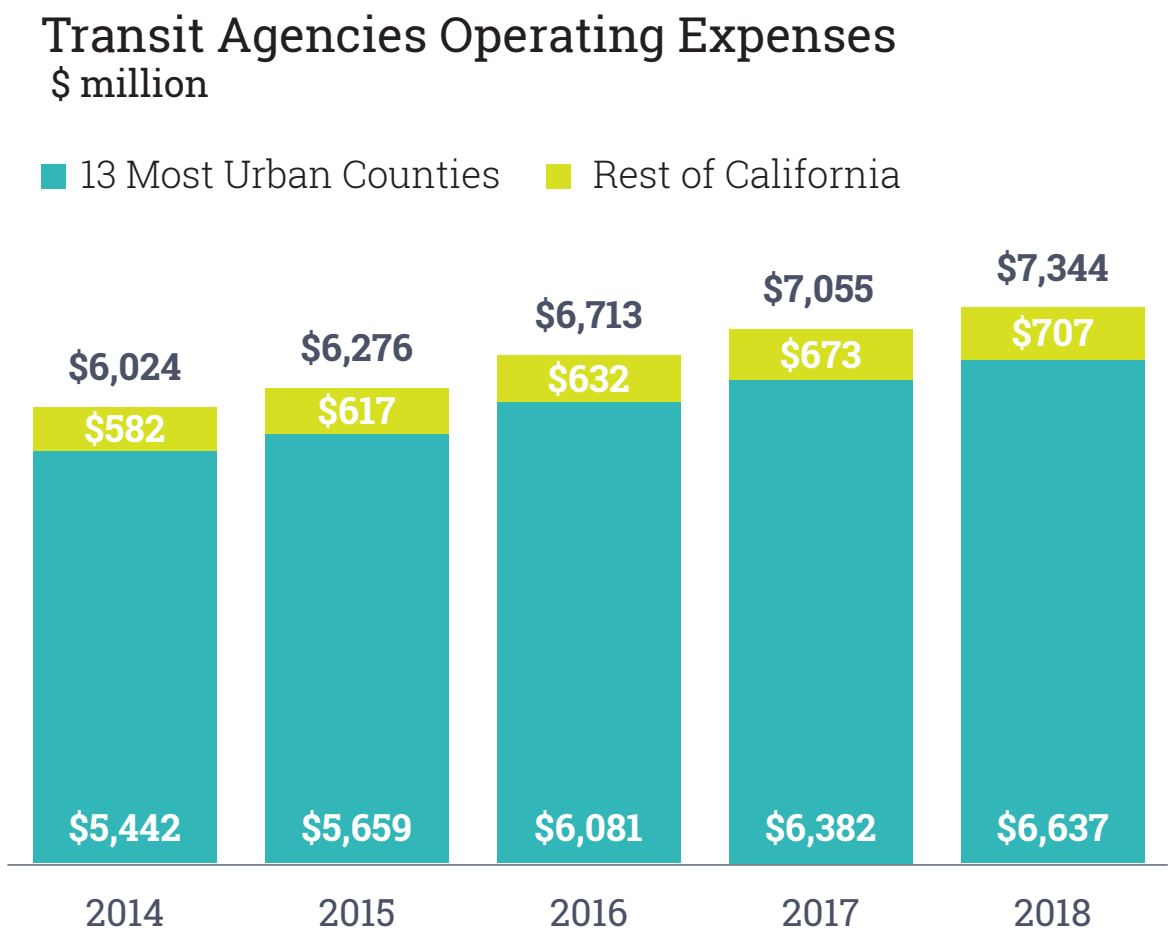
CALIFORNIA'S TRANSIT IS CONCENTRATED IN THIRTEEN COUNTIES

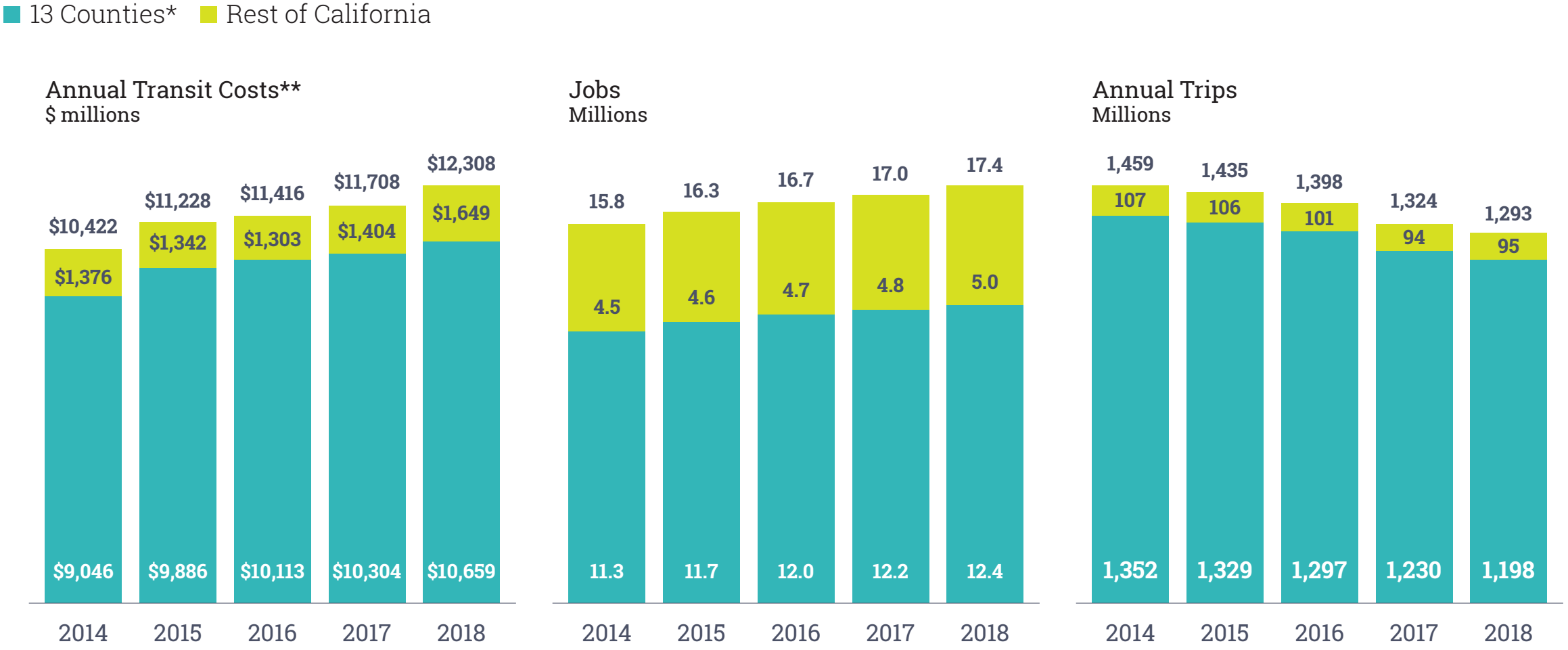
The state legislature favors transit-oriented development (TOD) as the greenest way to house the next generation of Californians. Ninety percent of the state's transit is concentrated in the thirteen most urban counties, hence they have become the focus of the latest state housing bills. Transit expense in these counties has increased by almost 20% in three years.



Source: Federal Transit Administration, National Transit Database 2014 to 2018.
* Counties selected as most urban based on a) the percentage of population living in urban area, b) population size and c) population density (see end notes)

TRANSIT COSTS INCREASED EVEN AS RIDERSHIP DECLINED

Even though transit expenses (operating and capital) increased steadily between 2014 and 2018, and even though more than a million new jobs were added in those same four years, transit ridership has continued to decline year over year.



Source: Federal Transit Administration, National Transit Database 2014 to 2018; Bureau of Labor Statstics QCEW 2014 to 2018

* 13 Counties - selected as most urban based on a) the percentage of population living in urban area, b) population size and c) population density (see end notes).
Alameda, Contra Costa, Los Angeles, Marin, Orange, Sacramento, San Diego, San Francisco, San Mateo, Santa Clara, Solano, Sonoma, Ventura

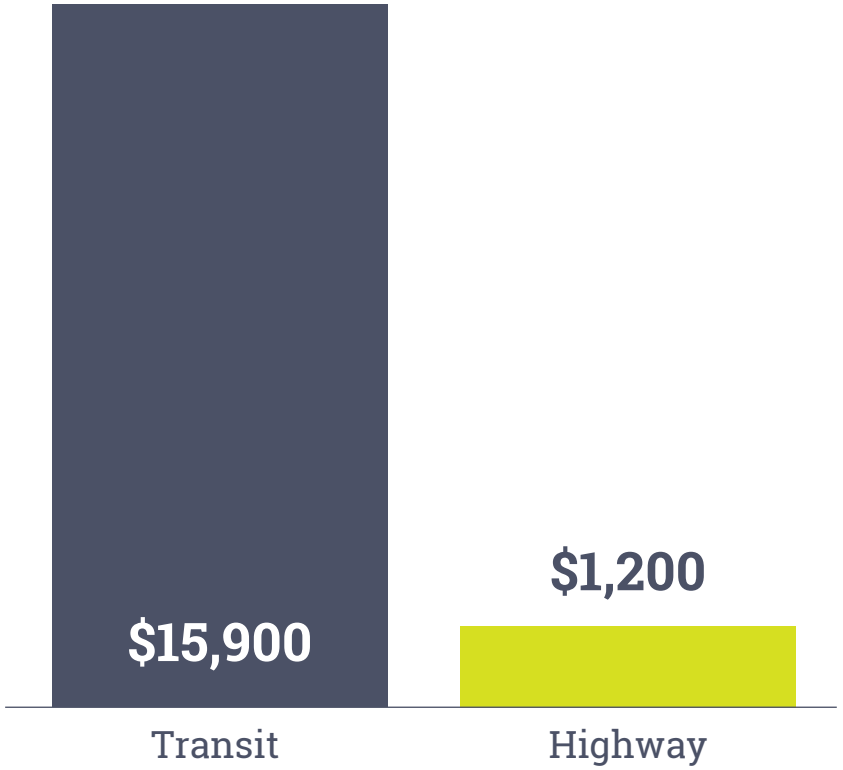
** Annual Transit Costs come from the National Transit Database and include operating expense, capital expense, and interest expense but do not include depreciation or amortization (see end notes)

THE INCREASE IN TRANSIT COST HAS BEEN SUBSIDIZED BY LOCAL GOVERNMENT

Despite this trend away from transit, California spends more than ten times the amount on a transit commuter as a driver. As transit costs have increased, the increased burden of funding transit has fallen to local government.

