of Oakland. This service, when fully operational, could remove trucks from the I-580 corridor and help address the growing congestion and truck traffic issues in this interregional corridor. Another future interregional highway connection could involve changes in the alignment and expansion of SR 152 between Santa Clara County and the Central Valley (discussed in Section 3.7).

On the Niles Subdivision, UP also has proposed adding a double mainline track and upgrading sidings in a number of locations and upgrading the old Niles Canyon Railroad to potentially separate freight and passenger traffic through this section. Since these improvements would allow potential growth in ACE traffic in the corridor, these improvements could involve public-private partnerships if they are determined to be necessary.

3.4 The U.S. 101 Corridor

U.S. 101 is the main north-south corridor on the peninsula for distribution of products to the major population centers in Santa Clara, San Mateo, and San Francisco Counties in the South Bay and Peninsula, as well as the only north-south connector in the North Bay serving Marin and Sonoma Counties. Through connections with SR 37/I-680/I-580, U.S. 101 also is part of an intraregional network that connects to the interregional system for agricultural producers in the North Bay and serves population centers in Sonoma and Marin Counties. As shown in Figure 3.4, the U.S. 101 corridor can be characterized in three segments based on its unique freight characteristics:

1. **Segment 1.** The portion from Santa Clara County to San Francisco where it ends. This part is heavily used by trucks. This portion of U.S. 101 is the main access route to SFO from the North and South Bay. It serves as a major gateway route between San Francisco and Silicon Valley, as well as providing access to SJC in the southern end of the corridor. It links with the East Bay via the Dumbarton Bridge, the San Mateo Bridge (SR 92), and the Bay Bridge (I-80) in San Francisco; and it provides access to the Port of Redwood City.

2. **Segment 2.** The portion through San Francisco (the route temporarily turns into Van Ness Avenue), and crosses the Golden Gate Bridge to go to Marin County. This segment has low truck traffic because trucks generally prefer to bypass the City of San Francisco due to urban congestion.

3. **Segment 3.** The northern portion that is in Marin County that begins when I-580 ends and goes up to Sonoma County. This portion of the corridor is the only continuous north-south highway west of the Coast Range in Northern California. The corridor serves as the primary freight route through Marin and Sonoma Counties, providing access to other Bay Area goods movement corridors via I-580 and Highway 37, and serving as a key access route to San Francisco and coastal Northern California.

In addition, the U.S. 101 corridor also connects to the East Bay via the four transbay bridges at various points along the corridor. These include, from north to south, the San Rafael Bridge (I-580), the Bay Bridge (I-80), the San Mateo Bridge (SR 92), and the Dumbarton Bridge (SR 84).

Other elements that comprise the U.S. 101 corridor include:

- **The Port of San Francisco.** A deepwater port with a channel depth of 38 to 40 feet, it has the largest floating dry-dock dedicated to ship repair on the West Coast of the Americas. The Port is owned by the City of San Francisco and governed by a Port Commission. The main exports include tallow and vegetable oil; and the main imports include steel products, boats/ yachts, wind turbines, aggregate, and sand. I-80 and U.S. 101 are the nearest highways, and on-dock rail service is available to Pier 80.[29]

- **The San Francisco Bay Railroad (SFBR)** is an independently owned and operated Class 3 short line railroad that serves the City and the Port of San Francisco. SFBR interchanges cargo with UP.

- **The Port of Redwood City.** A deepwater port with mean low-water depth of 30 feet. It is located in San Mateo County in South San Francisco Bay between the Dumbarton Bridge and the San Mateo – Hayward Bridge. The Port is owned by Redwood City and is self-supporting. It handles mostly dry-bulk, neo-bulk, and liquid-bulk cargoes. Land uses mainly consist of handling, processing, storage, and transportation of imported construction materials, scrap metal exports, construction debris for recycling, and chemicals. The Port is served by U.S. 101 and UP.[30]

- **The San Francisco International Airport (SFO).** SFO is an international air cargo trade gateway located at the north edge of San Mateo County on the west side of the Bay. The airport has four runways, and the longest runway is 11,870 feet long. Cargo service is

[29] Caltrans District 4 Fact Sheet on Port of San Francisco, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

[30] Caltrans District 4 Fact Sheet on Port of Redwood City, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

available from 56 airlines, including 7 cargo-only airlines. SFO's 11 cargo facilities provide more than 1,026,000 square feet of warehouse and office space, including newly added cargo facilities. In 2012, SFO captured 55 percent of the Bay Area air cargo market, including about 95 percent of the international market. Approximately 74 percent of cargo at SFO are carried on passenger aircraft (also known as belly cargo because it is carried in the "belly" of the passenger aircraft). More than 60 percent of that total are international cargo.[31] United Airlines is the largest carrier of international merchandise imports and the second largest carrier of exports. SFO is a major trade hub with Pacific Rim countries like South Korea, Japan, and Taiwan. U.S. 101 serves the airport and connects to I-280 via I-380 and to the East Bay via SR 92.[32]

