Center for Community Innovation
INDUSTRIAL LAND AND JOBS STUDY FOR THE SAN FRANCISCO BAY AREA

ASSESSING THE IMPACTS OF CHANGES IN INDUSTRIAL EMPLOYMENT ON JOB QUALITY AND COMMUTER PATTERNS

Professor Karen Chapple
with Evelyne St.-Louis and Ángel Ross

Berkeley

Authors
Karen Chapple
with Evelyne St.-Louis **and** Ángel Ross

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Key Support
The authors gratefully acknowledge the assistance of Aksel Olsen and Cynthia Kroll from the Association of Bay Area Governments. We also thank Anastasia Yip for help designing and formatting the report. This research was funded by the California Department of Transportation via the University of California Transportation Center.

The Center for Community Innovation (CCI) at UC-Berkeley nurtures effective solutions that expand economic opportunity, diversify housing options, and strengthen connection to place.

Report prepared for the Association of Bay Area Governments/Metropolitan Transportation Commission

January 2017

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INTRODUCTION

The Regional Industrial Land and Jobs Study complements the 2015 MTC Goods Movement Needs Assessment with an analysis of the demand for and supply of industrially zoned land in the nine-county region, both now and in the future. This Technical Memo analyzes the economic and transportation impacts from future projected changes in industrial land and jobs across the nine-county Bay Area region.

OVERVIEW OF INDUSTRIAL JOB CHANGE FROM 2011-2040

There were 600,824 jobs in the Bay Area in 2011 in the industries that tend to concentrate on industrial land. Just 205,561 of these jobs were actually located on exclusive or mixed-use industrial land; the remaining jobs might be considered the latent demand for industrial land. Projecting out to 2040 —assuming existing patterns of distribution remain constant—a 24% increase in overall jobs is expected in the Bay Area, for a projected total of 747,301 jobs, 254,966 of which will be located on industrial parcels.

Zooming in from the county-level to the block group level (Figure A), we find that areas of growth are found throughout the Bay Area. Although there are a few pockets throughout the region that show a net job loss, overall, there are no distinct areas of very concentrated decline.

CURRENT AND FUTURE TRENDS IN INDUSTRIAL JOB QUALITY

In 2011, middle-wage jobs counted for a near-majority (44%) of jobs on pure industrial land, while low-wage jobs counted for 28%, and high-wage jobs for 28% of jobs. This is a favorable distribution considering that only about a quarter (27%) of total jobs in the Bay Area offer middle wages, while a third (36%) offer low wages, and 38% offer high wages, according to the Regional Economic Prosperity Strategy (2014). In other words, middle-wage jobs are twice as concentrated on industrial land as in the region generally.

When we apply occupational distributions to employment growth patterns for 2040, the distribution of low-, medium-, and high-wage employment remains surprisingly similar.[1] The share of middle-wage jobs is projected to increase only slightly to 45%, at the expense of a one-percentage point decrease in the share of high-wage jobs. Furthermore, in 2040, the share of jobs that pay more than $18/hour and that require less than a bachelor's degree or five years' experience increases slightly from 57% to 60% of total industrial jobs.

IMPACTS OF INDUSTRIAL LAND AND JOB CHANGES ON COMMUTE PATTERNS AND VMT

Counties located further away from the urban core cities of Oakland and San Francisco—such as Sonoma, Marin and Solano—have the highest average vehicle miles traveled (VMT) estimates, between 18.4 and 24.6 miles per worker (one-way only). Santa Clara is not far behind, with both Santa Clara

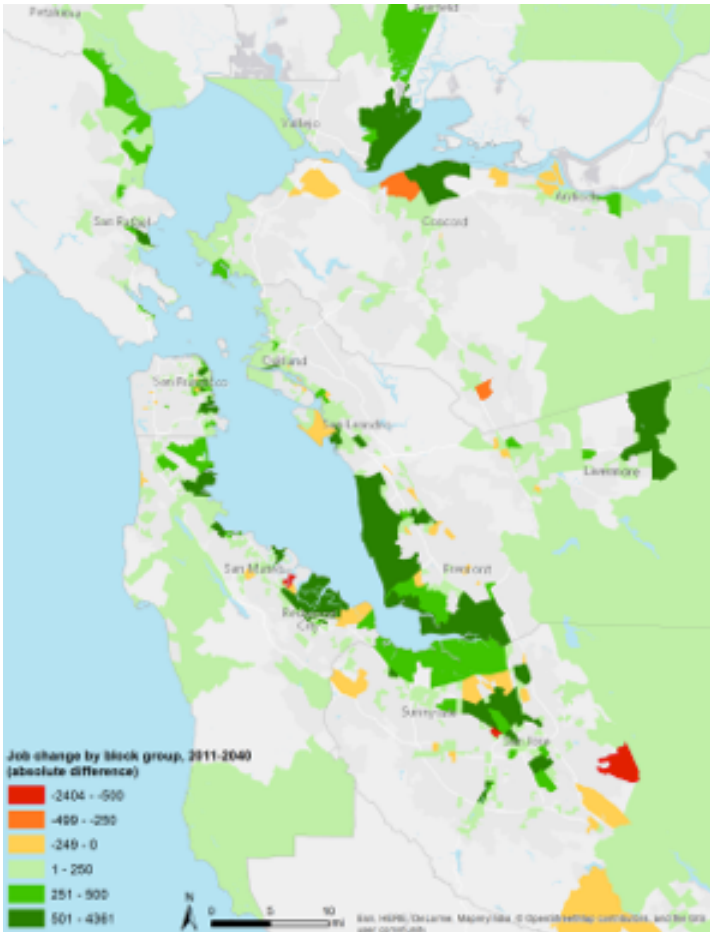

Figure A. Projected employment growth by block group (2011-2040) on exclusive and mixed-use industrial land

Core (San Jose and surroundings) and Non-core attracting similarly long trips of around 17-18 miles per worker (one-way). Because these are workplace based VMT calculations, we interpret this as: workers need to drive more, and/or longer distances to reach employment in these areas.

Conversely, San Francisco and Alameda Core (including Oakland and cities along the shoreline like San Leandro, Hayward, and Fremont) display the smallest average VMT estimates—with values of 7.7 and 8.6 miles per worker (one-way), respectively. Interestingly then, even though a city like San Francisco attracts workers from across the region, its per-worker average VMT (7.7 miles per worker, one-way commute) still remains much lower than Santa Clara Core's VMT estimate (18.1 miles per worker, one-way commute). To meet the goal of reducing greenhouse gas emissions, it may be beneficial to maintain industrial jobs in areas with lower VMT.

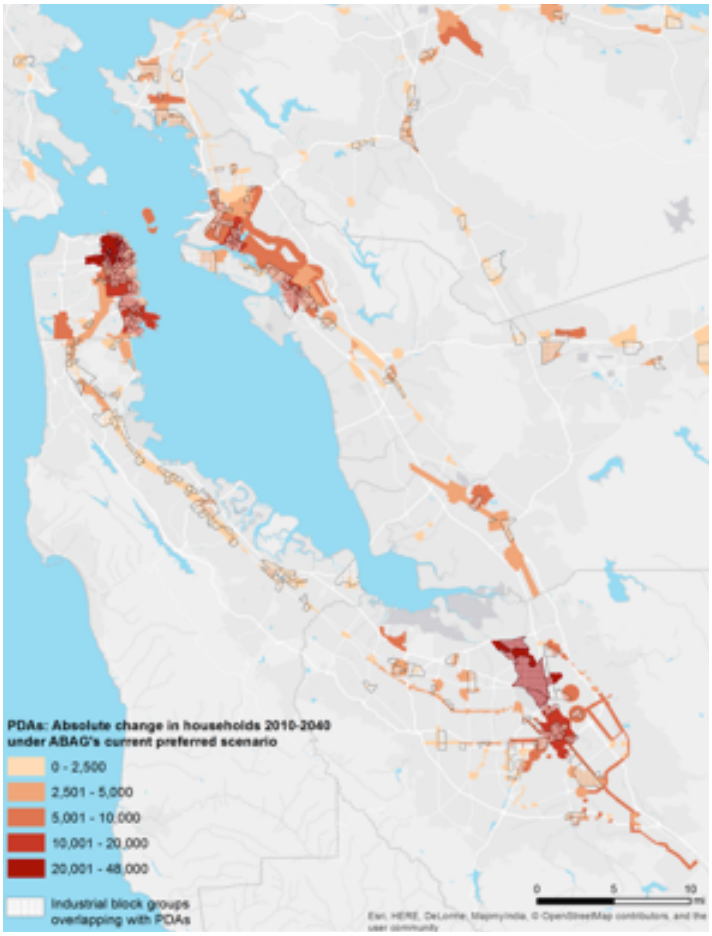

Figure B. Net new households in PDAs under ABAG middle scenario for growth to 2040, shown in relation to industrial block groups

OVERLAP OF REGIONAL HOUSEHOLD GROWTH SCENARIOS AND INDUSTRIAL LAND

Our analysis integrates ABAG's middle regional 2010-2040 projections for households and jobs with industrial block groups' location and projected growth.[2] What does the spatial overlap between these two geographic entities say about the pressure of priority development area (PDA) housing/job growth on industrial jobs?

At present, about 29,000 industrial land-dependent jobs are located on industrial land within the region's PDAs, and up to 320,000 are located in adjacent block groups. We find that about 96,700 industrial jobs are located in block groups within or adjacent to the eight highest-growth Priority Development Areas. These high-growth PDAs—each projected to accommodate over 10,000 new households by 2040—are located in Eastern and Downtown San Francisco, in Northern and Downtown San Jose, and in Downtown and East Oakland.

These numbers do not paint a complete picture of future growth, and certainly cannot confirm if industrial jobs overlapping with PDAs are definitely at risk of loss or displacement, however, this analysis is a useful first step to determine areas of potential conflict between housing growth and industrial sector growth. This analysis highlights the need to reconcile the regional housing and job strategy with broader regional economic development needs, such as planning for industrial land use at a regional scale.

REPORT

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PART I: INTRODUCTION

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This Technical Memo is the third product from the Regional Industrial Land and Job Study, prepared for ABAG and MTC as a complement to the 2016 MTC Goods Movement Needs Assessment. In this study, we analyze the economic and transportation impacts from projected changes in industrial land and jobs across the nine-county Bay Area region:

- Part II of this report provides an overview of job change in the Bay Area from 2011 to 2040, looking at overall shifts in employment sectors that are dependent on industrial land. Projected job change is also mapped for the region by block group.
- Part III looks more specifically at the impacts of the projected economic growth on job quality. By combining employment data with occupational data, we specifically focus on middle wage "accessible jobs"—that is, that require relatively lower levels of education.
- Part IV examines current commute patterns to industrial land in the Bay Area and estimates potential future impacts on Vehicle Miles Travelled (VMT) based on projected job growth across the region. We also analyze home location of industrial land workers.
- Part V compares 'business as usual' economic projections from Part 1 with ABAG's middle growth scenarios for the region.[3] We use the scenario for housing and job growth in Priority Development Areas for 2040, and we assess the extent of overlap between these housing/job high-growth areas and high-growth industrial areas.