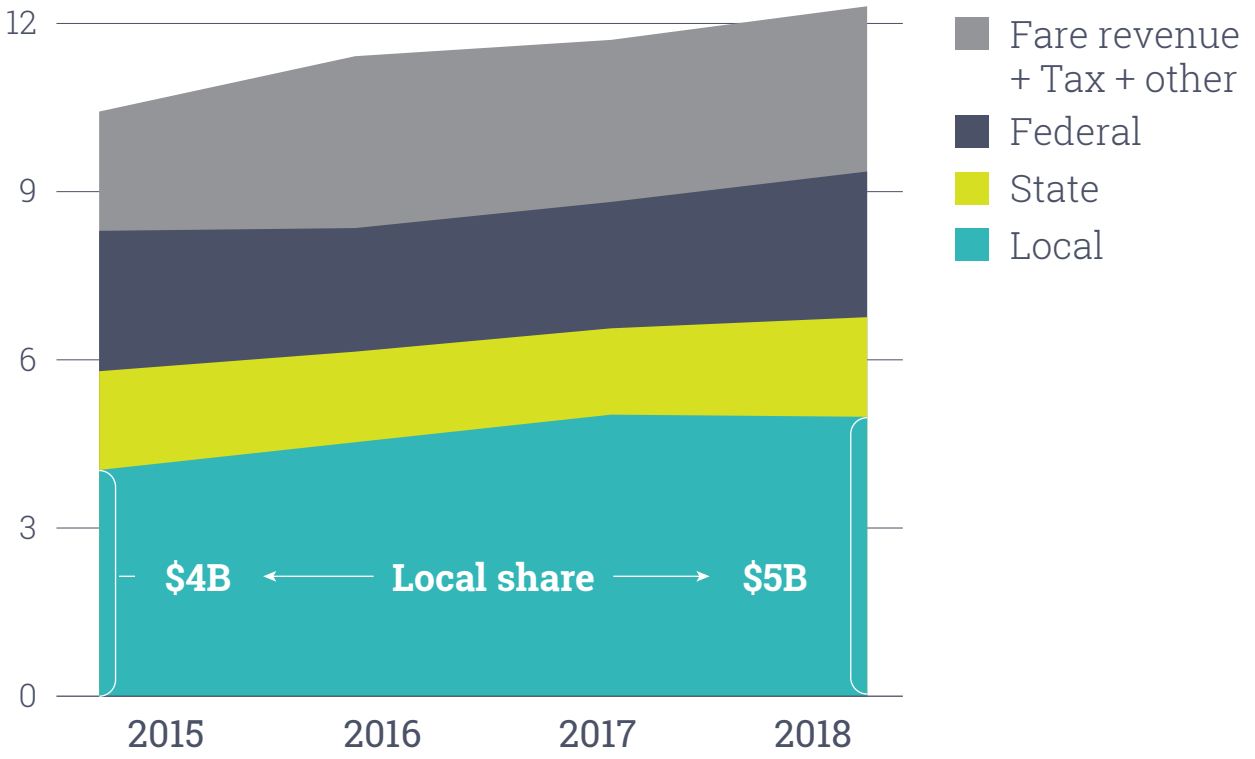
Expense per Commuter

2016



Transit Agency Subsidy

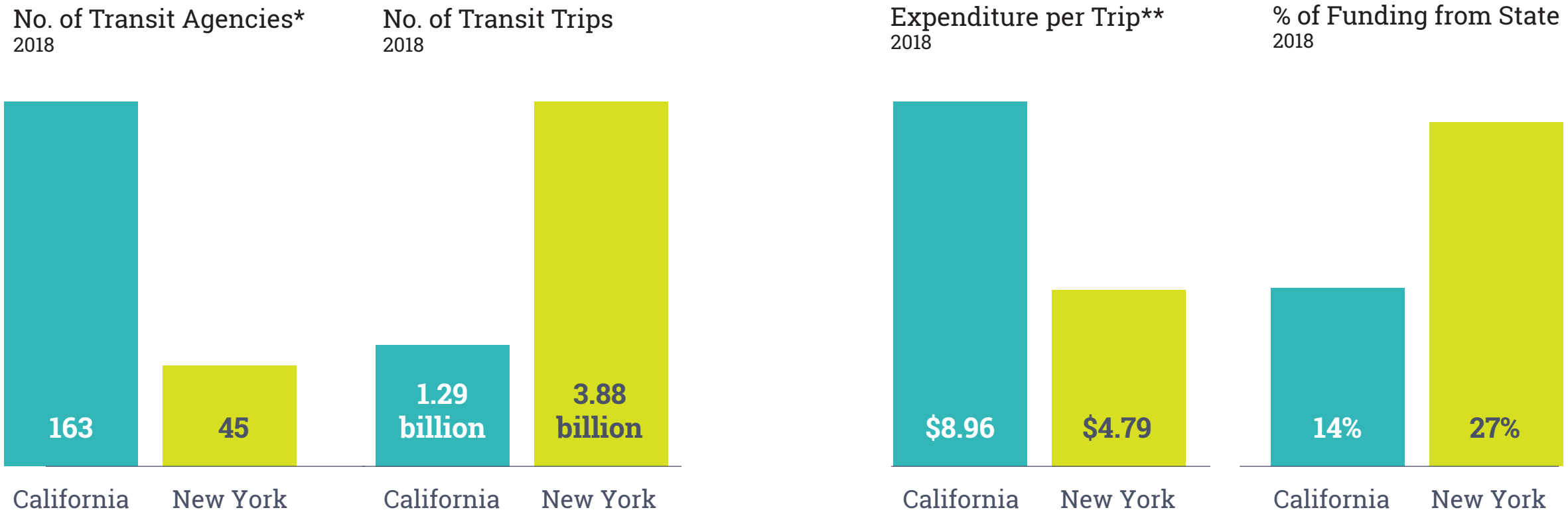
$billion



Source: Bureau of Transportation Statistics—State Transportation by the Numbers and Urban Transit Ridership by State and Mode, National Transit Database: Funding Summary Tables (2014 to 2018)

TRANSIT COSTS MORE IN CALIFORNIA, IN PART BECAUSE OF AGENCY OVERHEAD

Managing transit costs in California seems to be particularly challenging. California has three times as many transit agencies as New York, yet we have only 33% of the number of trips. Not surprisingly California's expenditure per trip is almost twice that of New York. Interestingly their transit agencies receives significantly more state funding.



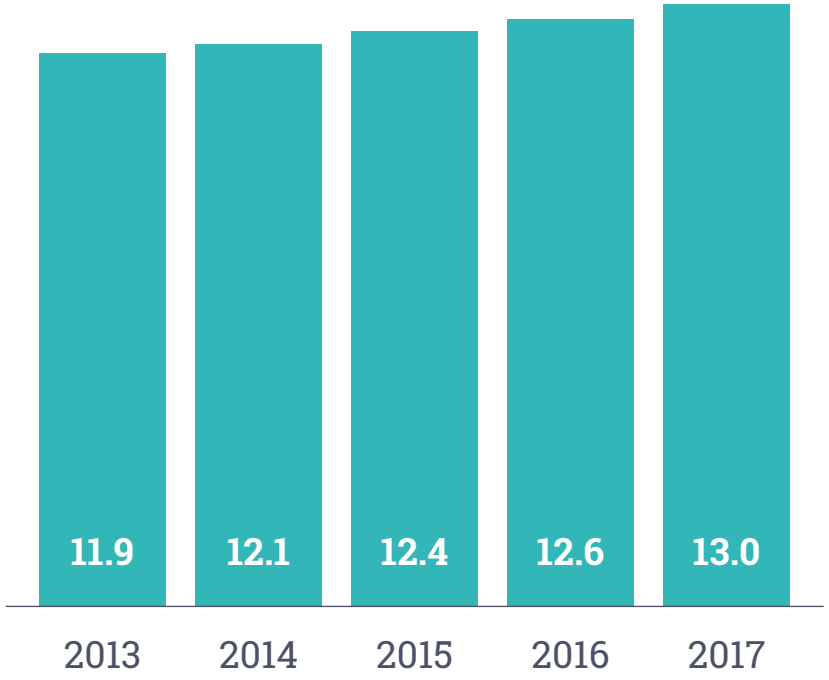
Source: Federal Transit Administration, NTD 2018 Metrics, summary tables; Bureau of Transportation Statistics, State Transportation Statistics : Urban Transit Ridership by State and Mode and State Transportation by the Numbers
* Includes only the number of transit agencies with reporting obligation to the Federal Transit Administration; ** Includes Operating and Capital Funding

THE DECLINE IN RIDERSHIP HAS BEEN ACCOMPANIED BY A RISE IN AUTO

As transit ridership declined, the number of commuters driving alone, not surprisingly, increased. Even as the rest of the world appears to have passed 'peak car,' in California we are seeing car ownership per household and vehicle miles traveled per household continue to climb.