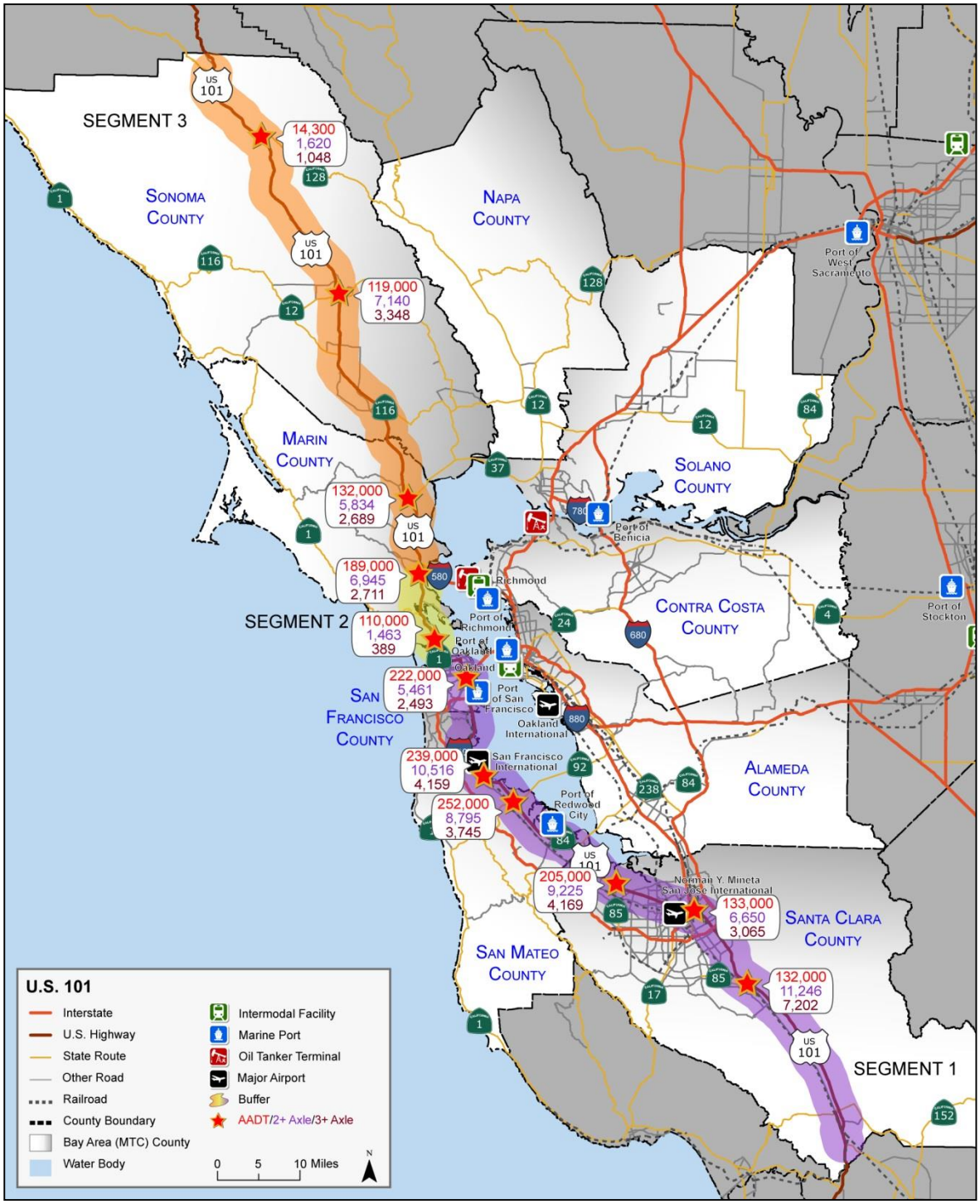
- **The Northwestern Pacific Rail (NWP).** In Marin and Sonoma Counties, construction is underway to develop the SMART passenger service on the legacy Northwestern Pacific (NWP) rail line that runs parallel to U.S. 101. The enabling legislation for the new service transferred ownership of a portion of the NWP line to SMART, specifically the segments running from Healdsburg south to Novato and then east in the SR 37 corridor to the interchange with the California Northern Railroad (CFNR) at Lombard in Napa. However, that same legislation also granted the freight authority that operates in the area an exclusive perpetual easement to operate freight rail on the SMART-owned tracks.[33] FRA approval to operate freight service was granted, and the line reopened in June, 2011, transporting primarily agricultural and timber products between Brazos (near American Canyon) and Windsor. The NWP connects with the California Northern Railway (CFNR) at Brazos, and the CFNR connects to UP at Suisun City, providing a link to the national rail network.

[31] Caltrans, California Air Cargo Groundside Needs Study, July 2013.

[32] Caltrans District 4 Fact Sheet on San Francisco International Airport, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

[33] Whitepaper Number 14: Freight Trains and Passenger Trains, Sonoma Marin Rail Transit Authority, July 2008.

Figure 3.6 U.S. 101 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.4.1 Current Freight Flows and Future Trends

Figure 3.6 shows the existing traffic volumes on U.S. 101, indicating that the total traffic volumes are highest around major population centers of San Jose, San Mateo, and Mountain View, Millbrae and San Francisco. Truck traffic (2+ axles) forms between 1 percent to about 17 percent of total traffic, with the highest percentage observed in Sonoma County. The highest truck counts occurred in San Jose, with more than 7,000 trucks per day. The numbers gradually decreased going north, with some higher volumes on the peninsula, particularly closer to the industrial areas in South San Francisco and SFO. The low-truck volumes of 1,500 trucks a day through San Francisco increases to about 7,000 trucks a day once it meets with I-580 in Marin County. Looking at the distribution of truck-axle counts, heavy trucks make up a significant percentage of total truck traffic near San Jose, however, in the vicinity of SFO, the trucks used in these areas include relatively modest volumes of tractor-trailer and higher volumes of smaller trucks. According to the MTC truck model, in the future, truck volumes will increase significantly along U.S. 101 in South Bay, almost doubling its existing truck volume in 2040. However, the growth is more modest going north towards San Francisco and up to Marin and Sonoma Counties. Driving the growth are primarily local population demands especially in the South Bay, and agricultural product demand in the North Bay and Central Coast.

In addition, the forecast growth of air cargo at SFO may significantly impact truck volumes on U.S. 101 in the future. Air cargo volumes at SFO are forecast to increase from 380,790 metric tons in 2012 to 971,900 metric tons by 2040, with a CAGR of 3.4 percent,[34] led by faster international air cargo growth due to the shift to higher value goods.