PART II: OVERVIEW OF INDUSTRIAL JOB CHANGE FROM 2011 TO 2040

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To understand the overall impacts of future change in industrial land, we first need to understand the regional outlook for industrial job growth in the Bay Area looking forward. For this reason, this section explores projected growth in industrial employment, by geography and by industry type.

METHODS

We estimated employment growth from 2011 to 2040 based on REMI projections.[4] We projected the sum of employment in 6-digit industries dependent on industrial land[5] using the closest corresponding 3-digit REMI projection. While a straightforward match between NAICS and REMI industry categories was possible in most cases, projections using closely related industries or corresponding 2-digit industries had to be performed for a small number of industries.[6] We calculated employment growth for jobs located both on exclusively-zoned industrial land and on exclusive and mixed-use industrial land.

Following this, we used 2011 NETS data to break down employment projections by block group. Although employment numbers are much smaller at this geographic level—making projections riskier to do with certainty—this analysis still provides crucial insight into where growth and decline are expected to occur. Given that industrial jobs tend to be geographically concentrated in specific zones throughout the Bay Area, a spatial approach to job projection is key: a certain district could be highly impacted depending on its relative specialization.

In sum, we conducted employment projections at the following levels:

- By NAICS category (3-digit, summarizing 6-digit employment numbers for industries dependent on industrial land)
- Regional level (total)
- Sub-regional or county level
- Block group level

We did not conduct projections specific to the parcel level, i.e., for actual industrially zoned land, because of uncertainty in predicting economic trends at the micro scale. In order to project job growth in industrial land-dependent industries actually located in exclusive or mixed-use industrial zones (Figure 1), we apply the growth rate from summing the block group projections at the county level.

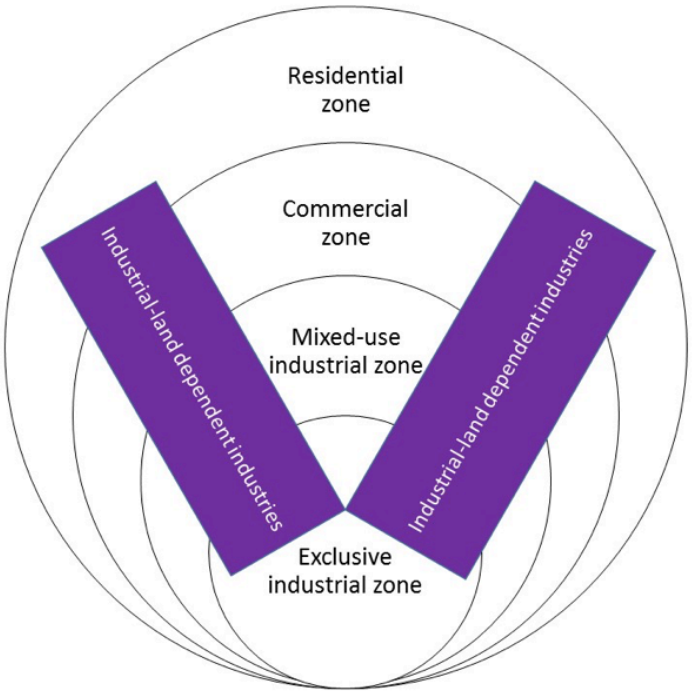


Figure 1. Location of industrially zoned land and industrial land-dependent jobs.

FINDINGS: REGION-WIDE PROJECTIONS

Based on our definition of industrial land-dependent employment,[7] the estimate for industrial jobs located on exclusive and mixed-use industrial land in 2011 for the Bay Area is 600,824 jobs. Projecting out to 2040, a 24% growth is expected, resulting in about 747,301 jobs, with 254,966 jobs actually located on industrial parcels and the remainder in adjacent block groups.

A few sectors emerge as having a large number of projected net new jobs (for full list, see Appendix 1). For example, in ranked order, Merchant Wholesalers of Durable Goods (NAICS code 423) and Nondurable Goods (424), Repair and Maintenance (811), Transit and Ground Passenger Transportation (485), Waste Management and Remediation (562), Machinery Manufacturing (333), Truck Transportation (484), Support Activities for Transportation (488), and Warehousing and Storage (493) are each contributing an additional 1,000 new jobs or more by 2040.[8]

Interestingly, a few select manufacturing industries also are projected to see net positive growth to 2040, such as Nonmetallic Mineral Product Manufacturing (327), Fabricated Metal Manufacturing (332), Transportation Equipment Manufacturing (335), Wood Product Manufacturing (321), and Beverage and Tobacco Product Manufacturing (312), which are each providing over 200 net new jobs or more by 2040.

In contrast, a smaller number of NAICS industries are projected to experience a net decline in jobs to 2040. Some of the more noticeable declining industries include, in ranked order, Computer and Electronic Product Manufacturing (334), Couriers and Messengers (492), Apparel Manufacturing (315), Plastics and Rubber Products Manufacturing (326), Petroleum and Coal Manufacturing (324), Paper Manufacturing (322) and Primary Metal Manufacturing (331).

FINDINGS: INTER-REGIONAL DIFFERENCES IN INDUSTRIAL GROWTH

Notable differences occur between counties, as shown in Figure 2 and Table 1. In general, the South Bay counties (Santa Clara and San Mateo) display high growth rates and a large number of net new jobs (over 19,000 new jobs by 2040). The East Bay counties (Alameda and Contra Costa) have relatively smaller growth rate percentages, and while Alameda will be contributing many jobs (~18,000 jobs), Contra Costa does not display many net new jobs (~5,000). Interestingly, the East Bay accounts for a distinctively larger proportion of industrial jobs located on exclusive industrial land (40%) compared to the share it contributes to industrial jobs on exclusive and mixed use land (30%). Finally, San Francisco contributes a relatively high share of growth as well (~17,500 jobs), while the North Bay counties (Solano, Sonoma and Marin)—albeit only growing by around ~5,000 jobs each—are growing at a considerable pace given their size.

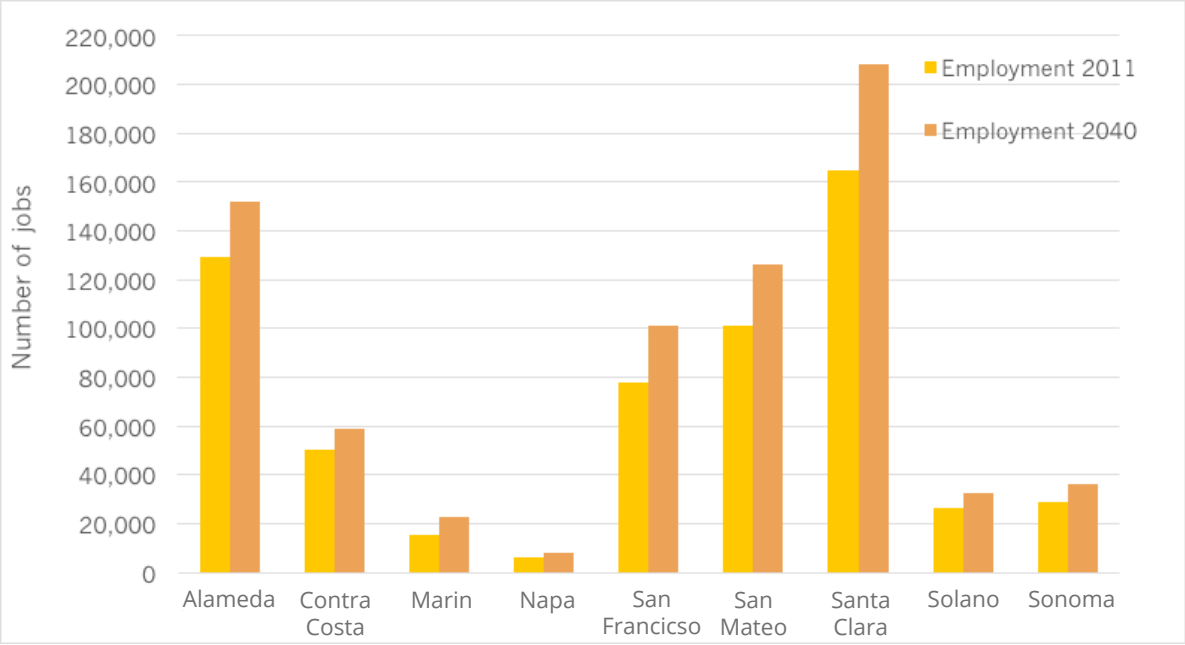


Figure 2. Projected job growth by county (2011-2040) on exclusive and mixed-use industrial land

Zooming in from the county-level to the block group level (Figure 3), we find that areas of growth occur throughout the Bay Area, with no distinct areas of very concentrated decline.

Areas of high growth are projected to be spread through parts of the East Bay, merging into parts of Northern and Central San Jose. Pockets of high growth are also present in the Northern Contra Costa Waterfront area and southern Solano County. San Francisco also displays a few block groups of high growth. Moderate growth areas are also found throughout the nine-county region — mainly in the outskirts of Solano, San Mateo, Alameda and Contra Costa Counties, and in parts of Richmond, Oakland, Berkeley, and San Francisco. This is perhaps a sign that, in most cases, employment industries are sufficiently diversified that no single area suffers from the decline of a single industry.

In turn, projected areas of strong decline are few: pockets of decline are located in Northern Contra Costa (near Antioch, Martinez/Concord, and Hercules) and around San Ramon, which is related in large part to the projected decline of Petroleum and Coal Products Manufacturing (324). There is a small concentration of declining block groups in Santa Clara County, near Northern San Jose, in the

outskirts of the city, in Cupertino, and on the San Mateo shoreline. Most of these areas of decline in the South Bay are related to decline in Computer and Electronic Product Manufacturing (334) as well as Postal Service (491) and Couriers and Messengers (492). Another pocket of decline is located in the Oakland Airport area, which is due to the projected decline in Air Transportation jobs, and around Union City, which is explained by the decline in Plastics and Rubber Products Manufacturing (326). In San Francisco, the decline of Apparel Manufacturing (315) and Computer Electronic Product Manufacturing (324) explains the small decline seen in SoMa.

Sub region	Employment 2011	Employment 2040	Absolute difference	Percent difference
East Bay	179,511	210,966	31,455	0.175
North Bay	77,279	100,213	22,934	0.297
South Bay	265,883	334,991	69,108	0.260
West Bay	78,151	101,130	22,979	0.294
Total	600,824	747,301	146,477	0.244

Table 1. Projected job growth by sub-region (2011-2040) in industrial land-dependent industries.