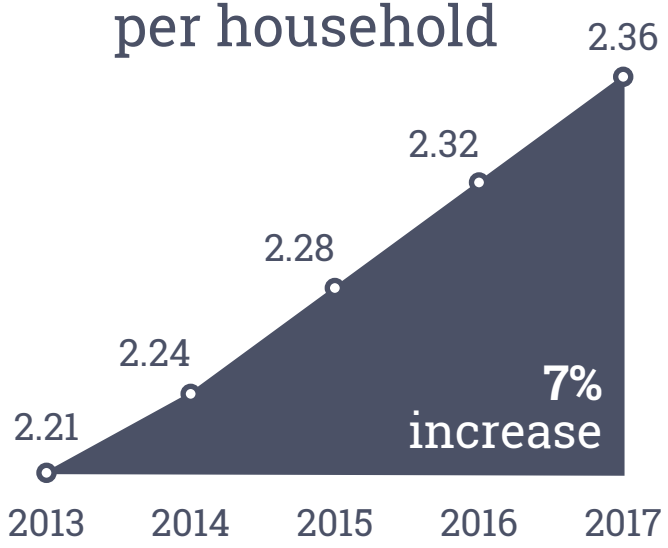
Commuters Driving Alone

California, millions



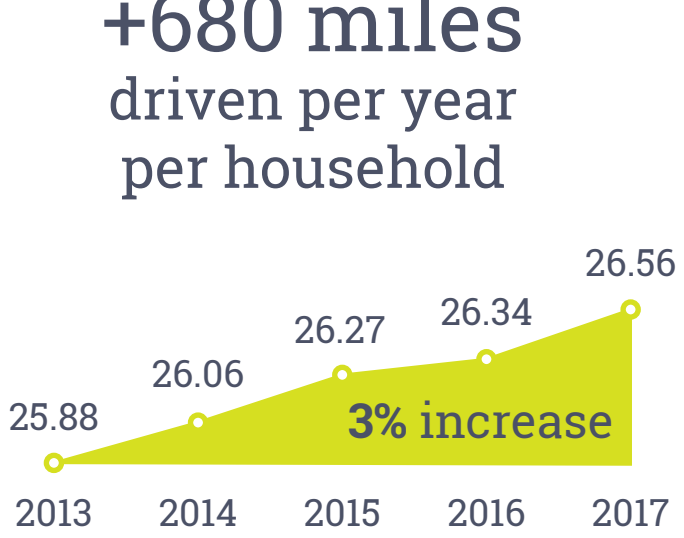
Cars per Household*

California, thousand miles



Annual VMT per Household

California, thousand miles



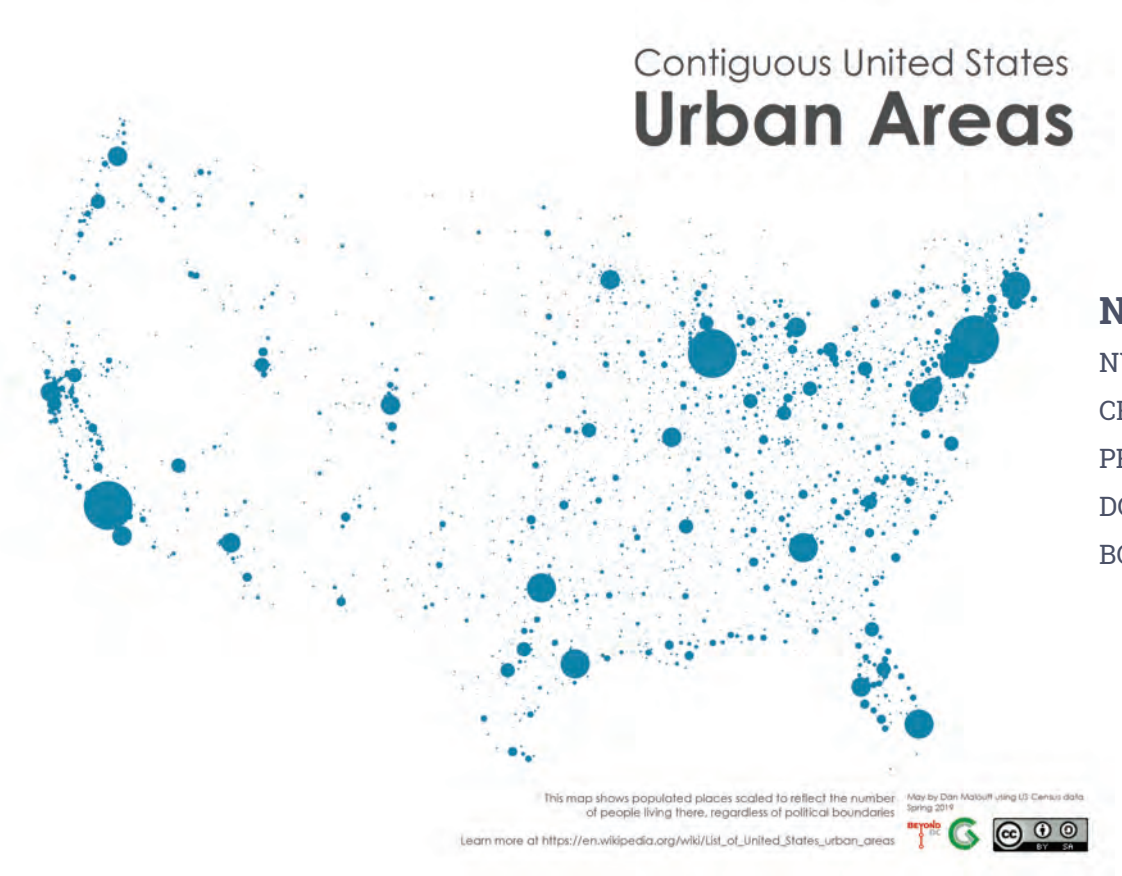
Sources: American Community Survey 5-year (2013–2017); Federal Highway Administration: Highway Statistics Series: State Tables 2014 to 2017; Bureau of Transportation Statistics—State Transportation by the Numbers, Urban Transit Ridership by State and mode, California DMV—The Future of California Transportation Revenue.

OUR TRANSIT CHALLENGE IS BETTER UNDERSTOOD BY COMPARING URBANIZED AREA PERFORMANCE

The Federal Transit Administration collects transit agency performance data, and reports by agency, state and Urbanized Area (UZA). UZAs are determined by the the U.S. Census Bureau based on population density. There are 498 UZAs in the United States. Of the top 50 UZAs (based on population density), 35 are in California. The UZA is an important geographical unit as it is used by various government agencies in their funding formulas. For example, the U.S. Department of Transportation determines federal aid for transit and transit planning based on the size and density of an Urbanized Area. The acronyms below will be used in all graphics to follow.

California's most populous UZAs

LAU Los Angeles-Long Beach-Anaheim
SFU San Francisco-Oakland
SDU San Diego-Carlsbad
RIU Riverside-San Bernardino
SJU San Jose



National UZAs with highest transit use*

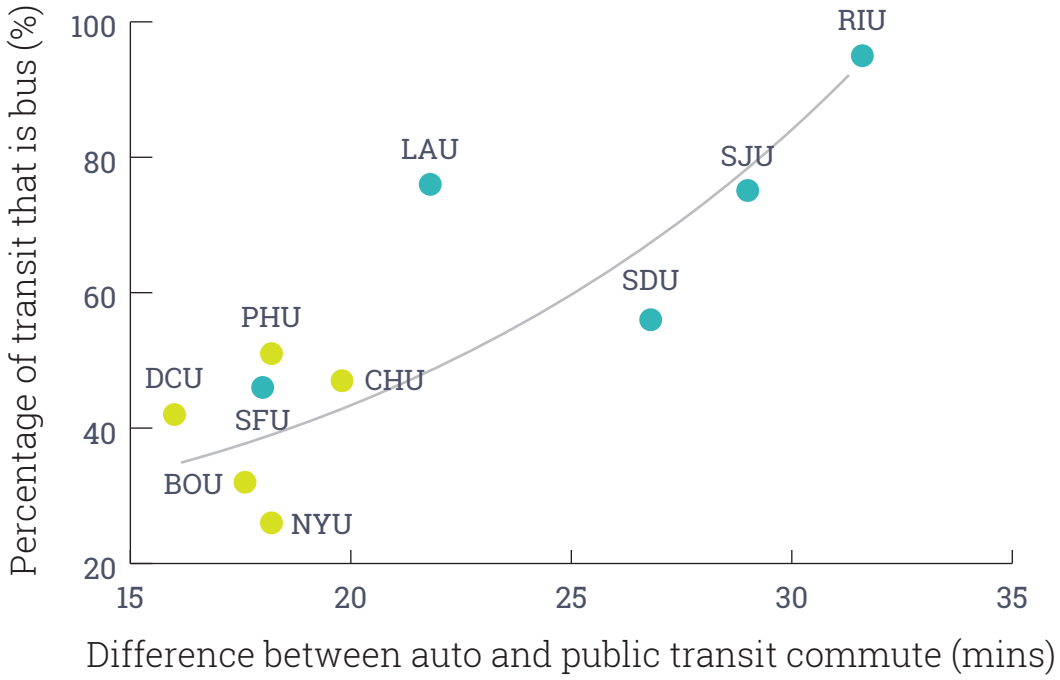
NYU New York-Newark NY-NJ-CT
CHU Chicago IL-IN
PHU Philadelphia PA-NJ-DE-MD
DCU Washington DC-VA-MD
BOU Boston MA-NH-RI

* 'Best-used transit' is based on number of unlinked passeneger trips per population served.
Source: American Community Survey (2013-2017); Map https://ggwash.org/view/71944/map-of-us-uas-urban-areas-vs-cities-really-are-compare-population;