3.4.2 Major Existing Bottlenecks

U.S. 101 has lower truck volumes than I-880 because it does not serve a major seaport, and it does not directly connect to a major interregional corridor like I-880. However, as the only major north-south route connecting San Francisco to the South and North Bay, there is significant truck and commuter traffic on the route due to lack of alternatives. There are a number of bottlenecks along U.S. 101 that have relatively high levels of truck delay, including (see Table xx):

- Between Brokaw Road and Bowers Avenue in Santa Clara County;
- Between Broadway and Poplar Avenue in San Mateo County;
- Between Poplar Avenue and 3rd Avenue in San Mateo County;

[34] Air Cargo Mode Choice and Demand Study, 2010, http://www.dot.ca.gov/hq/tpp/offices/ogm/key_reports_files/Air_Cargo_Mode_Choice_&_Demand_Study_080210.pdf#zoom=65.

- Interchange with Hillsdale Boulevard in San Mateo County; and
- Between East Washington Street and Kastania Road in Sonoma County.

The Port of San Francisco experiences constraints on landside access that have made drayage of containerized consumer goods from the port uneconomic and politically unacceptable.[35] Nevertheless, the Port has committed to rejuvenate its industrial profile as an import center for bulk/neo-bulk industrial functions.[36] The Port of San Francisco is seeking to improve its rail-handling capability to accommodate future cargo growth, including automobiles. Currently, there is inadequate rail infrastructure serving the Port for such cargo, including low-rail tunnel clearance on the UP Peninsula line just south of its cargo terminals. The Port also has become a major transfer site for construction waste from the many large construction projects in the City of San Francisco. This waste is hauled by rail, so the rail access improvements that are planned also will help the movement of this cargo type.

The Port of Redwood City has seen growth as a niche port for bulk commodities, such as construction materials, including aggregate. Projected growth in these materials over the next 25 years will place strain on existing facilities unless bulk terminal capacity is increased.

3.4.3 Improvement Strategies

The CSMP for U.S. 101 South and U.S. 101 North recommended a multipronged approach to solving congestion problems along the corridor to ensure preservation and maintenance of freeway infrastructure, and encourage alternative modes of traveling. At the core of such an approach is the use of ITS. Other strategies include advanced ramp metering, widening, interchange improvements, addition of auxiliary lanes, and implementing a Smart Corridor Plan. Many projects already are completed or underway, with others planned projects included in *Plan Bay Area*.

In addition to managing the main corridor, access to SFO, Port of San Francisco and Port of Redwood City are important. Currently, the Quint Street Lead Port Rail Access Project will relocate and improve a one-mile spur connecting Caltrain mainline track to Port of San Francisco's railyard. This will benefit the industries served by the rail line and improve access to

[35] "SF Bay Area Containerized Cargo Outlook," prepared by the Tioga Group for the San Francisco Bay Conservation and Development Commission, July 2009, http://www.bcdc.ca.gov/proposed_reg/07-31-2009_containercargo.pdf.

[36] Port of San Francisco Strategic Plan, http://www.sfport.com/ftp/uploadedfiles/about_us/divisions/finance_admin/PortStrategicPlan.pdf.

the Port. There also are several projects related to Port of Redwood City that include channel deepening and wharf improvements.[37]