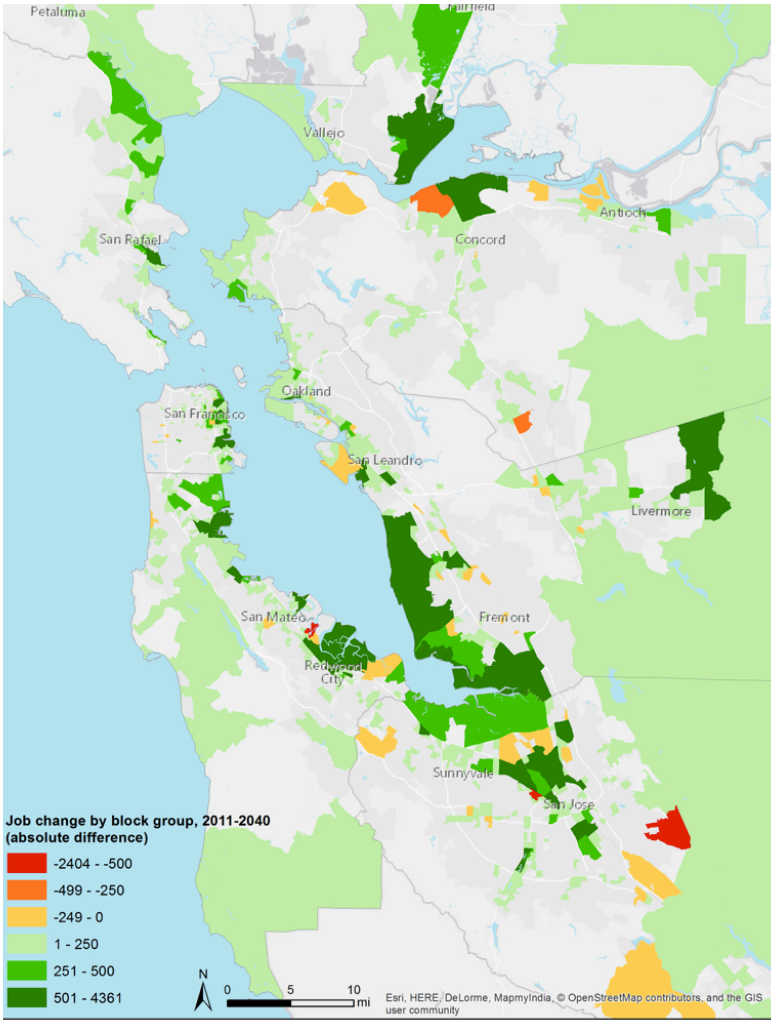


Figure 3. Projected employment growth by block group (2011-2040) on exclusive and mixed-use industrial land

PART III: CURRENT AND FUTURE TRENDS IN JOB QUALITY

The second part of the report explores whether industrial sectors that are expected to grow on industrial land offer the type of jobs that are beneficial to the Bay Area's economy and residents. According to the Bay Area Regional Prosperity Plan, the region should be growing the economy with an explicit focus on middle-wage work. As said in the report, "In the Bay Area, more than 1.1 million workers, over one third of the total workforce, earn less than $18 per hour (or less than $36,000 per year for full-time work). The majority of these workers earn less than $12 per hour. Further, the number of jobs that pay wages less than $18 per hour has risen during the economic recovery, and these low-wage jobs are expected to increase even more over the coming years."[9] In other words, there is a critical need to improve economic conditions for low- and moderate-income Bay Area residents and workers. Opportunities for improvement include examining more closely the contribution of the industrial sector to job quality in the Bay Area.

In this section, we combine NAICS employment numbers, as described in Part II, with their associated occupational salary and educational levels, and estimate changes in this distribution to 2040. For this analysis, we focus only on jobs in industries that are dependent on exclusive industrial land, because the industries located on mixed-used industrial land are not only extremely diverse, but also do not experience the locational constraints that of the industrial land-dependent industries (as described in Technical Memo #1).

METHODS

We aggregated industries dependent on exclusive industrial land in each of the nine counties, accounting for 171,740 jobs in 2011. Using a similar process to match REMI 2- to 4-digit categories as described in Part II, we projected employment out to 2040. Note that job totals in this section are smaller than those described in Part II, as we did not include jobs in sectors for which we did not have a direct REMI match.[10]

Then, we identified occupations associated with each three-digit industry that had at least 100 jobs using the California Employment Development Department's (EDD) Staffing Patterns Matrix. Ultimately, we used 54 industries accounting for 171,419 jobs. The Staffing Patterns matrix provides employment estimates for every 6-digit occupation within a respective industry. We also pulled 6-digit occupations from the Bureau of Labor Statistics matrix, which we integrated with the 6-digit occupational data provided by the California EDD. The BLS matrix includes an estimated percentage of employment for each occupation within the respective industry. We pulled all 6-digit occupations with more than 1% employment in the industry. We reweighted these job-to-occupation proportions, and then estimated an occupational distribution for all 54 industries. We obtained 370 unique 6-digit occupations accounting for all 171,419 jobs.

We then linked each occupation to its associated wage, training, and educational data. We used the EDD 2014 Occupational Employment Statistics updated to the first quarter of 2015 for the Oakland-Fremont-Hayward Metropolitan Division, as this geography was the closest approximation to the nine-county Bay Area region available.[11]

Throughout the report, we use the definition of "quality jobs" as defined in the Regional Economic Prosperity Strategy: the report describes low-wage jobs as having salaries under $18/hour (less than $36,000/year), middle-wage jobs with salaries between $18 and $30/hour (between $36,000-$62,0000/year), and high-wage jobs with salaries over $30/hour (over $62,000/year). We also define "accessible" good jobs as these mid- or high-paying jobs that require less than a bachelor's degree.

FINDINGS: MIDDLE-WAGE JOBS ON INDUSTRIAL LAND, PROJECTED TO 2040

In 2011, middle-wage jobs counted for a near-majority (44%) of jobs on exclusive industrial land, while low-wage jobs counted for 28%, and high-wage jobs for 28% of jobs. This is a favorable distribution considering that only about a quarter (27%) of total jobs in the Bay Area offer middle wages, while a third (36%) offer low wages, and 38% offer high wages, according to the Regional Economic Prosperity Strategy (MTC 2014) (Figure 4).

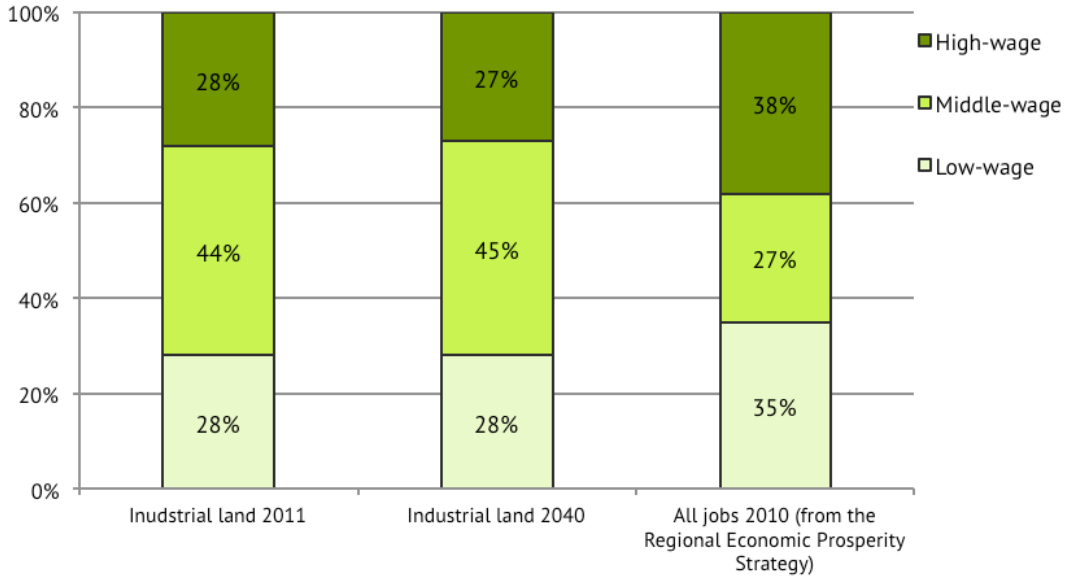


Figure 4. Wage distribution of jobs on industrial land in 2011 and 2040, compared to the wage distribution all jobs in the Bay area

Beyond wages, educational levels are also important to take into consideration. Middle- and high-wage paying jobs (>$18/hour) that also require less than a bachelor's degree and five years or less of work experience account for more than half of all jobs on industrial land (57%, or 99,000 jobs). Middle- and high-wage paying jobs (>$18/hour) that require less than a high school diploma count for about 7% of all jobs on industrial land (11,500 jobs).

When we apply occupational distributions to employment growth patterns for 2040, the distribution of low-, medium-, and high-wage employment remains surprisingly similar. The share of middle-wage jobs is projected to increase only slightly to 45%, at the expense of a one-percentage point decrease in the share of high-wage jobs. Furthermore, in 2040, the share of jobs that pay more than $18/hour and that require less than a bachelor's degree or five years' experience increases slightly from 57% to 60% of total industrial jobs.

Among the jobs that are expected to grow between 2011 and 2040, a majority requires less than a bachelor's degree (for full list, see Appendix 2). The top two growing "accessible" occupations — Construction Laborers and Heavy and Tractor-trailer Truck Drivers, which will account for over 4,000 new jobs combined— require a high school diploma and post-secondary non-degree award, respectively. Heavy and Tractor-trailer Truck Drivers in particular, will employ a total of 9,000 jobs by 2040 and offer a median wage of $22/hour. Other "accessible" occupations that are expected to grow by 2040 include Carpenters, Electricians, First-line Supervisors of Construction Trades, Plumbers, and several administrative positions such as Sales representatives, Office clerks and Secretaries and Administrative Assistants.