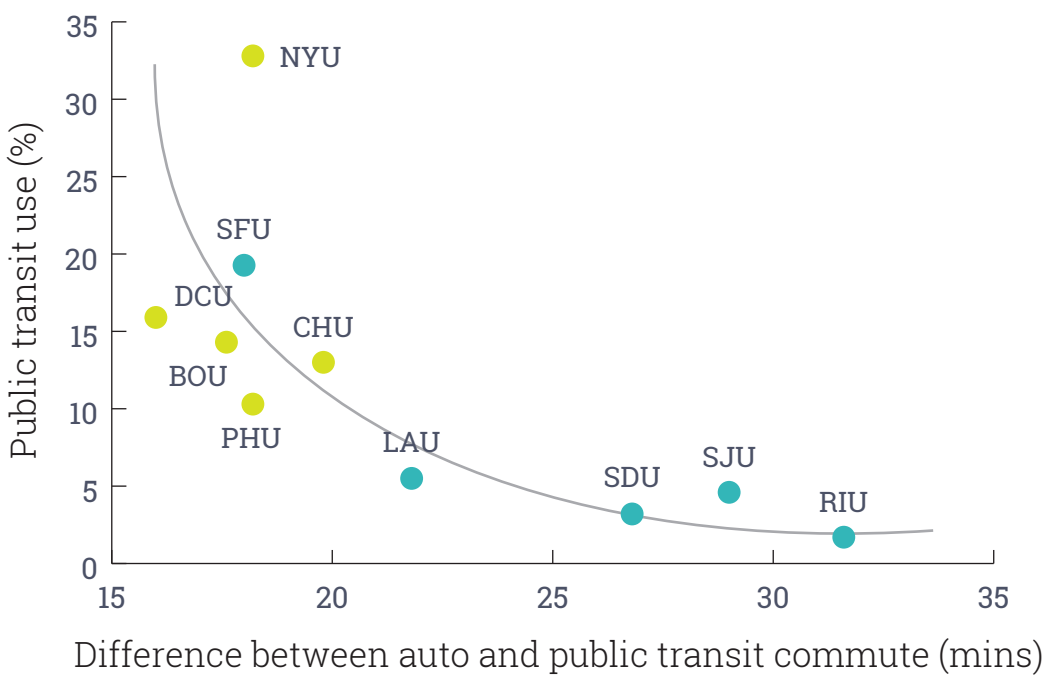
CALIFORNIA'S BUS-CENTRIC TRANSIT CAN'T COMPETE WITH AUTO

Except for the San Francisco-Oakland UZA, California's public transit skews towards buses rather than rail. Bus-centric transit times struggle to compete with driving times because buses are caught up in the same congestion, have to make stops, and do not necessarily take the most direct route. Not surprisingly, public transit use decreases as the time penalty for using transit increases, as we see below in SJU (San Jose).

Dependence on bus increases spread between auto and transit commute times



Transit use falls as the spread between auto and transit commute times widens

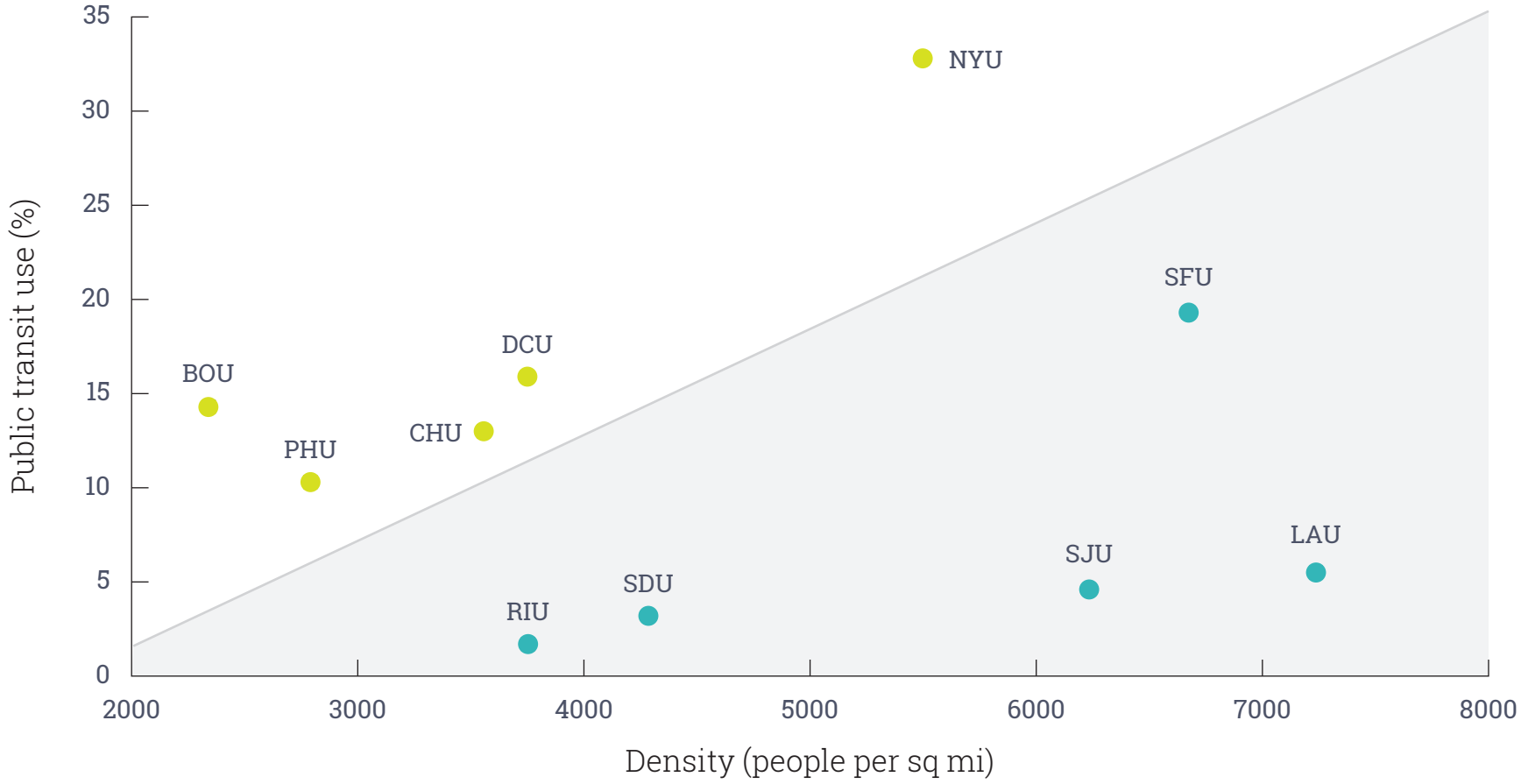


Source: Federal Transit Administration: National Transit Database (2017); American Community Survey 5- year (2017): Commuting to work
* NTD data were used to determine the Urbanzied Area for each agency. In the very few cases although the agency serves multiple Urbanized areas, its trips and modes accrue only to the primary Urbanized Area

DESPITE OUR DENSITY, TRANSIT USE IS COMPARATIVELY LOW

Higher density is often thought to be a condition for better transit, theoretically producing higher use. However, California already has some of the most dense UZAs in the country, yet still ridership falls below many less dense UZAs in the country. In California, only San Francisco-Oakland is competitive.

Urbanized areas: Public Transit Use vs. Density



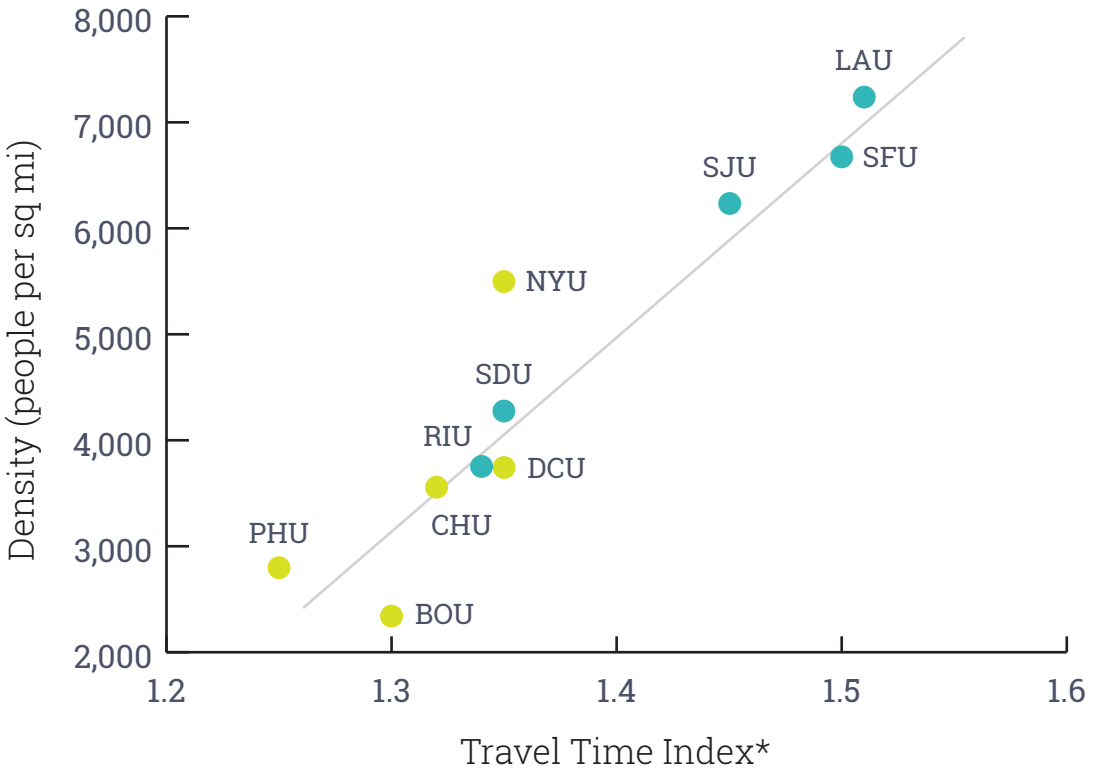
Source: American Community Survey 5-year (2017), Federal Transit Administration, National Transit Database UZA Sums 2017.