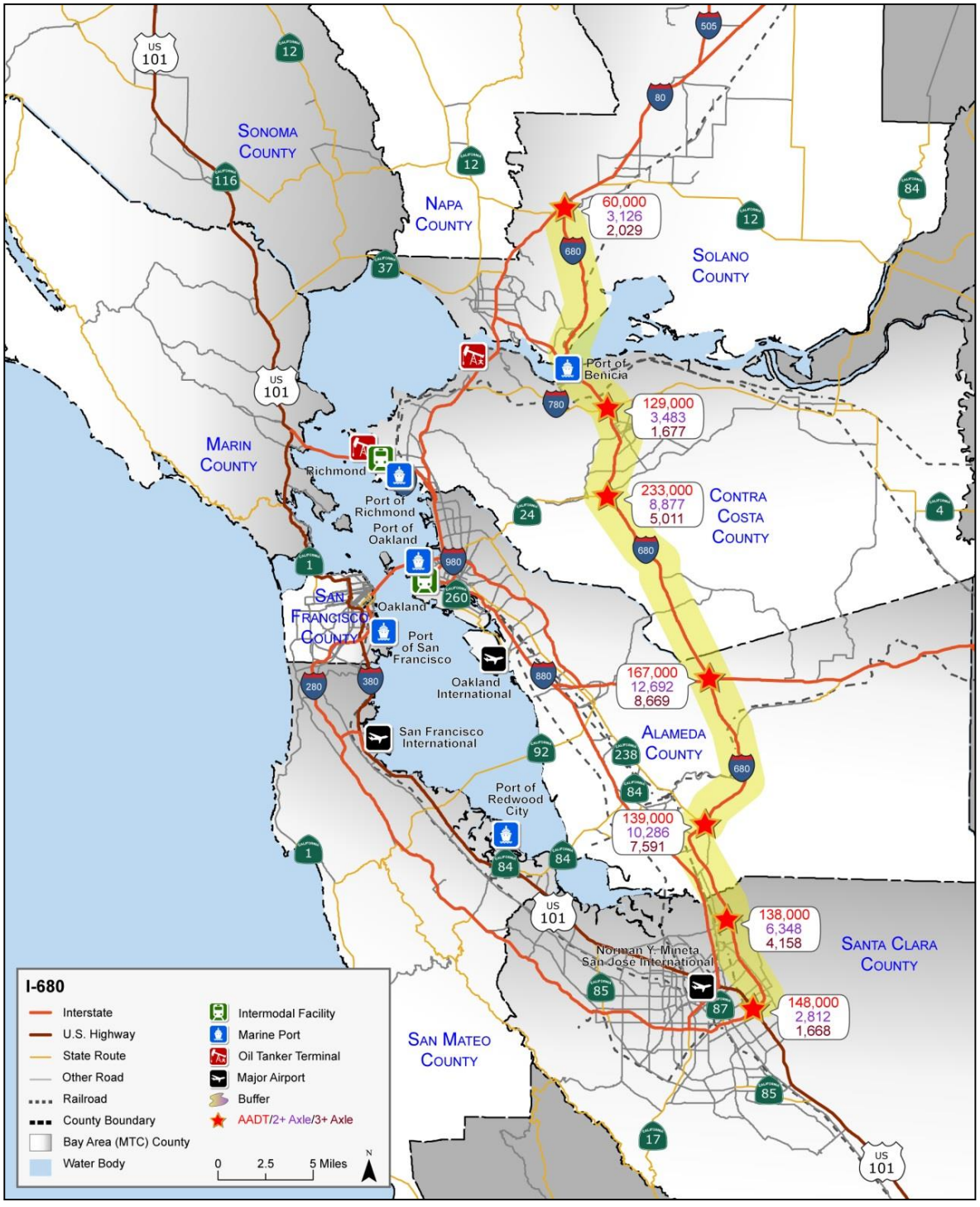
3.5 The I-680 Corridor

The I-680 Corridor is an important intraregional corridor that provides north-south connection of I-80 to the East Bay (Figure 3.7). The corridor also connects the wine regions of the North Bay to the Central Valley via connections with I-580. The corridor bypasses cities along East Bay such as Oakland, while serving more inland locations such as Pleasanton. In addition, the Port of Benicia can be accessed via I-680 and I-80, as well as on-dock rail provided by UP. The Port of Benicia is a deepwater seaport with a channel depth of 38 feet. The Benicia Industrial Park lies to the northeast of the residential areas of the City and includes the Valero oil refinery. The main exports are Valero's petroleum coke and the main imports are automobiles. The Port of Benicia is privately owned and operated by APS West Coast, Inc. AMPORTS, a leader in the vehicle-processing industry, operates the terminal facilities at Benicia. CODA Automotive, Inc. began assembly of all-electric cars on March 13, 2012, creating 50 new jobs at the AMPORTS facility.[38]

[37] San Francisco Bay Area Freight Mobility Study, Caltrans, 2014.

[38] Caltrans District 4 Fact Sheet on Port of Benicia, available at: http://www.dot.ca.gov/hq/tpp/offices/ogm/fact_sheets_index.html (last retrieved on October 15, 2013).

Figure 3.7 I-680 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.5.1 Current Freight Flows and Future Trends

Though I-680 is a major intraregional corridor, it also performs interregional and global gateway functions, and as such, its future demand is tied to the local and domestic market, as well as the export and imports around Ports of Oakland and Benicia. Figure 3.7 shows that for 2012, total traffic volumes on I-680 are highest around the population centers of Walnut Creek, with more than 230,000 daily vehicles. Truck (3+-axle) volumes, on the other hand, are highest (around 8,000 trucks daily) near Pleasanton and Fremont, where there are clusters of industrial activity, as well as connections to I-580. The vast majority of the truck traffic is made up of heavy trucks (5+ axles). It is anticipated that, at least in Solano County, heavy truck traffic on I-680 will increase between 18 to 25 percent over the next 20 years.[39]

3.5.2 Major Existing Bottlenecks

With anticipated increases in demand, I-680 should see growth in truck traffic, and with it, continued conflicts between trucks and automobiles. Heavy materials such as automobiles, waste/scrap, sand, and nonmetallic minerals that move by truck may contribute to pavement deterioration issues. With increased manufacturing activity in South Bay (such as the Tesla plant in Fremont), the changing traffic patterns and future needs on I-680 should be closely monitored. For the Solano County portion of I-680, the key corridor issues included mobility and congestion, defective ramp detectors, and lack of right-of-way availability.[40]

3.5.3 Improvement Strategies

Improvements to the I-680 corridor include delay reductions and access improvements that can reduce congestion and improve mobility. Projects such as auxiliary lane additions, widening, ramp metering, and ITS technologies, as well as interchange improvements, already are planned and programed within *Plan Bay Area*. In addition, as mentioned before, the I-80/I-680/SR 12 interchange improvement project will relive congestion, improve safety, and provide easier access.

One study underway that can potentially affect traffic on I-680 is the Tri-Link project, which includes construction of a new SR 239 as a potential multimodal link between SR 4 near Brentwood and I-205 west of Tracy in San Joaquin County. If this project were to be approved and constructed, it would provide an alternative linkage between Central Valley and North Bay,

[39] http://www.dot.ca.gov/dist4/systemplanning/docs/tcr/I_680_Solano_TCR_FINAL_10-21-13.pdf.