PART IV: IMPACT ON COMMUTE PATTERNS AND VMT

METHODS

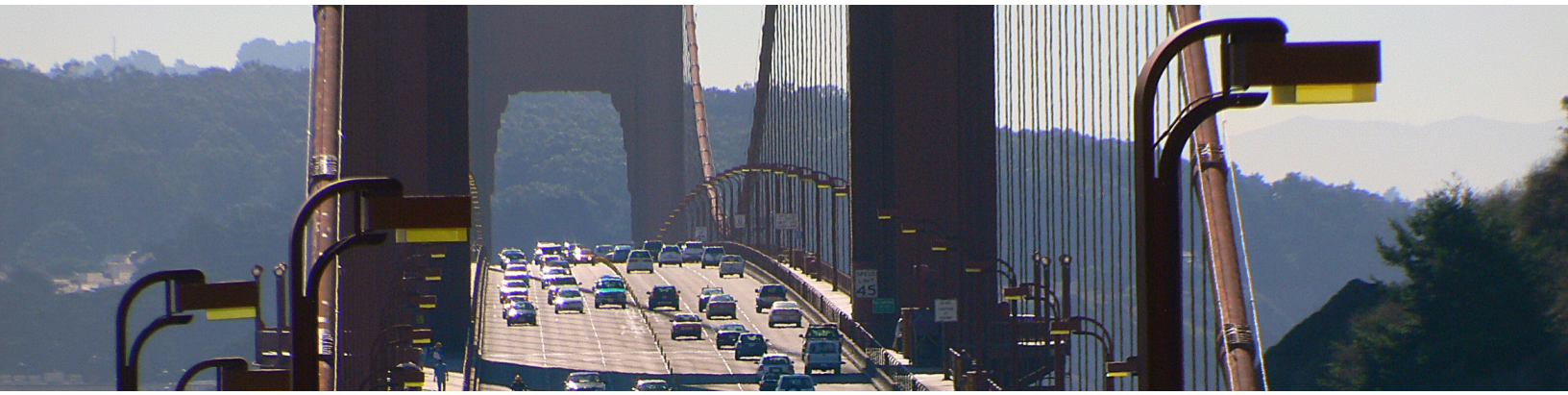
Industrial workers VMT estimates

The analysis of current and projected commute patterns in the Bay Area is based on commute work-place flows, using a set of 735 work block groups (WBGs) that display a high density of industrial jobs (>100 jobs dependent on industrial land). This set of block groups contains 493,120 jobs in industries considered dependent on industrial land. (Because it is only including high-density block groups, the total is less than the 600,824 jobs region-wide.) Detailed methods and maps for this process are included in Memo 1.

To understand where commuters working in these 735 industrial work block groups are coming from, we used the 2013 LEHD LODES dataset (Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics), provided by the U.S. Census Bureau. This dataset provides all origin-destination commute flows between home and work block groups in California. We narrowed our sample to only include commute flows to our set of 735 WBGs of interest. We then obtained the centroid of every associated home block group, and calculated home-to-work block group Euclidian distances for every unique home-to-work block group combination. We then calculated a **total commute distance travelled per work block group** by multiplying the Euclidian distance[12] between each unique home-work block group combination by the number of jobs that possessed that unique commute pattern.

We paired this with data from the Census Transportation Planning Package (CTPP) from 2006-2010 ACS, which is the most recent data available on work-place based commute mode shares.[13] We assume that overall, commute mode shares have not drastically changed since those dates. We thus used CTPP to discount the total distance associated to a given work block group by the proportion of workers who drive and carpool to work. However, because the CTPP is only available at the census tract level, we aggregated our work block group distances to the census tract level. We thus obtained the **total commute distance travelled per work census tract, in private or carpooling vehicles.**

The final step was to create a per-worker weighted aggregated averages. We calculated countywide averages for Napa, Marin, Solano, Sonoma and San Francisco; for Alameda, Contra Costa, Santa Clara, and San Mateo, we differentiated core versus non-core tracts and calculated two separate averages for each of these aggregated areas. The census tracts selected for this analysis are shown in Appendix 3. What this means is that we averaged out the total commute distance by tract, for all census tracts in a county, core, or non-core area, and weighted the average by the number of workers in the census tract. Results are summarized in Table 2, and Figures 5 and 6.



Using this per-worker VMT average, we multiplied the net new number of jobs in industrial sectors by 2040, by county, (as described in Part II), by county-specific VMT, in order to estimate the net VMT impact of job growth in different areas of the region. This gave us an estimate of the contribution of each county to new total VMT created. Although this is a rough assessment that does not take into consideration various possible changes in growth patterns across the region, it does give an overall sense of what areas of the region are contributing most to VMT.

Industrial workers home location

We also mapped the density of workers' home location by block group—only representing workers who commute to the 735 industrial work block groups described previously. Results are shown in Table 3 and Figure 7. The LODES dataset also allows to break down workers by wage level, so we mapped the home location of low-wage workers (wage below $18/hour) who commute to industrial block groups.[14]

As a final note on our methodology, the employment numbers used from the LEHD dataset account for total employment in the work block groups of interest (as seen in Table 3 and Figure 7 for instance). This differs from the employment numbers used in the majority of this report, which were obtained from NETS, by block group, only accounting for jobs in specific 6-digit industries dependent on industrial. Thus, in the 735 work block groups of interest, LEHD yields a total of 1,800,000 industrial jobs, whereas the NETS numbers yields about 493,000 industrial jobs.[15] Although this is a significant discrepancy, what matters in this analysis is that the same industrial work block groups are being used throughout the report.

FINDINGS

Industrial workers VMT estimates

County-specific VMT values are summarized in Table 2. Counties located further away from the urban core cities of Oakland and San Francisco—such as Sonoma, Marin and Solano—have the highest average VMT estimates, between 18.4 and 24.6 miles per worker (one-way only). Santa Clara is not far behind, with both Santa Clara Core and Non-core attracting similarly long trips of around 17-18 miles per worker (one-way). In other words, because these are work-place based VMT calculations, we interpret this as: workers need to drive more, and/or longer distances to reach employment in these areas. Conversely, San Francisco and Alameda Core (Oakland, and cities along the shoreline like San Leandro, Hayward, Fremont) display the smallest average VMT estimates—with values of 7.7 and 8.6 miles per worker (one-way), respectively. Interestingly then, even though a city like San Francisco, for instance, attracts workers from across the region, its per-worker VMT (7.7 miles per worker, one-way commute) still remains much lower than Santa Clara Core's VMT estimate (18.1 miles per worker, one-way commute). Finally, Contra Costa and San Mateo hover between these two extremes, with values ranging from 11 to 16 miles per worker (one-way).

The difference between core and non-core areas is most stark for Alameda County: while Alameda Core work block groups attract workers with an average commute of 8.6 miles, Alameda Non-core industrial work block groups attract on average of 15.6 miles—almost double. When thinking about the location of industrial jobs in the future, this type of finding suggests that to reduce VMT, there is potentially some benefit to keeping jobs in the areas closer to the core, particularly in San Francisco and Alameda counties. However, as discussed later in this section, further research is needed to claim this with more certainty.

When combining job growth projections (from Part II) with VMT estimates from Table 2, we find that Santa Clara's core areas seem to be the biggest contributor to increased VMT under a "business-as-usual" scenario. Its high job growth and high per-worker VMT averages mean that this would be a key area on which to improve transit, and/or otherwise increase the amount of housing available to workers to live closer to their work destination. Other counties also contribute significant VMT—mainly San Mateo core and Alameda Core—but this is related more to their high job growth rates. Conversely, although Marin, Sonoma, and Solano had high VMT estimates, their net new number of jobs to 2040 is not very high—making the total impact appear more reasonable.

	Average per worker VMT (one-way) to industrial block groups (miles)*	Employment 2011**	Projected employment 2040**	Projected net new jobs (2011-2040)	Estimated net new daily one-way VMT (2011-2040) (miles)
Alameda total	9.0	-	-	-	-
Alameda core	8.6	94,670	108,890	14,220	121,817
Alameda non-core	15.6	17,577	21,456	3,879	60,645
Contra Costa - total	15.4	-	-	-	-
Contra Costa - Core	16.1	9,735	10,979	1,244	19,994
Contra Costa - Non-core	15.3	28,349	32,060	3,711	56,809
Santa Clara - total	17.9	-	-	-	-
Santa Clara - Core	18.1	113,280	140,270	26,990	489,868
Santa Clara - Non-core	17.0	26,763	32,164	5,401	91,590
San Mateo - total	13.6	-	-	-	-
San Mateo - Core	14.0	81,134	99,076	17,942	251,671
San Mateo - Non-core	11.0	6,771	8,737	1,966	21,711
San Francisco	7.7	62,935	80,374	17,439	134,849
Marin	18.4	10,548	15,597	5,049	92,994
Sonoma	24.6	20,220	25,374	5,154	126,963
Solano	20.3	21,138	25,763	4,625	94,077
Napa***	n/a	n/a	n/a	n/a	n/a
Total		493,120	600,741	107,621	

Table 2. Current VMT per worker to industrial jobs, and projected VMT impact from industrial projected job growth to 2040

* Per worker, one-way commute, weighted average for the aggregated geography by census tract employment, accounting for census tract mode share
** Employment numbers used only from block groups with >100 jobs
***Napa does not have any block groups with employment in industries dependent on industrial land > 100

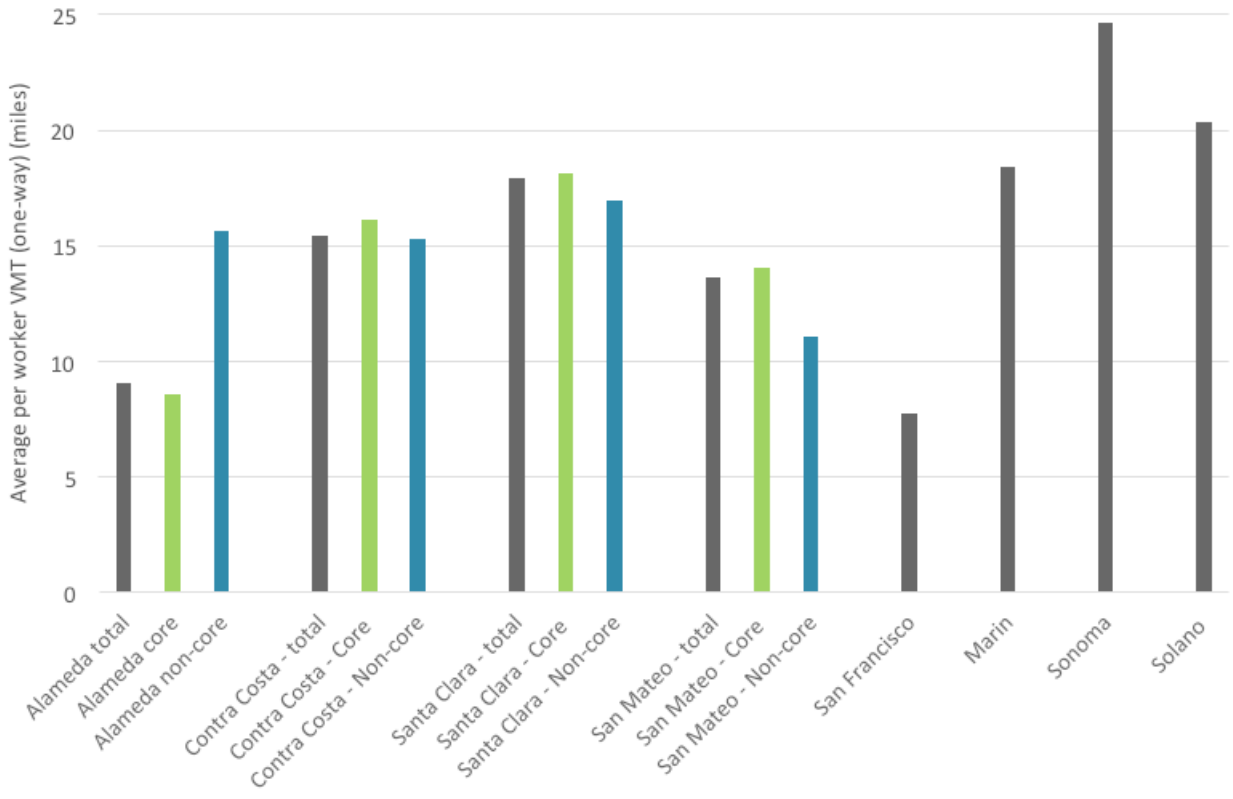


Figure 5. Average per-worker VMT generated by county, based on 2011 Longitudinal Household Employer Dynamics