DENSITY INCREASES CONGESTION, BUT CONGESTION DOESN'T ENCOURAGE TRANSIT USE

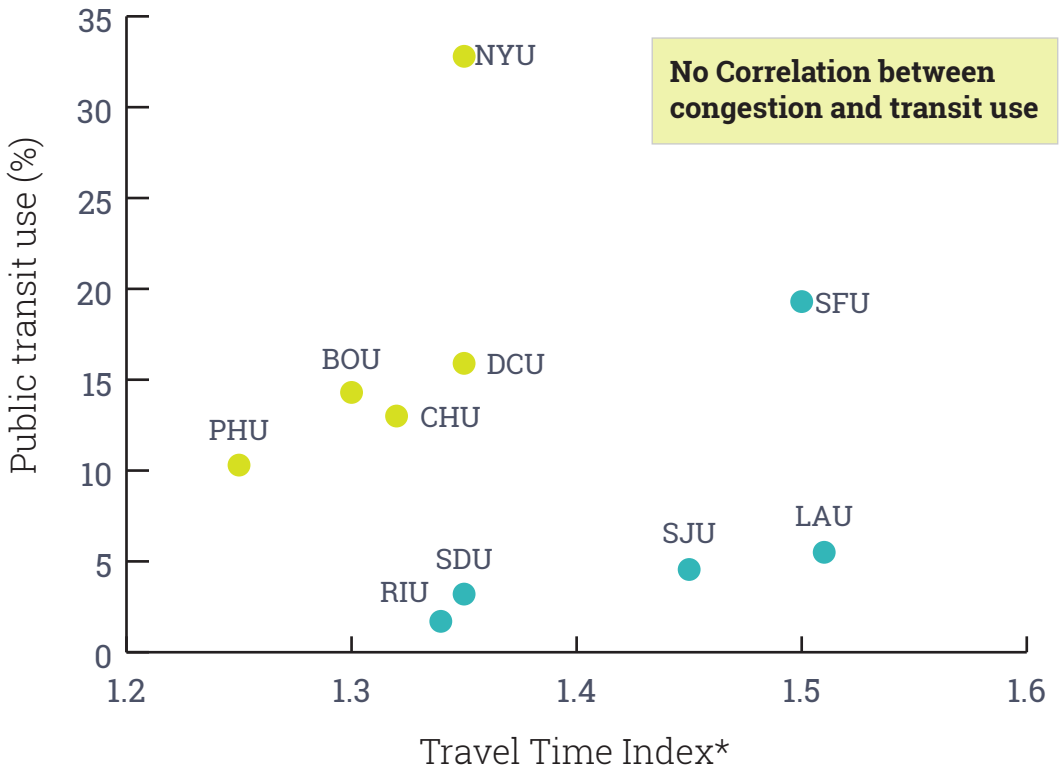
There is no suggestion in leading data sources that congestion and slow travel times cause people to choose transit.

■ California UZAs ■ Non-CA UZAs

Impact of density on congestion



Transit use vs. Congestion

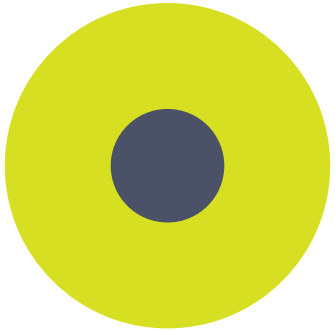


Source: American Community Survey (2017), Federal Transit Administration NTD UAZ Sums (2017); Texas A & M Transport Institute's Urban Mobility Report
* TTI refers to Texas A& M Travel Time Index which is a 'comparison between the travel conditions in the peak period to free-flow conditions

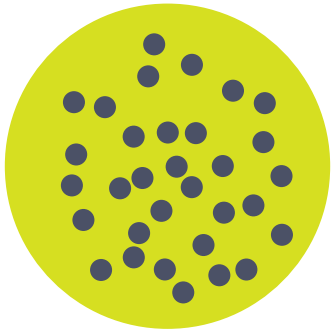
ONE FACTOR THAT APPEARS TO PREDICT HIGHER TRANSIT USE IS JOB DENSITY

Older more established Urban Areas have built up around very dense cores where jobs are concentrated. Ridership seems to be less a function of housing density and more a function of job density, but very focused job density at the core of the Urbanized Area. Other than San Francisco-Oakland, where transit use is competitive, California's other Urbanized Areas have far more job dispersion.

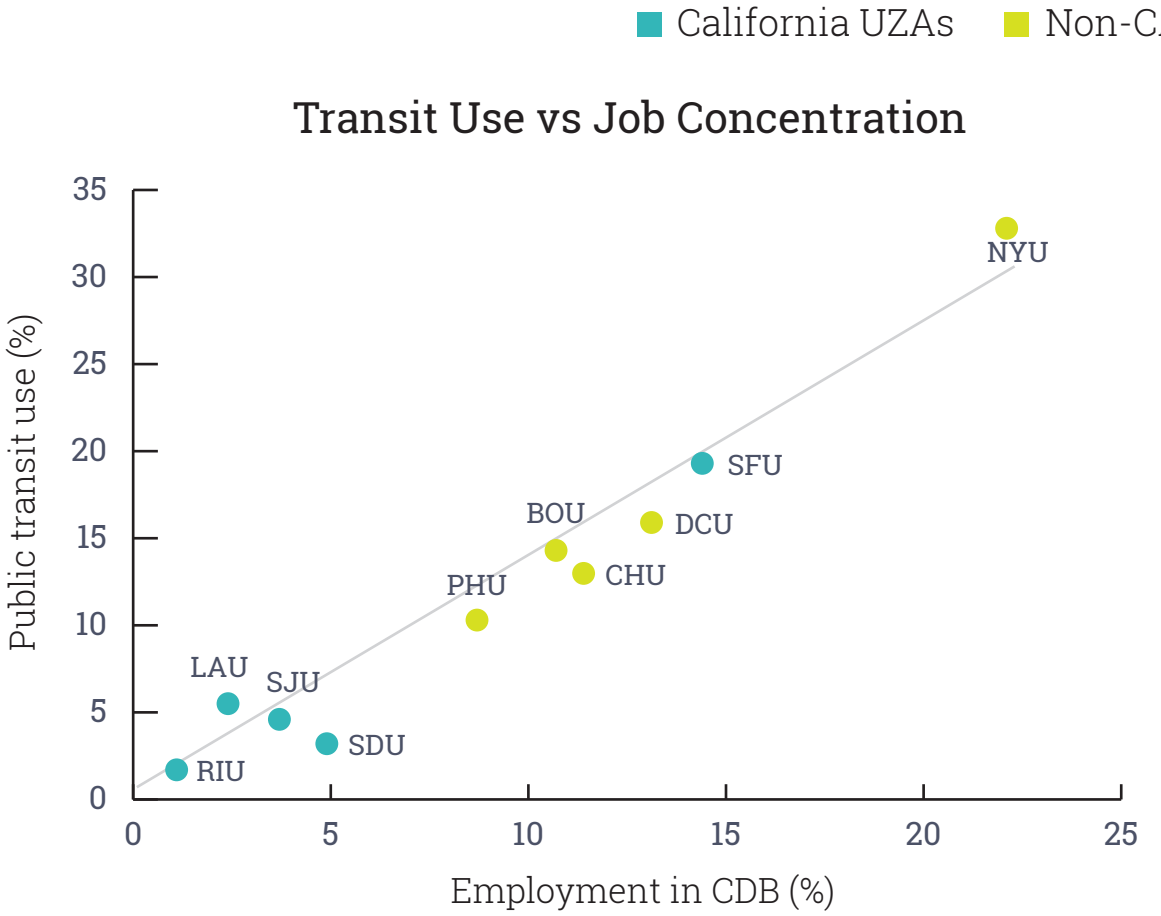
Job concentration



Concentrated core,
e.g., New York



Dispersed job market,
e.g., Los Angeles

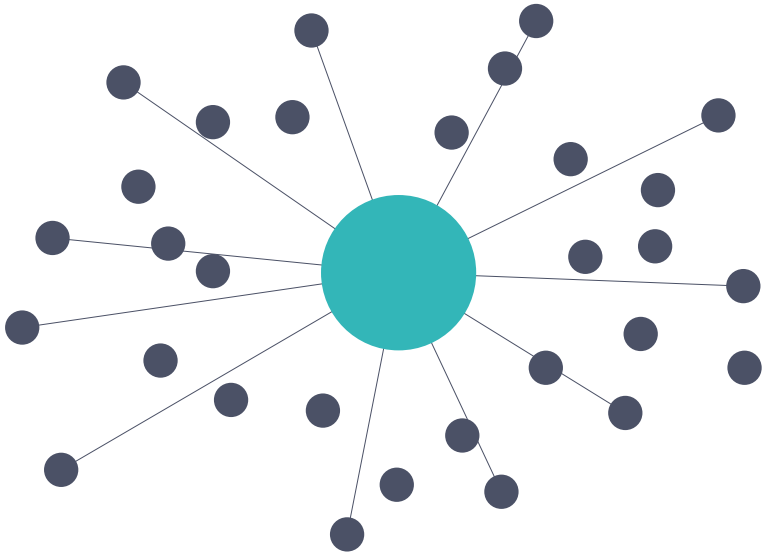


Source: American Community Survey (2013–2017):Commuting Modes; Demographia: Percent of Metropolitan Statistical Area Employment within the Central Business District (CBD)

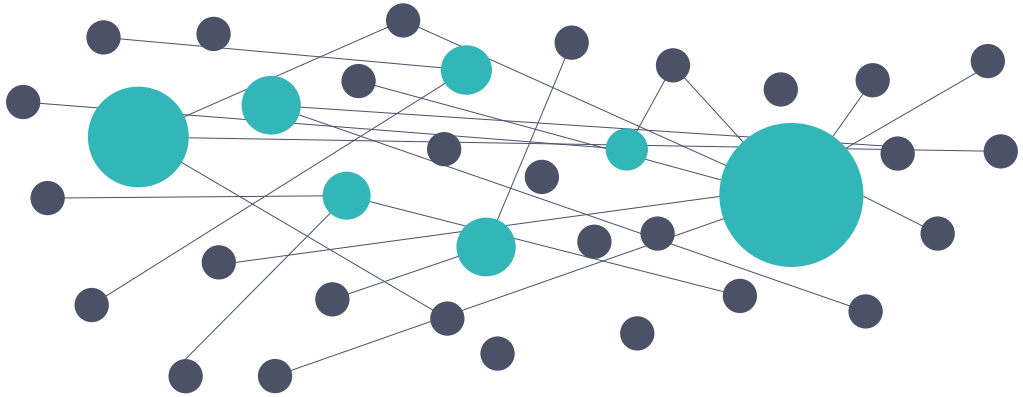
CALIFORNIA'S JOB DISPERSON EXACERBATES THE TRANSIT CHALLENGE

The challenge for California remains that 84% of commuters are still driving cars—in part because they can't get to where they need to go using transit. California's Urbanized Areas have many job centers scattered throughout, creating a more complex transit puzzle to solve. It is easier to optimize transit solutions when jobs are concentrated in major job centers and higher volume routes make rail a practical option.