[40] http://www.dot.ca.gov/dist4/systemplanning/docs/tcr/I_680_Solano_TCR_FINAL_10-21-13.pdf.

as well as portions to northern Contra Costa County, thus, potentially reducing truck traffic on I-680.[41]

3.6 The SR 12 and SR 37 Corridors

The SR 12 Corridor is an east-west, mostly rural route that connects the North Bay to San Joaquin Valley. This two- to four-lane route is used to transport agricultural products from the Napa Valley, Solano County, and the Delta region. It consists mainly of two segments, as shown in Figure 3.8:

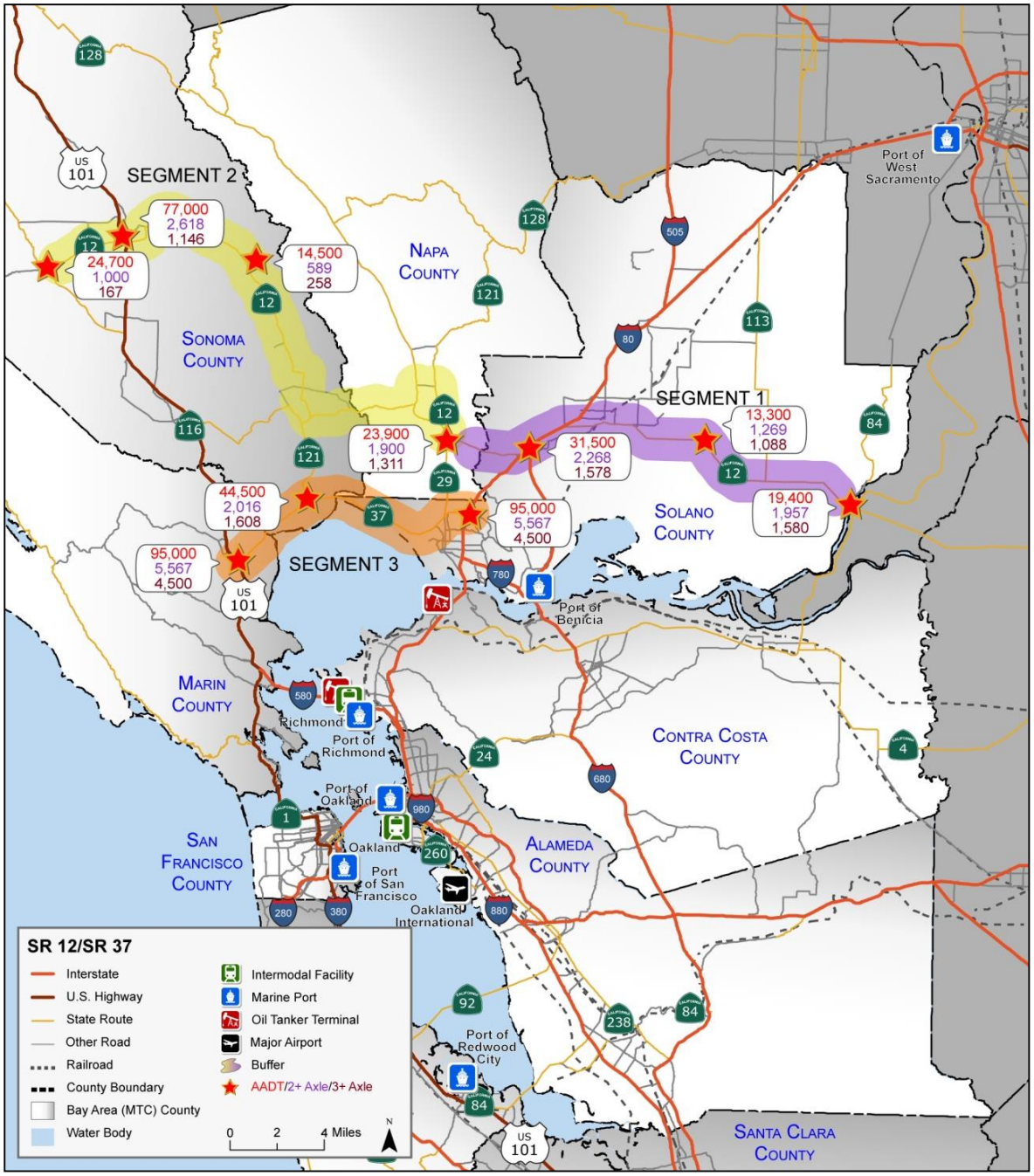
1. **Segment 1.** This segment begins at the Solano/Sacramento county line and ends at SR 29. This portion is a main interregional and intraregional corridor that is used for commuting and truck movement and will be the focus of discussion.

2. **Segment 2.** This segment begins at the junction with SR 29 and ends at the junction with SR 116. This portion of SR 12 has very light truck traffic.

SR 37 is a secondary east-west route with busy commuter traffic that provides connections to U.S. 101, west of I-80. Because this portion serves the same areas and industries as Segment 1 of SR 12 (and is in fact more frequently used by trucks), the two corridors are discussed together.

[41] http://trilink239.org/about/about-the-project/.

Figure 3.8 SR 12 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.6.1 Current Freight Flows and Future Trends

As Figure 3.8 shows, total traffic volumes on SR 12 in 2012 was highest around Santa Rosa in Sonoma County, though the traffic volumes are much more moderate when compared to other goods movement corridors such as I-880. However, truck (2+) volumes on SR 12 represent a

significant share of total traffic, making up more than 10 percent of total traffic in several locations in Solano County. In Sonoma County, the trucks are a mix of smaller 2-axle, and large 5-axle trucks. As the traffic meets U.S. 101, however, significant volumes of heavy (5+) axles trucks are gained, serving the farming communities around the region. Though currently not a major interregional goods movement corridor, SR 12 has potential to become one because of its direct access to San Joaquin Valley.

SR 37 has the highest truck traffic at the intersections with U.S. 101 and I-80, where the 2+ truck volumes average more than 5,000 per day. In addition, it also has significantly higher overall traffic than SR 12. On the corridor, about 2,000 trucks move along daily, higher than what moves on SR 12 in most locations. This indicates that SR 37 is perhaps a more important corridor for goods movement than SR 12.