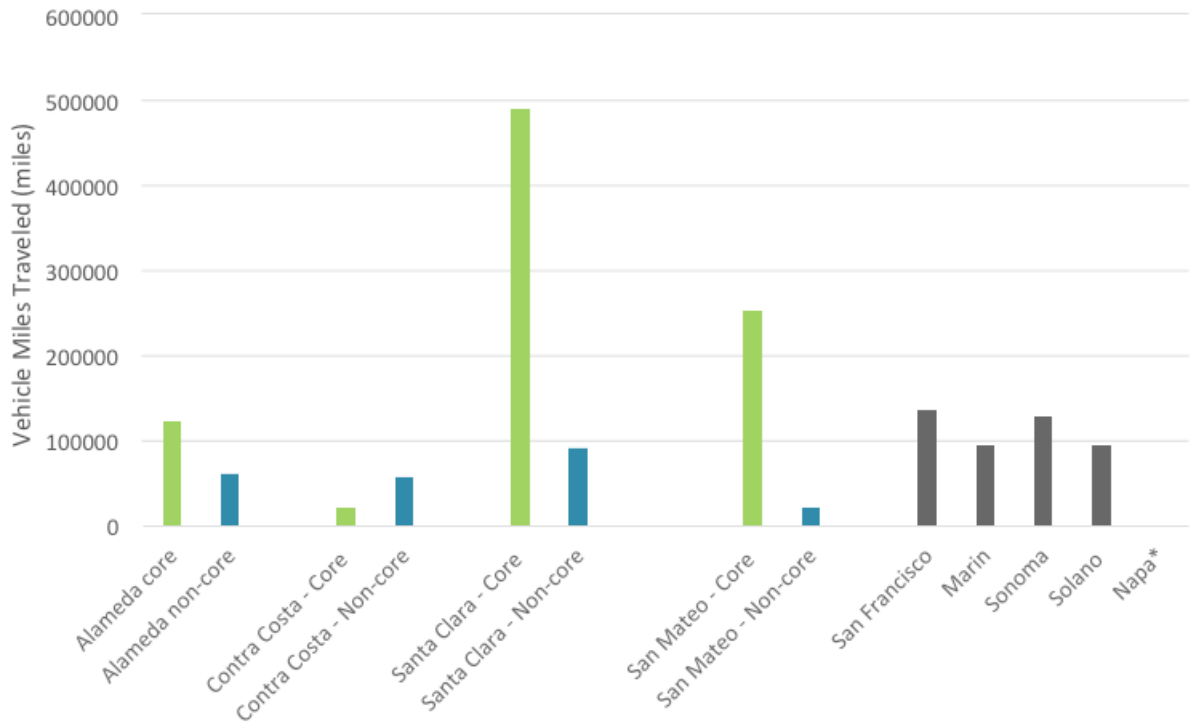


Figure 6. Net new VMT generated by county, based on employment projections from 2011 to 2040 and on countywide per worker VMT averages
*Napa does not have any block groups with employment in industries dependent on industrial land > 100

Industrial workers home location

As shown in Table 3, industrial workers tend to live in the largest four cities of the Bay Area—with approximately 14% of industrial workers living in San Jose, 14% in San Francisco, 5% in Oakland, and 4% in Fremont. Other cities that also have a substantial portion of this subpopulation include Hayward, Sunnyvale and Santa Clara. However, overall, people working in industries dependent on industrial land are found all across the Bay Area. As shown in Figure 6, there are no distinct areas from which these workers are commuting from—although a few pockets of concentration can be seen in Alameda, Contra Costa, and Santa Clara.

Figure 8 displays home location of low-wage workers only—again, it seems that low-wage workers are present in most areas of the region. There are, however, a few more concentrated areas. Part of SoMa, the Visitacion Valley, Daly City, South San Francisco/Millbrae in the West Bay, parts of eastern Contra Costa in the Antioch-Oakley-Brentwood area, parts of the Alameda shoreline, various block groups around San Jose, and parts of Solano in Fairfield and Vacaville, seem to have pockets of low-wage workers commuting to industrial block groups.

Limitations and future research

It should be noted that this analysis estimates VMT impacts from all block groups with concentrations of industrial land-dependent jobs, rather than all industrial land-dependent jobs in the region. Thus, it underestimates the magnitude of VMT impacts from industrial jobs now and in the future. Important in the discussion of VMT impacts from future industrial job growth and job location is the is a counterfactual question: what happens in place of industrial jobs/land if those jobs/land move? For example, if core industrial jobs move to the outskirts of the region, or if industrial land is converted to residential land, then several questions need to be asked:

- Do workers' home locations also change, and if so, will they commute longer or shorter distances?
- Do workers necessarily keep their job if their job changes location, or do workers change jobs when their job experiences a location change?
- Does a given worker's mode of transportation change as their job location changes?
- Do new residents now living in the hypothetical converted (industrial-to-residential) land now commute short or long distances to their respective jobs?

In other words, there is uncertainty in predicting the impact of changes in job location—especially because predicting worker home location in tandem with job location itself is technically complex. Nevertheless, examining one side of the equation (what we have begun doing in Part IV) is a first necessary step to illustrate the complexity of the tradeoffs. This methodology could be further developed in future work, with a larger emphasis on housing and job location predictions.

City	Number of workers	Percent
San Jose	259,001	14.3%
San Francisco	248,500	13.8%
Oakland	89,262	4.9%
Fremont	65,079	3.6%
Hayward	44,474	2.5%
Sunnyvale	43,664	2.4%
Santa Clara	36,122	2.0%
Daly City	32,550	1.8%
San Mateo	32,422	1.8%
Concord	25,715	1.4%
Livermore / Sunol	25,511	1.4%
Mountain View	24,536	1.4%
San Leandro	23,018	1.3%
Richmond	21,919	1.2%
San Ramon	21,718	1.2%
Vallejo	21,262	1.2%
Alameda	21,039	1.2%
South San Francisco	20,960	1.2%
Pleasanton	20,843	1.2%
Union City	19,233	1.1%
Other	812,136	45.0%
Total	**1,805,627**	100.0%

Table 3. Top 20 cities with largest population of workers (absolute numbers) working in industrial block group

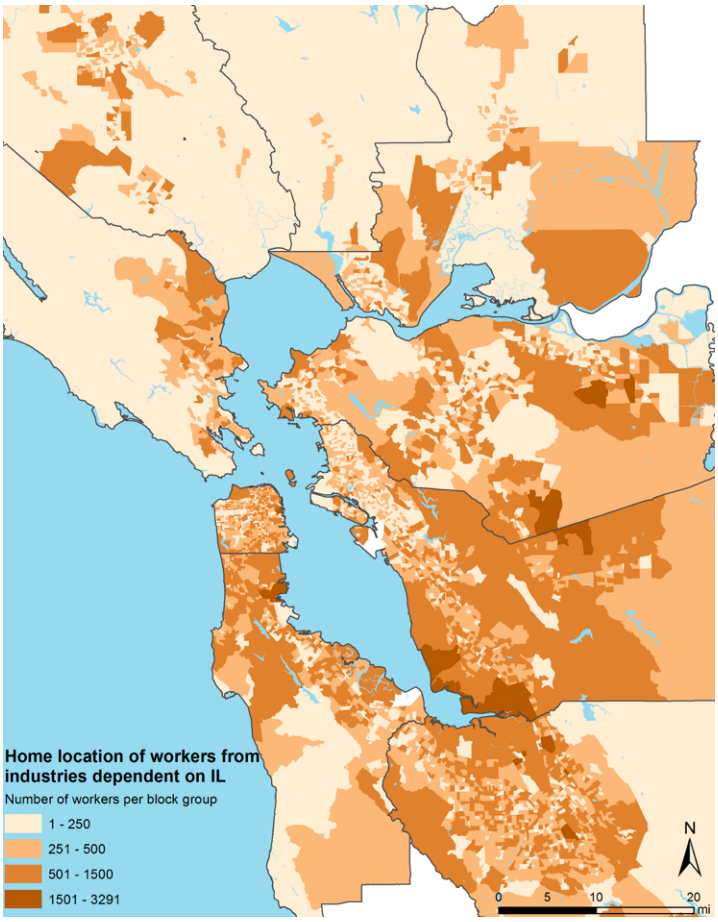


Figure 7. Home location of workers of industrial block groups, based on LEHD Origin-Destination 2011 data

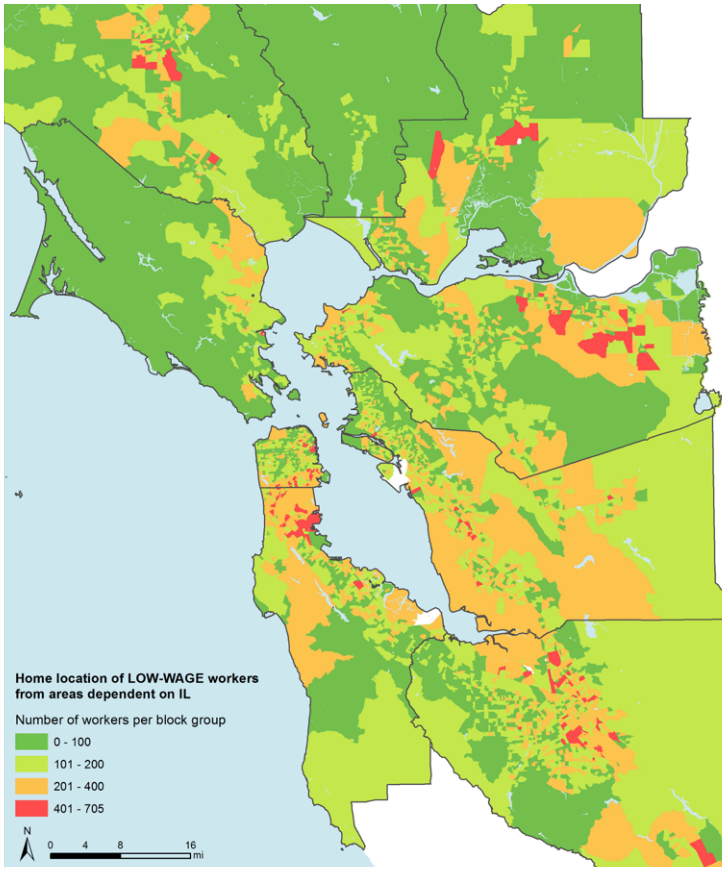


Figure 8. Home location of low-wage workers of industrial block groups, based on LEHD Origin-Destination 2011 data