Transit works best in a many-to-one universe



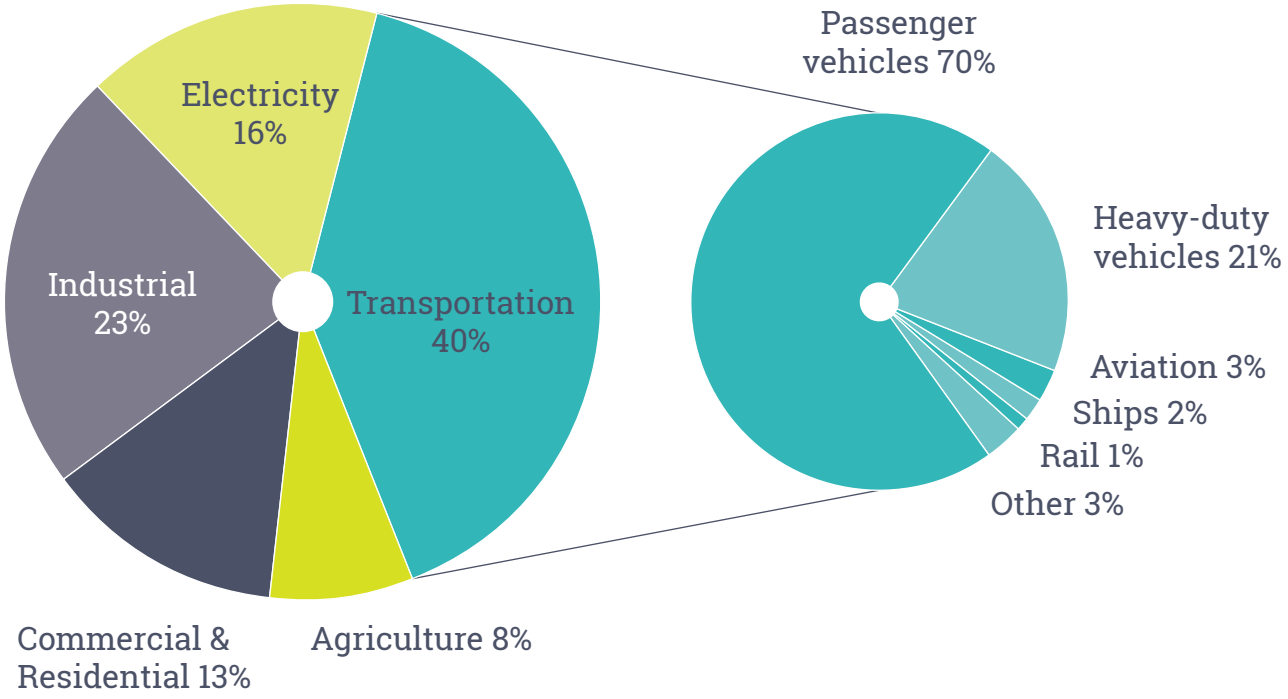
California has a many-to-many problem



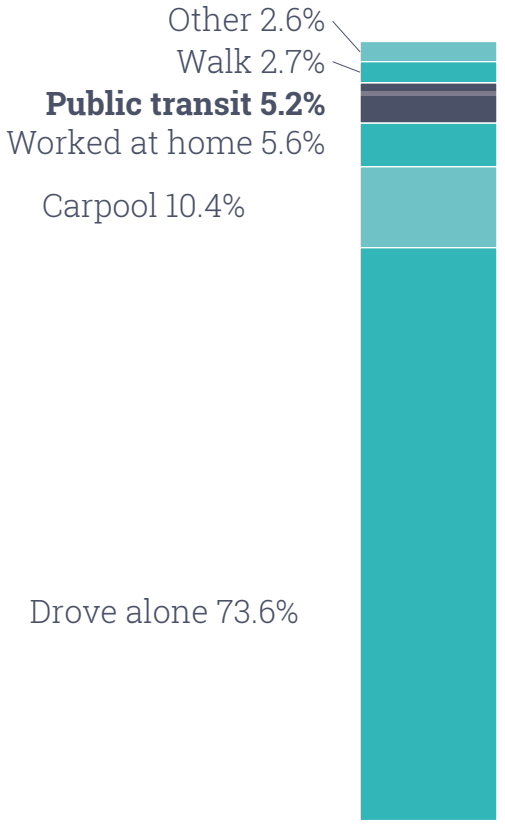
JOB DISPERSON CREATES THE CHALLENGE OF SINGLE OCCUPANCY COMMUTERS

Without efficient transit solutions, commuters resort to their cars. Passenger vehicles represent the lion's share of transportation emissions in California. They represent the greatest challenge but also perhaps the greatest opportunity.

Greenhouse Gas Emissions



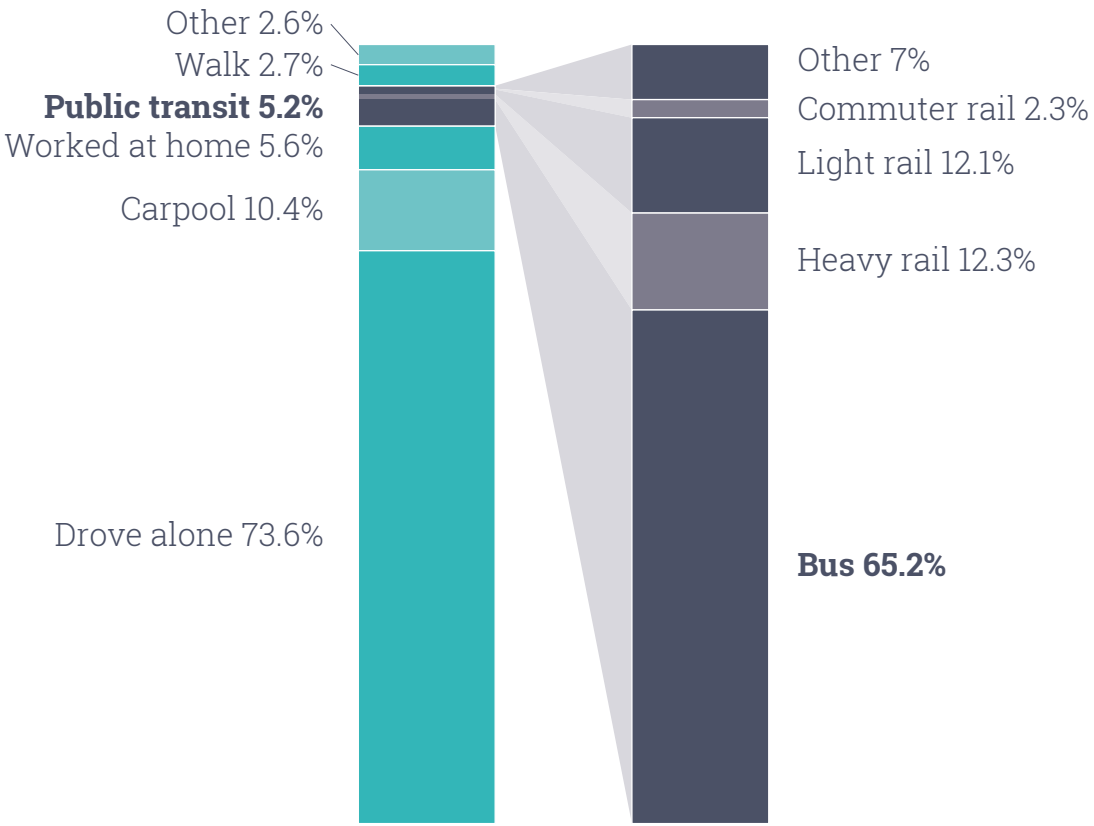
Commute Mode Share

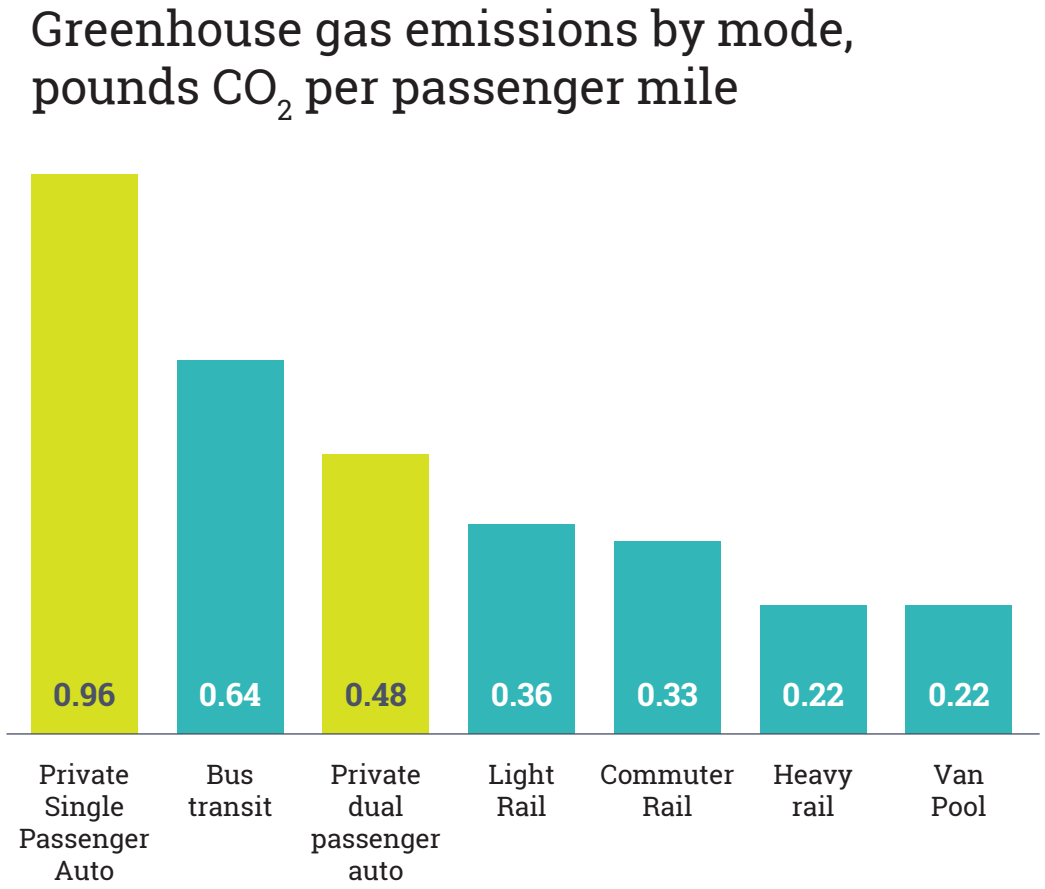


Source: US Department of Transportation, Federal Transit Administration; Legislative Analyst's Office :"Assessing Califronia's Climate Policies - Transportation" December 2018; American Community Survey 5-year (2017)