3.6.2 Issues and Improvement Strategies

Some of the major issues faced by SR 12 currently include congestion during peak commute times, environmental and climate change concerns as well as infrastructure and operational constraints imposed by river bridges (especially the Rio Vista Bridge). The top congested locations along SR 12 are at the intersections with SR 29, North Kelly Road, Red Top Road and Pennsylvania Avenue, as well the segment from SR 29 to I-80. Because of these needs, and the potential of SR 12 to serve increasing levels of interregional traffic, an SR 12 Corridor Study (I-80 to I-5) was recently completed that looked at several improvement options for the corridor, which included operational improvements as well as lane widening. The study recommended operation and safety improvements along the entire corridor, including construction of a four-lane divided highway from the SR 12/SR 113 intersection to a location east of SR 160, replacement of Sacramento River and Mokehumne River bridges, and installation of ITS devices.[42]

Currently, the I-80/I-680/SR 12 interchange improvement project will benefit freight movement along SR 12 and is one of the most significant projects along the corridor. One other project, the Jameson Canyon project that calls for the widening of SR 12 from I-80 to SR 29,[43] also will directly address the bottleneck on the segment and is listed in *Plan Bay Area*.

SR 37, as a significant commuter corridor, has been mentioned by various stakeholders as been significantly congested during rush hours and other peak travel hours, creating reliability issue as well. Because of its proximity to the water, it also faces sea level rise threats.

[42] http://www.sta.ca.gov/Content/10055/CountywidePlansampStudies.html#80to5.

[43] http://www.dot.ca.gov/dist4/systemplanning/docs/csmp/SR-12_CSMP_Fulldocument.pdf.

3.7 The SR 152 Corridor

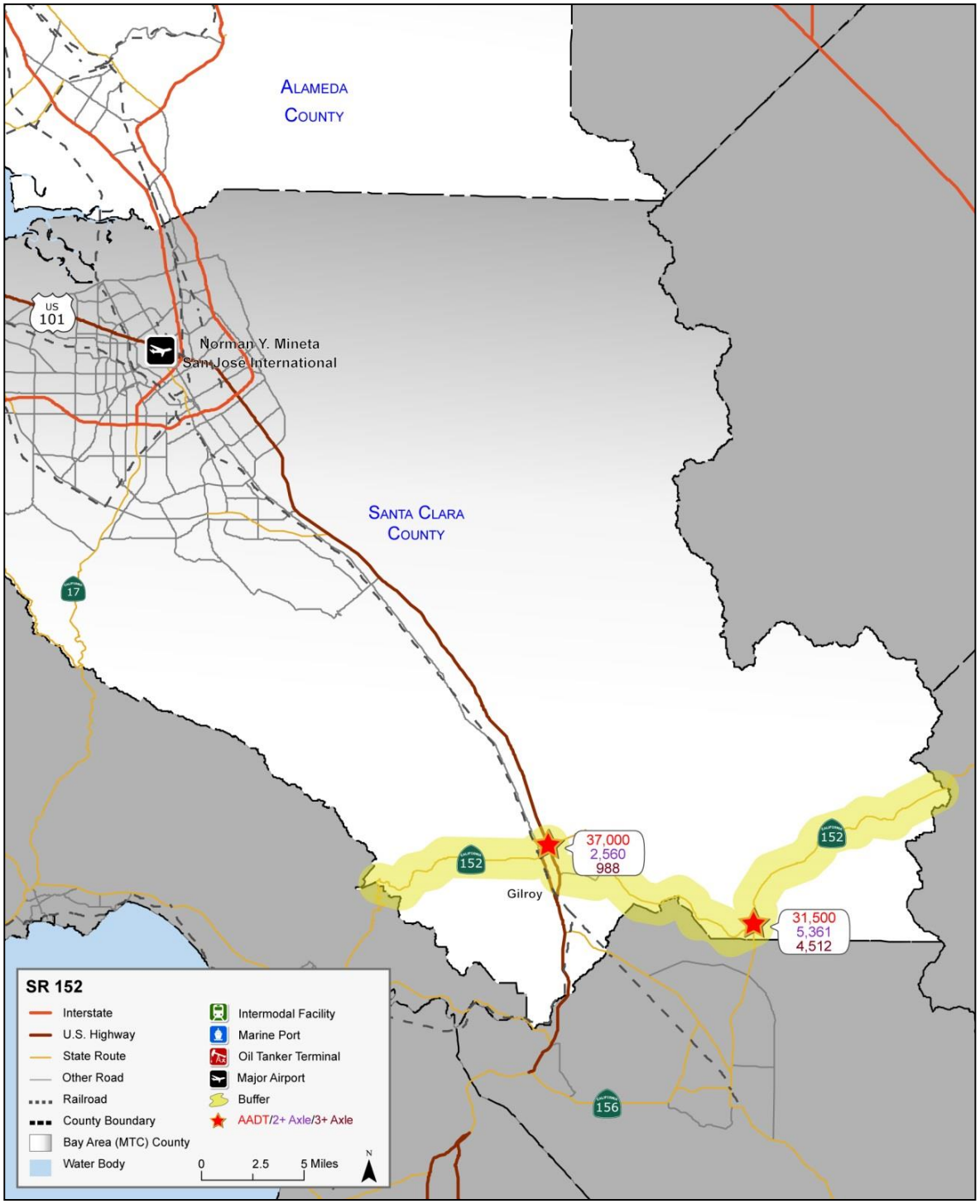
The SR 152 Corridor is a major east-west corridor for interregional traffic connecting the South Bay, North Central Coast, and Central Valley regions. Though only a relatively small portion of SR 152 is within the Bay Area (as shown on Figure 3.9), it offers an important connection to the Central Valley. The closest east-west routes traversable by trucks are I-580 and SR 46. Thus, SR 152 is a vital artery for connection to the San Joaquin Valley and Monterey Peninsula, and has the potential to become a major international trade highway corridor. Nearly 50 percent of the State's $36 billion in agricultural production take place in counties along and adjacent to the SR 152 corridor. SR 152 is the only continuous east-west route connecting SR 99 and U.S. 101, and provides a viable alternative to the heavily congested I-580/I-238/I-880 east-west corridor.[44]

Driven by the trend of integration of the Bay Area economy and that of neighboring regions in Northern California (including the agricultural regions of the Central Coast and the Central Valley), there is new emphasis on interregional goods movement corridors that link the various regions, which comprise the Northern California megaregion. Thus, because of its future importance, SR 152 has been designated as a Focus Route in Caltrans' Interregional Transportation Strategic Plan (ITSP).[45] Focus Routes are the highest priority for completion to minimum standards (usually expressway or freeway standards) in order to serve interregional trips and provide access to statewide gateways.