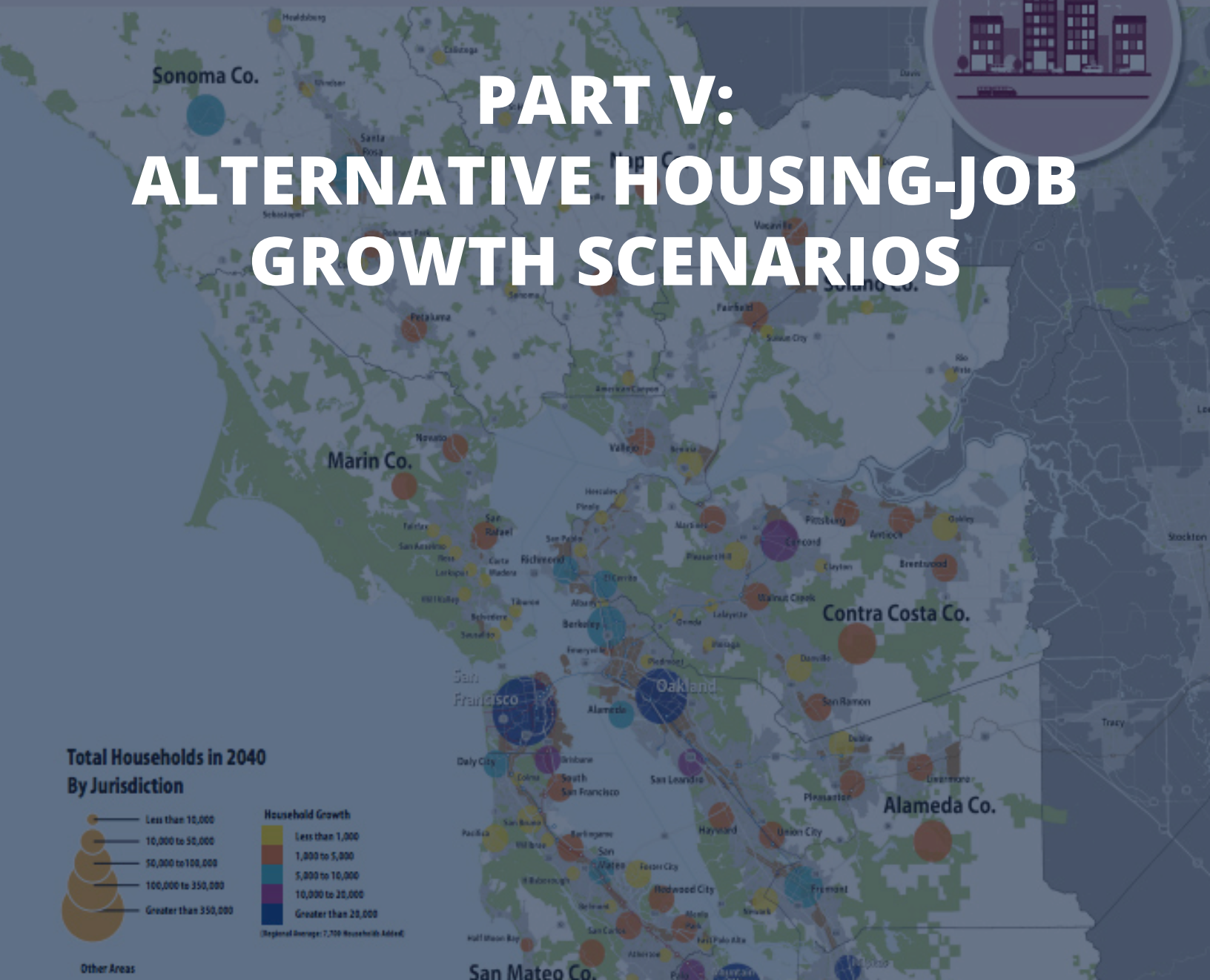
Scenarios

Big Cities Scenario

Plan BayArea 2040

The **Big Cities Scenario** targets future population and employment growth in locally adopted Priority Development Areas (PDAs) within San Jose, San Francisco and Oakland.

Neighboring cities already well-connected to the region's three largest cities would also see growth, particularly in their locally adopted PDAs. Growth outside of these three cities would be small, with limited infill development in PDAs and no development on currently undeveloped land.



PART V: ALTERNATIVE HOUSING-JOB GROWTH SCENARIOS

In this section, we integrate MTC/ABAG regional 2010-2040 projections for households and jobs with industrial block groups' location and projected growth. As established in regional plans such as Plan Bay Area, MTC/ABAG projections in Priority Development Areas (PDAs) are meant to help plan for future sustainable and equitable growth—in this section, we use ABAG's current middle growth scenario, which focuses growth along key corridors in the region.[16]

However, as described in the three previous sections of this report, job growth is also predicted across many industrial block groups. What does the spatial overlap between these two geographic entities say about the pressure of PDA housing/job growth on industrial jobs?

METHODS

Using ABAG's current middle growth scenario for jobs and households, we mapped the absolute change in number of jobs and number of households by Priority Development Area (PDAs), for the 188 PDAs in the Bay Area. Then, we selected industrial block groups that display significant spatial overlap with PDAs, and mapped them in relation to the region's PDAs.

FINDINGS

Figure 9 shows the highest-growing PDAs in terms of households in dark red, overlaid with industrial block groups. In areas of high housing growth, there is a possibility of land use conflict—i.e., can significant housing growth occur alongside industrial land? For example, if we consider the 188 PDAs across the Bay Area, eight of them (in Downtown/Eastern San Francisco, Downtown/East Oakland, and Downtown/North San Jose) are predicted to have over 10,000 new households, each, by 2040. Combined, these eight top-growing PDAs are expected to contribute 160,000 new households to the Bay Area's population. At the same time, we also know from previous analyses (Part II) that within these top-growing PDAs are found block groups with 96,700 industrial jobs. Rather than manufacturing or transportation jobs, these are likely to be in smaller scale industrial uses, such as auto repair or contracting, or information technology-related businesses.

Furthermore, combining Figure 3 (industrial job growth by block group) with Figure 9 (Figure 10) allows us to compare the overlap of high-growth industrial areas with high-growing housing areas. Coming back to our top eight high-growing PDAs, a majority of the industrial block groups overlapping with them are also predicted to have medium to high growth, with the exception of a few declining block groups in San Jose, due mainly to the Electronic and Computer Manufacturing sectors, and of a small number of block groups in Oakland.

These numbers do not paint a complete picture of future growth, and certainly cannot confirm if industrial jobs overlapping with PDAs are definitely at risk of loss or displacement, however, this analysis is a useful first step to determine areas of potential conflict between housing growth and industrial sector growth. This analysis also highlights the pressing need to reconcile the regional housing and job strategy with broader regional economic development needs—such as planning for industrial land use at a regional scale.

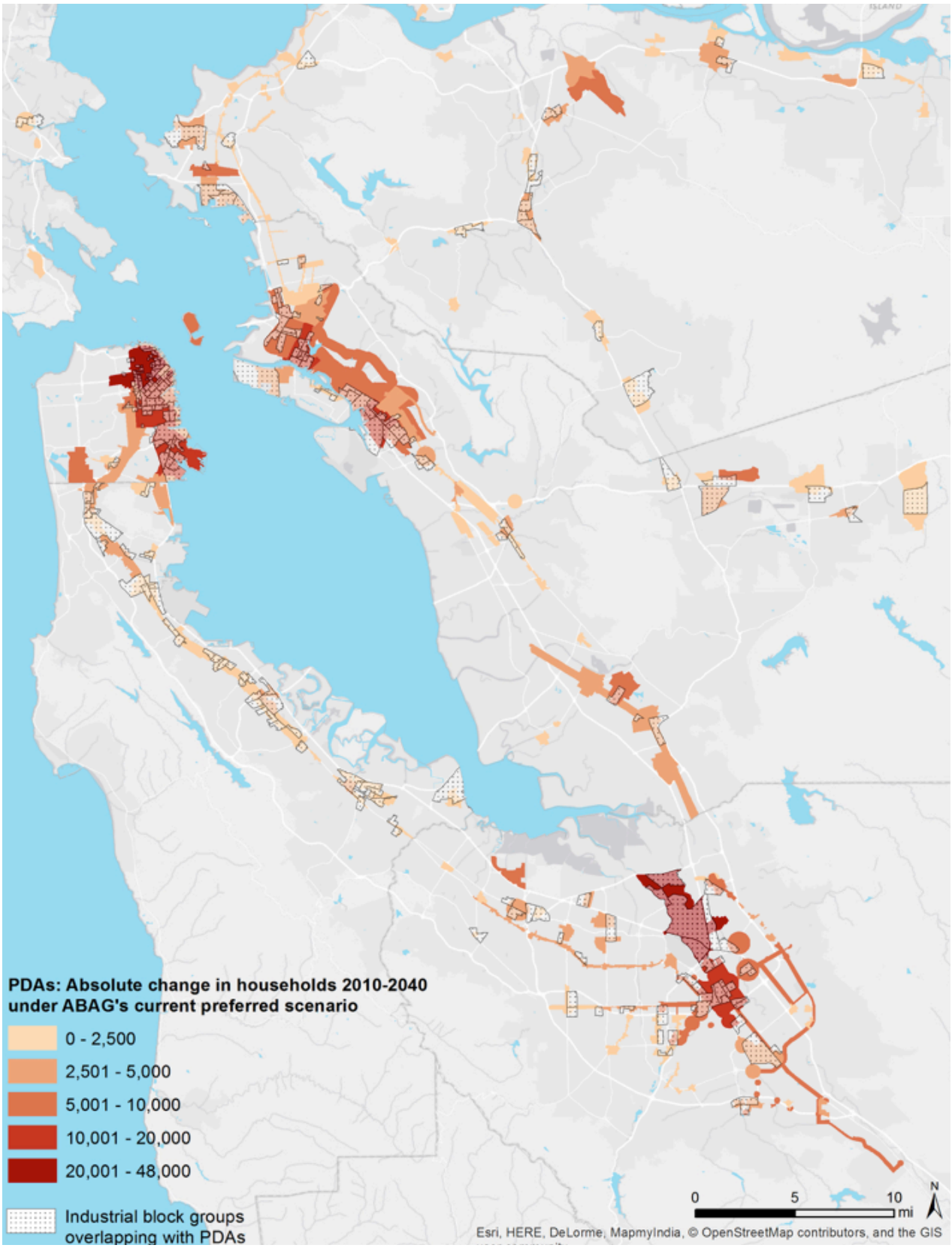


Figure 9. Net new households in PDAs under ABAG middle scenario for growth to 2040, shown in relation to industrial block groups