ADDING ONE MORE PASSENGER MAKES CAR EMISSIONS COMPETITIVE WITH TRANSIT

Everyone is focused on transit, but despite funding to the tune of more than $12 billion/year transit only represents 5% of commuters in California. Of those, almost two-thirds ride buses. **Interestingly, it takes only one passenger for auto to become more environmentally friendly than buses and competitive with rail.**





Source: US Department of Transportation, Federal Transit Administration; American Community Survey 5-year (2017), State Transportation Statistics, 2017 Table 4–3. U.S. Department of Transportation, Research and Innovation Technology Administration, Bureau of Transportation Statistics

CALIFORNIA'S BIGGEST GHG OPPORTUNITY MAY BE CARPOOLS NOT TRANSIT

What if the biggest impact on green house gas emissions lay in incentivizing carpooling among the 74% of commuters who drive alone? Paying SOV commuters to participate ($50 a week to drive, $20 a week to be a passenger) is cheaper than expanding transit solutions and has a better pay-off. Tripling train ridership would require a significant investment in rail miles and capacity. Tripling bus ridership requires dedicated bus lanes to ensure buses are competitve with or superior to auto.

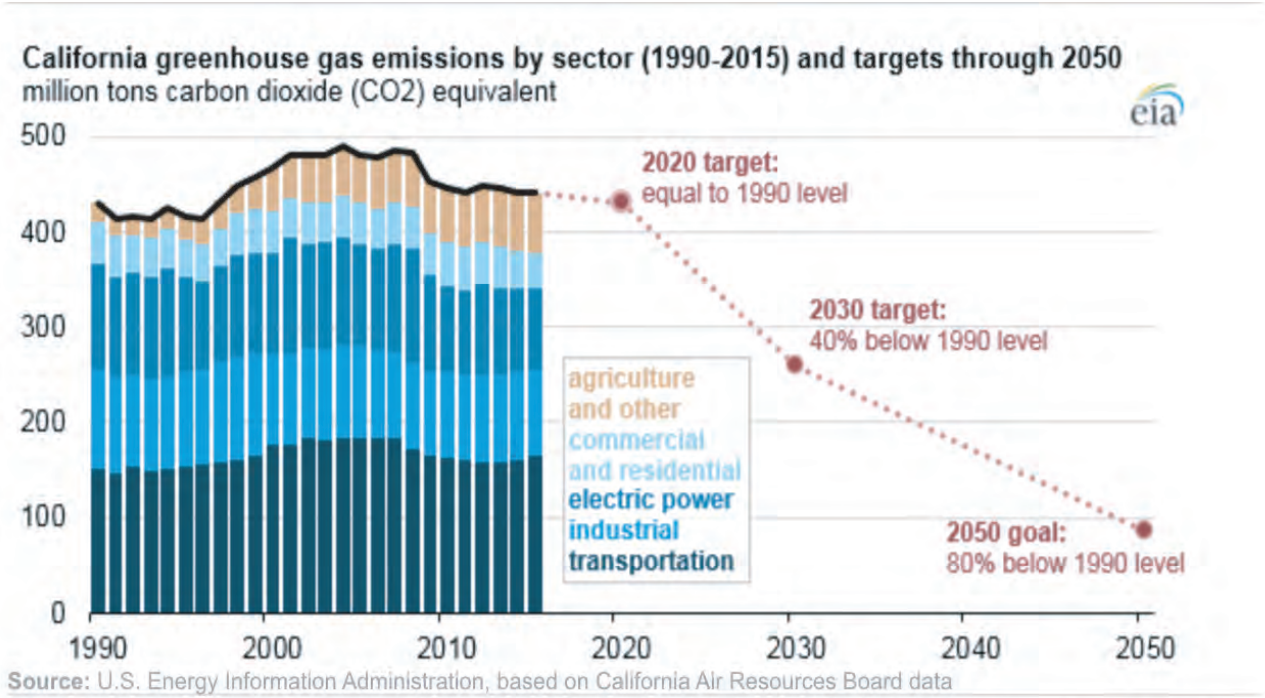
Finally, while we wait for better transit solutions the state should keep in mind that it is job density not housing density that is correlated with higher transit use.

Reduction Strategy	No. of Commuters Influenced*	No. of Annual Auto Trips Saved*	Change in GHG/mile*	+$/yr, time to Implement*	GHG Reduction
Triple Train ridership	0.45M	216M	0.96 to .33	$10B/10yr	0.93 M tons
Triple Bus Ridership	1.2M	576M	0.96 to .64	$2B/5yrs	1.66M tons
Incentivize 10% of SOV Commuters to Carpool	1.3M	312M	0.96 to 0.48	$1.8B/1yr	1.95 M tons
Encourage 20% of SOV commuters to telecommute 1 day/ week	2.5M	242M	0.96 to 0	$0.01B/1yr	1.74 M tons

* See Endnotes for more detail

OUR REDUCTION GOALS ARE AMBITIOUS. THE STATE CAN'T WAIT FOR TRANSIT TO IMPROVE

Encouraging 10% of SOV commuters to carpool and 20% of commuters to telecommute once a week, would reduce carbon emissions by around 4 million tons a year. That represents 30% of the statewide carbon emissions across all sectors in 2016.



In July 2017, California's state legislature passed assembly bill (AB) 398 to reauthorize and extend until 2030 the

The goal is to reduce CO_2 emissions by approximately 170 million tons by 2030

4 million tons may seem like a small contribution, but it's more than double what's possible if we increase statewide transit use to San Francisco levels. More importantly it won't take 10 years and cost $10billion a year to get there.

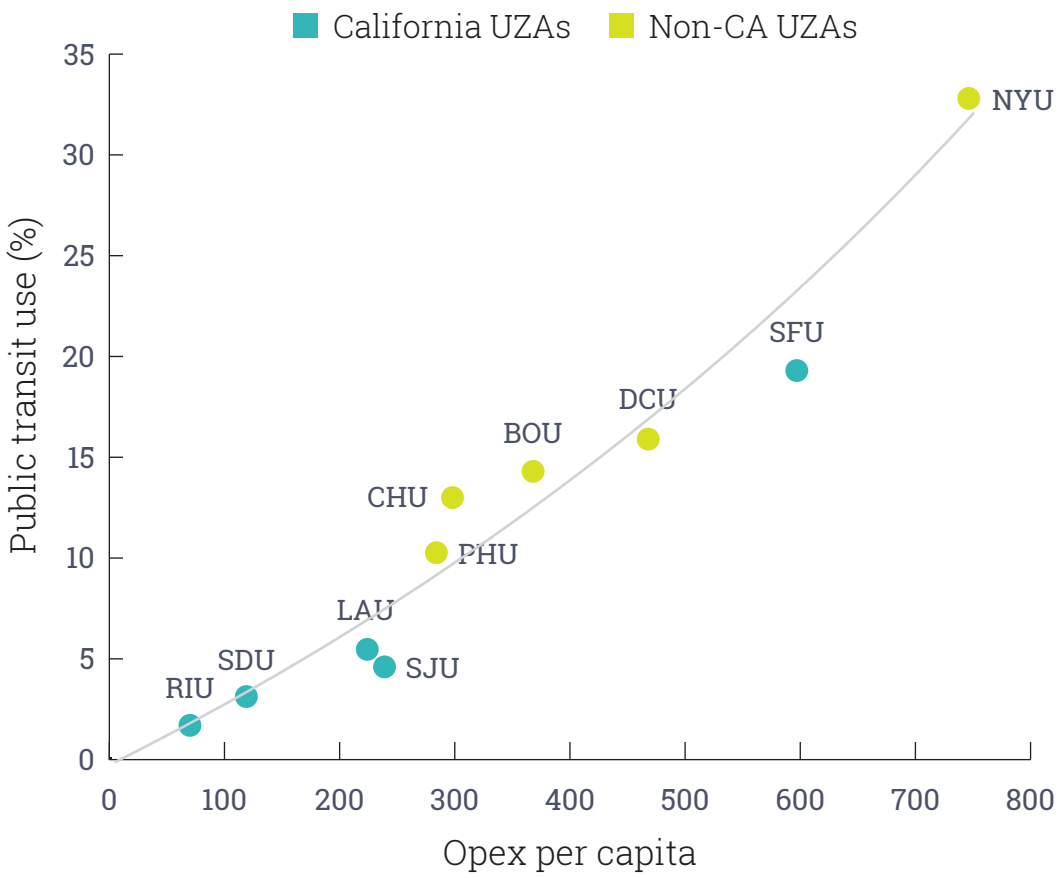
Given that emissions in the transportation sector are rising not falling, a 4 million ton reduction would be a significant turn around.

We've assumed $5 to $10 a day would incentivize higher levels of carpooling, but perhaps there are other opportunities for incentives like more dedicated carpool lanes, stricter enforcement of carpool lanes or free parking for carpoolers.