[44] Route 152 Trade Corridor Summary Report, VTA, 2013.

[45] http://www.dot.ca.gov/hq/tpp/offices/oasp/ITSP_document_11_25_2013_rev1.pdf#zoom=75.

Figure 3.9 SR 152 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.7.1 Current Freight Flows and Future Trends

The total traffic volume on SR 152 varies significantly, with very little traffic west of U.S. 101 (less than 5,000 vehicles per day to 37,000 vehicles daily near the intersection with U.S. 101. According to the Route 152 Corridor Study final report, by 2015, volumes along some portions of the whole SR 152 corridor are forecast to increase by over 40 percent, and nearly double by 2035.[46] Truck percentages on portions of SR 152 within Santa Clara County are highest at the junction with SR 156, with 4,512 trucks daily in 2012, making up almost 15 percent of total traffic. On a more interregional level, comparing the total number of trucks crossing the three east-west crossings of SR 152, SR 46, and I-580, 26 percent used SR 152, 10 percent used SR 46, and 64 percent used I-580 (west of the I-205 merge). Although I-580 carries the highest truck volumes, the portion of I-580 south of SR 132 carries similar truck volumes to SR 152, suggesting that Central Valley truck movements south of SR 132 are split evenly between these two routes (Figure 3.10). Truck volumes along the corridor are expected to increase in the future.[47]

[46] Route 152 Trade Corridor Summary Report, VTA, 2013.

[47] Ibid.

Figure 3.10 East-West Truck Crossings Percent Splits

Source: Route 152 Trade Corridor Summary Report, VTA, 2013.

3.7.2 Major Existing Bottlenecks

The Route 152 Corridor Study final report, completed in 2013, determined the major needs along the SR 152 corridor, including determining the location of bottlenecks.[48] Within the MTC study area, the 10-mile long, two-lane segment from east of Gilroy to the SR 156 interchange is a major bottleneck. And delays at the 21 signalized intersection in the Cities of Gilroy and Los Banos create bottlenecks to the free flow of traffic.

Traffic bottlenecks also create safety issues. Between 2003 and 2008, actual collision rates exceeded the statewide average between Gilroy and SR 156, at the U.S. 101, SR 156 interchanges. In addition, portions of the route exhibit poor connectivity with the adjoining state

[48]Route 152 Trade Corridor Summary Report, VTA, 2013.

highway system. West of the SR 152/SR 156 interchange, the route splits from a four-lane expressway type facility to the two-lane conventional highways of SR 152 and SR 156 before reaching U.S. 101. Rural, two-lane undivided highways are not capable of effectively moving the traffic we see today or expect in the future. The resulting congestion causes some traffic to divert onto local roads such as Ferguson Road. A continuous four-lane freeway or expressway type facility would significantly improve system connectivity throughout the corridor.

3.7.3 Improvement Strategies

As seen in the previous section, in order to address the bottleneck issues and develop SR 152 as an important east-west trade corridor, the roadway needs to be improved to freeway or expressway standards. SR 152 has potential to offer increased interregional benefits to agricultural traffic traversing the Bay Area between the Central Coast and the Central Valley. It also could provide an alternative route for distributing traffic from warehouses in the Central Valley to South Bay population centers.

It has thus been proposed that a new alignment be established between U.S. 101 and SR 156, which could include upgrading the alignment to a continuous four-lane facility, upgrading 12 miles of the route to freeway standards, and providing an alternative route for interregional traffic to potentially lessen the burden of carrying such traffic on Gilroy's local roadways.[49] Currently, this proposed project is included in *Plan Bay Area*.