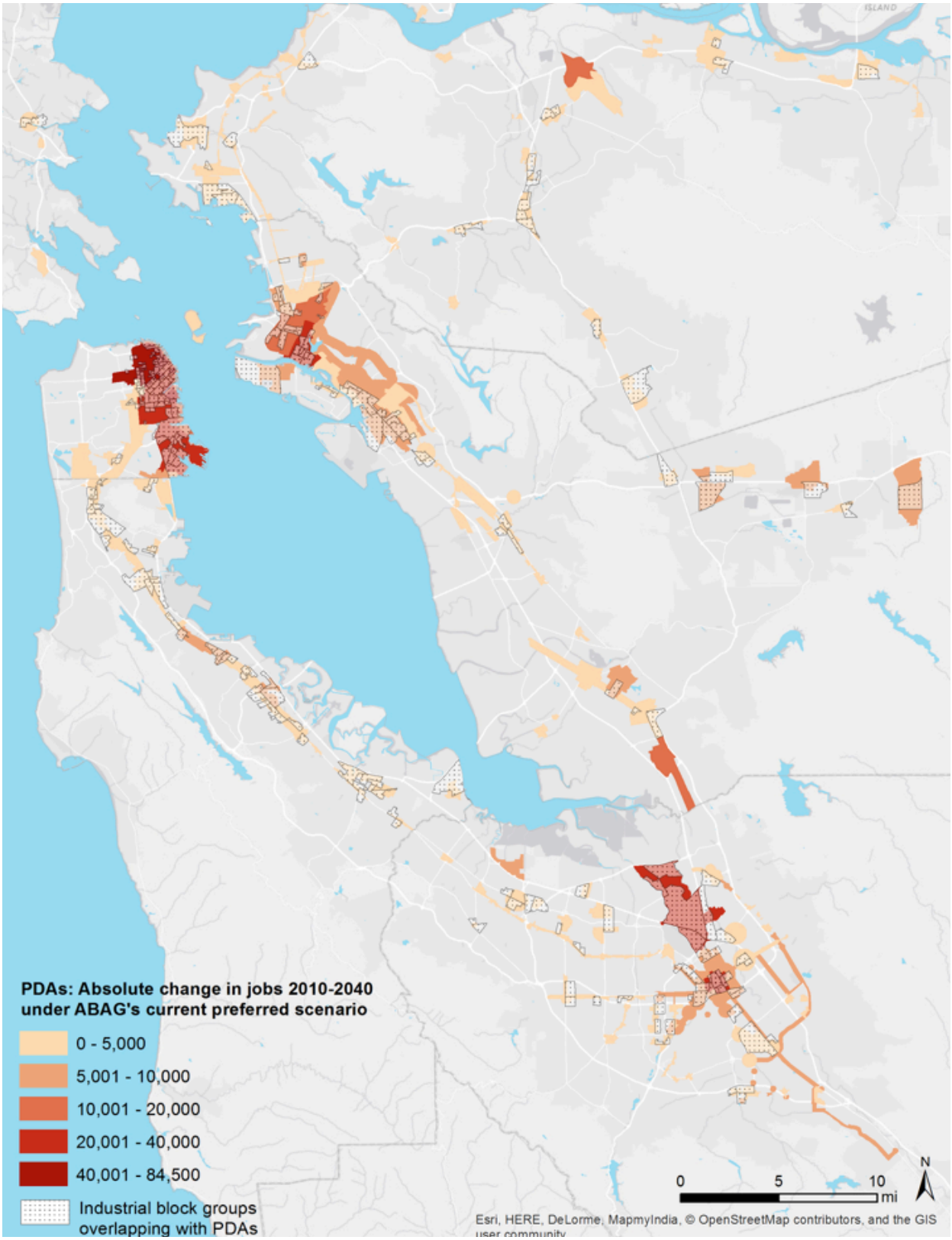
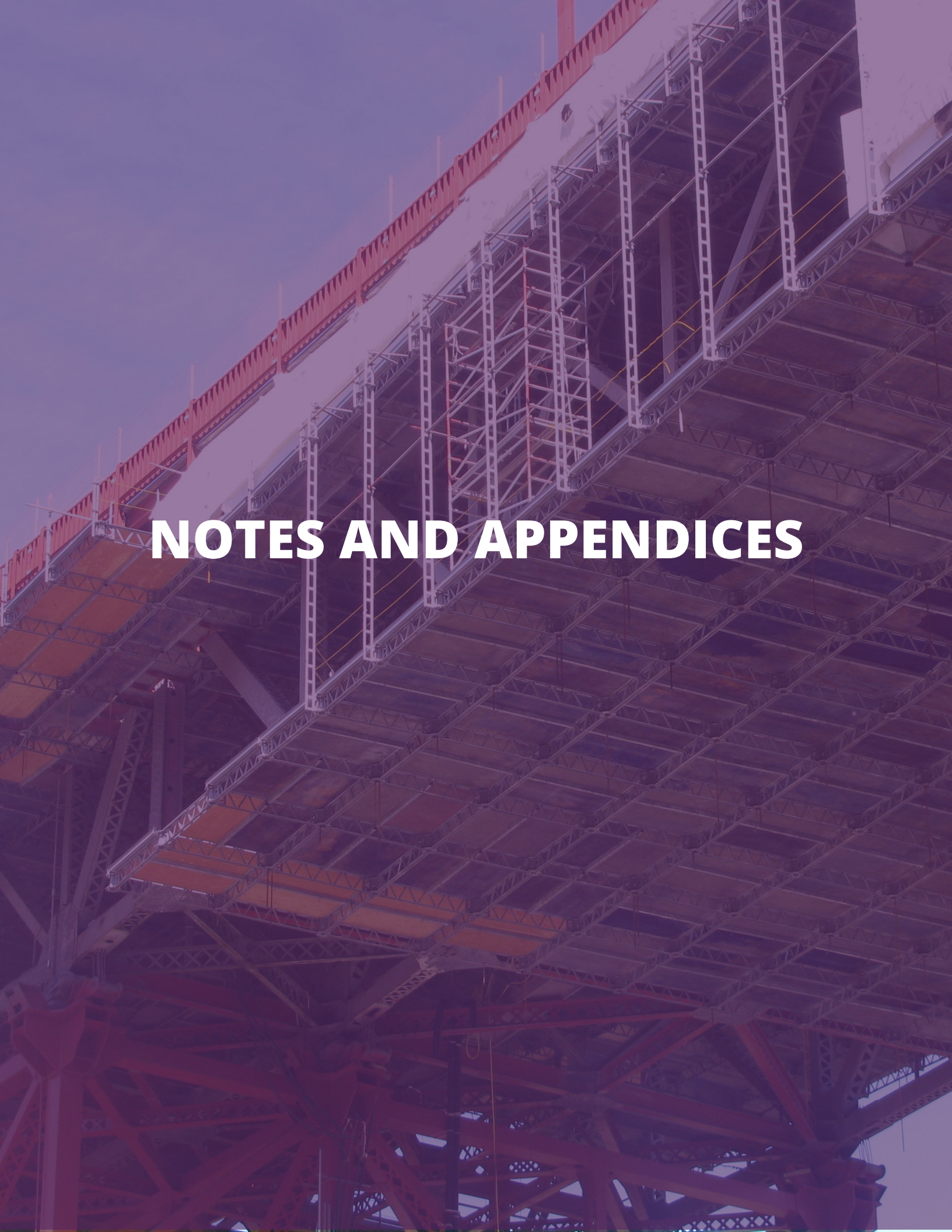


Figure 10. Net new jobs in PDAs under ABAG middle scenario for growth to 2040, shown in relation to industrial block groups

Berkeley



NOTES AND APPENDICES

NOTES

1. For this analysis, we assume that wage levels will remain constant from 2011 to 2040. In reality, some middle-wage jobs may become low-wage (and vice-versa).
2. At the time of analysis, this was the only scenario available for study. The final version of the scenario differs slightly from the one studied here.
3. At the time of analysis, this was the only scenario available for study. The final version of the scenario differs slightly from the one studied here.
4. For Plan Bay Area, ABAG produced two REMI projections, one based on the industry distribution used by the Bureau of Economic Analysis, and the second using the Bureau of Labor Statistics industry distribution. For this analysis, we used the first projection; thus, our outputs may differ from those used in Plan Bay Area.
5. Refer to Technical Memo #1 for technical details on jobs dependent on industrial land. Employment in these 6-digit industries was only included in the sum of those jobs in a given block group was higher than 100.
6. The job sum by block group only counts the jobs in the 6-digit industries dependent on IL – the 3-digit descriptor is used for ease of projecting using the REMI numbers.
7. Refer to Technical Memo #1 for methods and findings.
8. As a caveat, these growth categories also include NAICS industries such as Specialty Trade Contractors (238), Administrative and Support Services (561), and Construction of Buildings (236), which are not typically what cities explicitly encourage to locate on industrial land.
9. *San Francisco Planning and Urban Research, Center for the Continuing Study of the California Economy, San Mateo County Union Community Alliance, and Working Partnerships USA, Economic Prosperity Strategy* (San Francisco, CA: San Francisco Planning and Urban Research, 2015), 8.
10. NAICS 111, 112, 114, 314, 316, 451, 452, 453, 488, 491, 522, 535 and 533 did not have a direct match in the REMI projections. Because there are two steps of projection here, we took a more conservative route and did not also project occupational change for jobs that did not have an appropriate REMI match.
11. Its median wage is near the various median wages of the Metropolitan Statistical Areas of the Bay Area.
12. Euclidian distances, as opposed to network (Manhattan) distances, are used. Although Manhattan distances are more accurate for calculating absolute VMT, we only use these numbers to calculate a marginal difference in VMT, and the proportional difference in distance is estimated to be about the same. Also, we automatically assigned a distance of 0 miles to workers who work and live in the same block group.
13. We could have used home-location commute mode shares from US Census ACS data. However, it is more accurate to use work-based commute mode shares in our case. The reason for this is that the work block groups we have in our sample might be biased towards driving in their mode share break down, since, due to their industrial nature, they might be more isolated geographically or further away from transit. Previous research has also found that work-place characteristics, such as transit availability or job density, affect VMT levels (for example, see a 2013 report by the Washington State Department of Transportation entitled "Tools for Estimating VMT Reductions from the Built Environment").
14. Again, it is important to note that the employment numbers used in Figure 6, taken from the LEHD total employment by work block groups of interest, differs from the employment numbers used in previous figures and calculations (from NETS, by block group, for specific industries of interest). The large discrepancy relates to the fact that LEHD includes all industry categories. Thus, in the 735 work block groups of interest, LEHD yields a total of 1,800,000 jobs, whereas the NETS numbers for industrial jobs yields about 493,000.
15. We ran our analysis above excluding the "Other Services" jobs in the LODES – thus only accounting for "Goods producing" and "Transportation and Utilities" jobs. However, this led to discording

numbers and excluded too many industries considered dependent on industrial land.

16. At the time of analysis, this was the only scenario available for study. The final version of the scenario differs slightly from the one studied here.

Appendix 1. Projected growth from 2011 to 2040 by 3-digit NAICS industries on exclusive and mixed-use industrial land in the Bay Area. NOTE: this table focuses on block groups with more than 100 employees. Thus, the totals are significantly lower than in the rest of Memo #3.

NAICS 3-digit	NAICS 3-digit Category Description	Employment 2011	Employment 2040	Absolute difference	Percent difference
238	Specialty Trade Contractors	62,245	93,430	31,185	0.50
561	Administrative and Support Services	18,378	32,126	13,748	0.75
423	Merchant Wholesalers, Durable Goods	59,756	73,172	13,416	0.22
236	Construction of Buildings	17,933	26,517	8,584	0.48
811	Repair and Maintenance	14,430	22,307	7,877	0.55
541	Professional, Scientific, and Technical Services	13,910	21,769	7,859	0.56
424	Merchant Wholesalers, Nondurable Goods	27,926	34,118	6,192	0.22
485	Transit and Ground Passenger Transportation	5,604	9,710	4,106	0.73
237	Heavy and Civil Engineering Construction	8,250	12,259	4,009	0.49
562	Waste Management and Remediation Services	6,237	10,238	4,001	0.64
624	Social Assistance	2,010	5,852	3,842	1.91
333	Machinery Manufacturing	7,540	10,932	3,392	0.45
532	Rental and Leasing Services	7,693	10,922	3,229	0.42
621	Ambulatory Health Care Services	3,605	6,021	2,416	0.67
484	Truck Transportation	11,582	13,727	2,145	0.19
488	Support Activities for Transportation	7,075	8,888	1,813	0.26
721	Accommodation	3,267	4,664	1,397	0.43
812	Personal and Laundry Services	4,175	5,261	1,086	0.26
493	Warehousing and Storage	3,738	4,795	1,057	0.28
441	Motor Vehicle and Parts Dealers	6,263	7,218	955	0.15
921	Executive, Legislative, and Other General Government Support	5,801	6,745	944	0.16
922	Justice, Public Order, and Safety Activities	7,045	7,981	936	0.13
327	Nonmetallic Mineral Product Manufacturing	3,188	3,992	804	0.25
332	Fabricated Metal Product Manufacturing	18,993	19,792	799	0.04
336	Transportation Equipment Manufacturing	4,692	5,460	768	0.16
515	Broadcasting (except Internet)	2,346	3,024	678	0.29
722	Food Services and Drinking Places	1,619	2,232	613	0.38
444	Building Material, Garden Equipment & Supplies Dealers	3,987	4,594	607	0.15
321	Wood Product Manufacturing	1,609	2,181	572	0.36
924	Administration of Environmental Quality Programs	3,429	3,987	558	0.16
926	Administration of Economic Programs	6,731	7,269	538	0.08
442	Furniture and Home Furnishings Stores	2,971	3,497	526	0.18
452	General Merchandise Stores	2,652	3,157	505	0.19
213	Support Activities for Mining	210	710	500	2.38
523	Securities, Commodity Contracts, and Other Financial Investments	887	1,379	492	0.55
531	Real Estate	1,663	2,016	353	0.21
111	Crop Production	1,806	2,123	317	0.18
453	Miscellaneous Store Retailers	1,679	1,909	230	0.14
524	Insurance Carriers and Related Activities	1,330	1,553	223	0.17
337	Furniture and Related Product Manufacturing	4,368	4,584	216	0.05
487	Scenic and Sightseeing Transportation	365	571	206	0.57
312	Beverage and Tobacco Product Manufacturing	1,415	1,613	198	0.14
813	Religious, Grant-making, Civic, Professional, and Similar Orgs.	1,364	1,558	194	0.14
443	Electronics and Appliance Stores	1,367	1,561	194	0.14
711	Performing Arts, Spectator Sports, and Related Industries	713	887	174	0.24
221	Utilities	1,315	1,486	171	0.13
611	Educational Services	488	654	166	0.34
533	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	647	804	157	0.24
212	Mining (except Oil and Gas)	70	198	128	1.83
518	Data Processing, Hosting, and Related Services	409	532	123	0.30
445	Food and Beverage Stores	762	875	113	0.15

Appendix 1 Continued.

NAICS 3-digit	NAICS 3-digit Category Description	Employment 2011	Employment 2040	Absolute difference	Percent difference
451	Sporting Goods, Hobby, Musical Instrument, and Book Stores	483	581	98	0.20
486	Pipeline Transportation	153	246	93	0.61
622	Hospitals	384	467	83	0.22
511	Publishing Industries (except Internet)	847	928	81	0.10
923	Administration of Human Resource Programs	1,529	1,604	75	0.05
454	Non-store Retailers	422	478	56	0.13
446	Health and Personal Care Stores	384	429	45	0.12
623	Nursing and Residential Care Facilities	98	133	35	0.36
339	Miscellaneous Manufacturing	3,863	3,897	34	0.01
713	Amusement, Gambling, and Recreation Industries	100	132	32	0.32
483	Water Transportation	6	33	27	4.44
447	Gasoline Stations	168	188	20	0.12
551	Management of Companies and Enterprises	100	115	15	0.15
522	Credit Intermediation and Related Activities	50	58	8	0.16
112	Animal Production and Aquaculture	57	64	7	0.13
525	Funds, Trusts, and Other Financial Vehicles	31	36	5	0.17
448	Clothing and Clothing Accessories Stores	36	41	5	0.14
113	Forestry and Logging	6	11	5	0.81
114	Fishing, Hunting and Trapping	9	9	0	-0.02
325	Chemical Manufacturing	5,961	5,960	-1	0.00
115	Support Activities for Agriculture and Forestry	31	29	-2	-0.07
482	Rail Transportation	27	25	-2	-0.08
314	Textile Product Mills	541	461	-80	-0.15
512	Motion Picture and Sound Recording Industries	873	747	-126	-0.14
481	Air Transportation	651	484	-167	-0.26
316	Leather and Allied Product Manufacturing	1,250	1,077	-173	-0.14
313	Textile Mills	534	168	-366	-0.69
311	Food Manufacturing	12,372	11,734	-638	-0.05
335	Electrical Equipment, Appliance, and Component Manufacturing	2,268	1,477	-791	-0.35
331	Primary Metal Manufacturing	2,797	1,982	-815	-0.29
323	Printing and Related Support Activities	5,801	4,954	-847	-0.15
491	Postal Service	7,153	6,076	-1,077	-0.15
322	Paper Manufacturing	4,674	3,349	-1,325	-0.28
324	Petroleum and Coal Products Manufacturing	4,408	2,675	-1,733	-0.39
326	Plastics and Rubber Products Manufacturing	8,002	5,539	-2,463	-0.31
315	Apparel Manufacturing	2,656	67	-2,589	-0.97
492	Couriers and Messengers	10,104	6,975	-3,129	-0.31
334	Computer and Electronic Product Manufacturing	36,753	24,663	-12,090	-0.33
Total		493,120	600,741	107,621	0.218

Occupation Title	Employment 2011	Employment 2040	Absolute di	Median Wa	Typical Education Needed	Typical Work Experience
Construction laborers	4,847	7,181	2,335	$21.12	Less than high school	None
Heavy and tractor-trailer truck drivers	7,437	9,143	1,705	$22.47	Postsecondary non-degree award	None
Sales representatives, wholesale and manufacturing, except technical and scie	9,375	11,038	1,663	$29.16	High school diploma or equiv	None
Carpenters	3,513	5,144	1,631	$30.05	High school diploma or equiv	None
Office clerks, general	5,362	6,984	1,621	$18.26	High school diploma or equiv	None
Electricians	2,989	4,282	1,294	$37.75	High school diploma or equiv	None
Secretaries and administrative assistants, except legal, medical, and executive	3,353	4,542	1,189	$20.55	High school diploma or equiv	None
First-line supervisors of construction trades and extraction workers	2,474	3,660	1,186	$38.49	High school diploma or equiv	5 years or more
Bookkeeping, accounting, and auditing clerks	3,262	4,249	987	$21.90	High school diploma or equiv	None
Plumbers, pipefitters, and steamfitters	1,976	2,912	936	$34.53	High school diploma or equiv	None
Customer service representatives	3,701	4,494	793	$19.82	High school diploma or equiv	None
Operating engineers and other construction equipment operators	1,564	2,311	747	$34.27	High school diploma or equiv	None
Bus drivers, school or special client	1,290	2,031	741	$19.37	High school diploma or equiv	None
Automotive service technicians and mechanics	1,921	2,639	718	$23.96	High school diploma or equiv	None
Heating, air conditioning, and refrigeration mechanics and installers	1,214	1,793	579	$29.53	Postsecondary non-degree award	None
Painters, construction and maintenance	1,042	1,538	497	$23.23	Less than high school	None
Refuse and recyclable material collectors	771	1,204	433	$25.67	Less than high school	None
Cement masons and concrete finishers	902	1,332	430	$24.57	Less than high school	None
First-line supervisors of office and administrative support workers	1,209	1,529	321	$29.04	High school diploma or equiv	Less than 5 years
Roofers	664	981	317	$23.84	Less than high school	None
Bus drivers, transit and intercity	547	857	311	$26.76	High school diploma or equivalent	None
Sheet metal workers	766	1,057	290	$25.01	High school diploma or equiv	None
Automotive body and related repairers	598	864	266	$24.40	High school diploma or equiv	None
Sales representatives, services, all other	487	751	264	$29.04	High school diploma or equiv	None
Drywall and ceiling tile installers	537	793	256	$38.39	Less than high school	None
Bus and truck mechanics and diesel engine specialists	669	911	243	$29.66	High school diploma or equiv	None
Brickmasons and blockmasons	386	570	184	$30.81	High school diploma or equiv	None
Hazardous materials removal workers	326	509	183	$19.42	High school diploma or equiv	None
First-line supervisors of non-retail sales workers	731	894	164	$34.46	High school diploma or equiv	Less than 5 years
Parts salespersons	800	958	158	$18.62	Less than high school	None
Industrial truck and tractor operators	1,817	1,969	152	$21.65	Less than high school	None
Welders, cutters, solderers, and brazers	1,285	1,427	142	$22.21	High school diploma or equiv	None
First-line supervisors of mechanics, installers, and repairers	637	773	136	$37.15	High school diploma or equiv	Less than 5 years
Registered nurses	422	557	135	$62.15	Associate's degree	None
Order clerks	555	679	124	$18.44	High school diploma or equiv	None
First-line supervisors of retail sales workers	382	501	119	$20.70	High school diploma or equiv	Less than 5 years
Bill and account collectors	167	277	110	$20.77	High school diploma or equiv	None

Appendix 3. Employment levels of industrial block groups, highlighting in darker pink the block groups considered "core areas" for the purposes of calculating VMT levels.