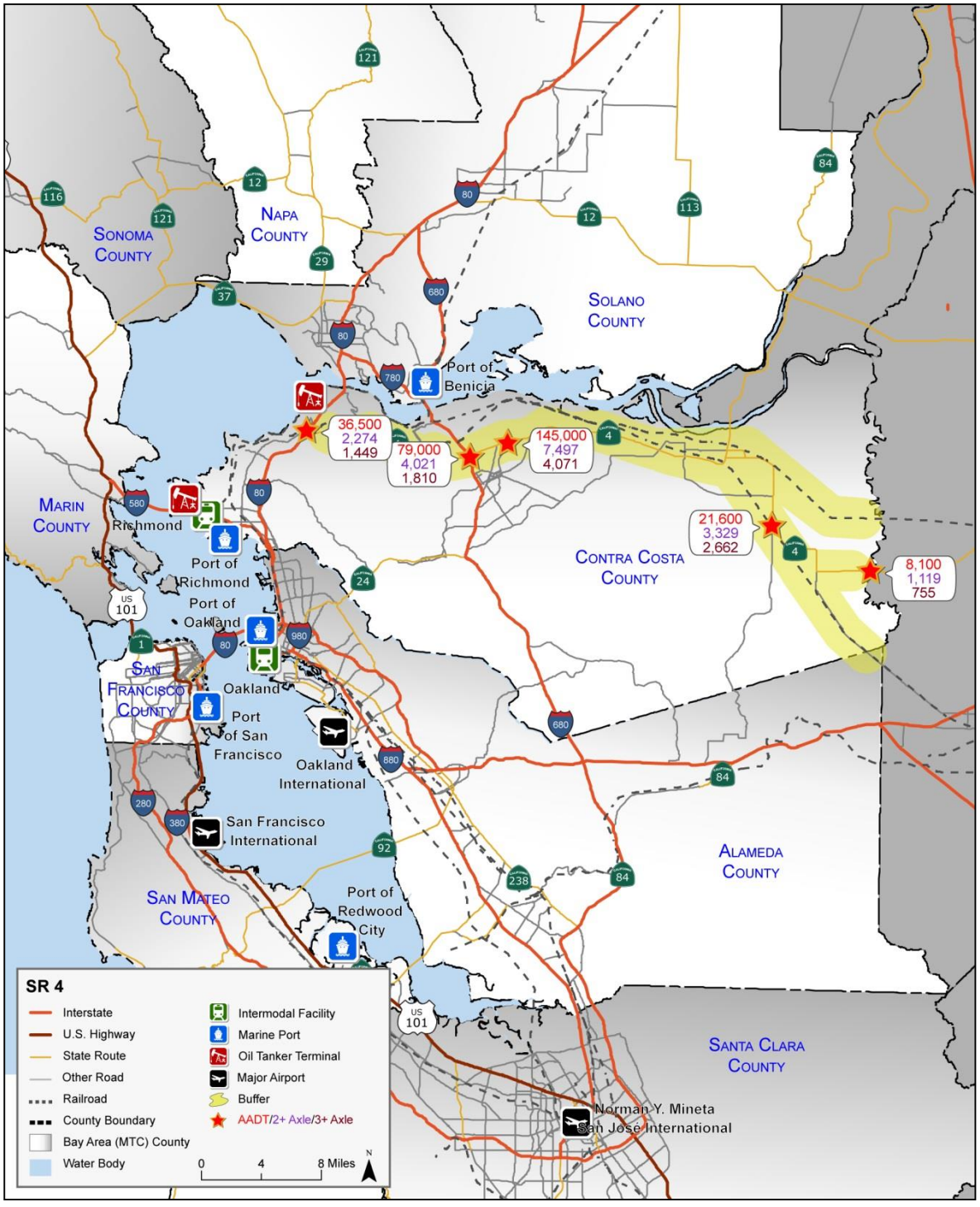
3.8 The SR 4 Corridor

The SR 4 Corridor is an east-west route providing intraregional and interregional travel between the Central Valley and Bay Area for commuter and commercial traffic. The SR 4 corridor serves local and intercity truck traffic for surrounding communities, and provides connections between the oil refineries and other industrial producers along the Contra Costa County Northern Waterfront with the rest of the intraregional network and customers in the Bay Area.

This corridor also includes the BNSF and UP rail lines from Stege/Port Chicago to Stockton, as well as the UP MOCOCO line from Martinez to Lathrop, following similar alignments to the SR 4 corridor, connecting the Bay Area to the rest of the nation.

[49] Route 152 Trade Corridor Summary Report, VTA, 2013.

Figure 3.11 SR 4 Corridor Map



Source: Caltrans Vehicle Classification Counts, 2012; GIS data from Cambridge Systematics.

3.8.1 Current Freight Flows and Future Trends

Figure 3.11 shows that total traffic volumes along SR 4 varies significantly, with the highest traffic observed around Port Chicago (more than 145,000 vehicles daily). Truck (3+ axles) traffic is highest at Port Chicago, with more than 4,000 trucks daily. While overall traffic decreases significantly moving east, truck traffic decreases slowly, thus making up 12 percent of total traffic around Byron Highway. The significant majority of the trucks on SR 4 comprises heavy (5+ axle) trucks. Because of its role in supporting the movement of refined petroleum products and other industrial products, its future growth in terms of truck traffic is closely correlated with these industries.

In terms of rail traffic, the BNSF line to Stockton runs around 10 freight trains and 8 passenger trains currently[50], which is expected to grow in the next 15 years. However, this line is unlikely to reach capacity.[51]

3.8.2 Major Existing Bottlenecks

According to the SR 4 CSMP[52], the top three most congested locations include Somersville Road to Loveridge Road (a.m.), Loveridge Road to Somersville Road (p.m.), and Willow Pass Road to Port Chicago Highway (a.m.). These same segments also are the key bottleneck locations. Most of the delays are due to insufficient capacity and merging activities, as well as a lack of corridor-wide traffic management.

3.8.3 Improvement Strategies

The CSMP lists corridor management strategies for the short and long term within the corridor. Strategies include deploying ITS technologies and capacity enhancements, such as interchanges. Currently in *Plan Bay Area*, several projects are planned that will improve the SR 4 corridor. The I-680/SR 4 interchange project, for instance, will eliminate weaving between I-680 and Pacheco Boulevard, thereby, reducing delay and improving safety. Other key projects that will benefit goods movement include constructing a freeway-to-freeway direction connection between SR 4 Bypass and SR 160, and widening the SR 4 Bypass from Laurel Road to San Creek Road.[53]

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[50] Sources: Freight train counts based on 2010 BNSF and 2008 UPRR train count data. Passenger train counts based on weekday published timetables for summer 2014.

[51] California Statewide Rail Plan, Caltrans, 2013.

[52] http://www.dot.ca.gov/dist4/systemplanning/docs/csmp/SR4_CSMP_CSMPSummay.pdf.

[53] Projects as seen in San Francisco Bay Area Freight Mobility Study, Caltrans, 2014.