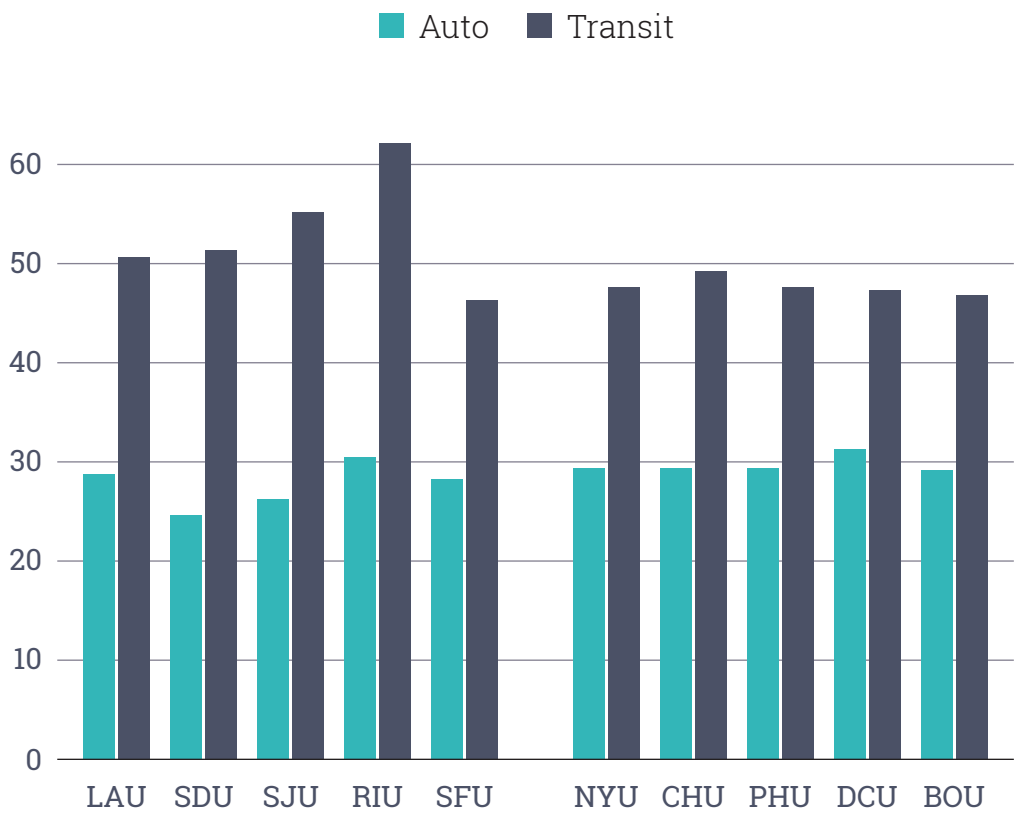
Source: U.S. Energy Information Administration: "California plans to reduce greenhouse gas emmisions 40% by 2030" Feb 2018

APPENDIX

Spending per Capita and Transit Use



Auto Commute Minutes vs. Transit Commute Minutes



ENDNOTES

Page 1

13 Most Urban Counties
Counties were selected as most urban based on absolute population, population density and the percentage of the county population living in urban areas based on data from the American Community Survey 5-year (2017). The 13 counties are Alameda, Contra Costa, Los Angeles, Marin, Orange, Sacramento, San Diego, San Francisco, San Mateo, Santa Clara, Solano, Sonoma, Ventura. An exception was made for Sonoma county. It had less than 90% of its population living in an urban area but was included because it is one of the Nine Bay Area counties.

Transit Agencies Operating Expense: From the FTA'a National Transit Database

Page 2

Annual Transit Costs and Annual Individual Trips
From the National Transit Database. The annual transit costs include operating expenses and capital expenses reflecting interest expense but excluding depreciation and amortization.

Jobs: from the CA Employment Development Department -QCEW county level data. These data provide a count of workers covered by unemployment insurance as derived from quarterly tax reports submitted by employers subject to state unemployment insurance laws. The data excludes members of the armed forces, self-employed, domestic workers and unpaid family workers. The Bureau of Labor Statistics publishes this data quarterly at all geographic levels.

Page 3

Expense per Commuter: From the Bureau of Transportation Statistics: State Transportation by the Numbers https://www.bts.dot.gov/sites/bts.dot.gov/files/legacy/California.pdf
CA expenditure on Highways (2016): $17,669 Million
CA expenditure on Transit (2016): $13,509 Million

Commuters by Mode:
CA Employment (2017) = 17M
Auto commuters (2017) = 73.9 + 10 = 84.8% = 14.4 M
Public Transportation commuters (2017) = 5% = .85

Transit Agency Subsidy.
Breakdown of federal, state and local subsidy, as well as fare and tax revenue are from the FTA's National Transit Database (2014 to 2018) - Funding Sources - Summary Tables=

Page 4:

No. of Transit Agencies

FTA's National Transit Database - Annual Database Agency Information (2018)

The number includes all transit agencies in Urbanized Areas that report to the FTA . It does not include agencies outside Urbanized Areas. A further 64 agencies in California and 18 agencies in NY outside these Urbanized Areas also reported to the FTA.

No. of Transit Trips
FTA's National Transit Database - Metrics (2018)

Expenditure per Trip
Federal Transit Administration: National Transit Database Data Reports:
2017 Metrics: Summary Tables

2018 Operating expenses:	California $7,360 M,	New York $13,121M
2018 Annual Unlinked Passenger Trips:	California 1,293 M,	New York 3,883 M
2018 Capital Expenses :	California $ 4,225 M,	New York $5,466 M
2018 Expenditure per Trip:	California = $8.45,	New York = $4.29

% of Funding from State - FTA's National Transit Database - Funding Sources (2018)

Page 5:

Commuters Driving Alone: American Community Survey (2013 to 2017) Commute Mode
Annual VMT per Houshold: **VMT** - Federal Highway Administration FHWA Highway Statistics Series, State Tables 2014 to 2017. Verified in the Bureau of Transportation Statistics: State Transportation by the Numbers; **No. of Households: -** California Department of Finance, Demographic Research Unit, Table E5
Cars per Household: California's DMV Forecasting Unit, Vehicle Registrations (2012–2017) as part of The Future of California Transportation Revenue by Wachs, King & Agrawal (2018); MTI for the State of California.On page 54 in the Appendix, Methodological Details.

"We assume vehicle registrations in California will continue to increase annually by 639,445, which is the mean annual change in the number of vehicle registrations between 2012 and 2017." This number is consistent with recent publications re vehicle registrations published by the DMV.

Page 6:

California's most populous UZAs: Urbanized Areas are geographical areas defined by the Census. The five California UZAs were chosen based on population and population density. There were other more dense UZAs than San Diego and Riverside, but none as large in population.

ENDNOTES continued

National UZAS with highest transit use
Selcted based on the number of unlinked passenger trips per population served. Data are from the Federal Transportation Administration's NationalTransit Database 2017 UZA Sums.

Page 7:

Dependence on Bus Increases Spread Between Auto and Transit Commutes
Transit mode share is established using data from the National Transit Database. NTD designates a primary Urbanized Area population for each agency. In a very few cases an agency may serve two UZAs and in such a case the transit performance numbers accrue to the primary Urbanized Area. This anomalies represent a small percentage of the total UZA trips. Therefore to be consistent we have simply used the NTD designation.

Page 8:

Population Density: Population from American Community Survey 5-year (2017), land area from 2010 Census Urban Area File

Page 9:

Congestion: As measured by the Travel Time Index from Texas A & M Transport Institute's Urban Mobility Report. Data & Trends : Base Statistics Excel Spreadsheet (2017)

Page 10

Job Concentration: Demographia, Central Business Districts (Downtown) 2014 is based on American Community Survey information. Metropolitan Statistical Areas do not marry exactly to Urbanized Areas but are generally within a few percetage points in terms of population.

Page 14:

Many factors influence individual travel choice. Travel time and travel cost have been shown to be significant factors, but less quantifiable factors such as comfort, habit, convenience, safety also play a role. The scenarios analyzed are high level estimates of what's possible given mode shifts. Scenario 2 and 3 use information from The U.S. Dept of Energy's Transportation Energy Futures Series, Demand -Effects of Travel Reduction and Efficient Driving on Transportation: Energy and Greenhouse Gas Emissions (2013)

1. Triple Train Ridership : Triple the number of train commuters
Current transit users = 0.9M or 5% of commuters
Current train transit use approx 25% of 0.9M = 0.22M = 1.25% of commuters
Triple train ridership to represent 3.75% of commuters
Assume all new trainridership (450k) were previously SOV commuters
Assume commuters work 48 wks/yr * 5 days/wk *2 trips a day = 480 M
Auto trips would be reduced by 0.45*480M = 216 M trips annually
Average VMT per auto commute is 15 miles (based on Texas A&M Transportationa Institute, Data for Urbanized Areas in CA where the average ranges from 15 to 20 miles)
Assume train transit adds 20% to commute distance, therefore new distance is 18 miles/trip
Assume new train ridership is mainly light or commuter rail at 0.33 pounds GHG per mile
GHG savings per trip 15*.96 - 18*.33 (assumes all switch from SOV) = 8.46 GHG pounds/trip
Annual GHG savings = 216 M trip* 8.46 lbs/trip = 1,827 M lbs = 0.93 M ton GHG

2.Triple Bus Ridership: Triple the number of bus commuters
Current transit users = 0.9M; 65% of transit is bus = 590K bus commuters
Tripling bus ridership means converting 1.2 M SOV commuters to bus
Assume commuters work 48 wks/yr * 5 days/wk *2 trips a day*1.2 M = 576M car trips annually
Average VMT per auto commute is 15 miles
Assume bus transit adds 20% to commute distance, therefore new distance is 18 miles/trip
Bus emissions =0.64 pounds/mile; SOV Auto emissions = 0.96 pounds/mile
GHG savings per trip 15*.96 - 18*.64 (assumes all switch from SOV) = 2.88 GHG pounds/trip
Annual GHG savings = 576 M trip* 2.88 lbs/trip = 3,966 M lbs = 1.66 M ton GHG

3. Incentivize 10% of SOV to Car Pool
10% of SOV = 10% of 12.6 million = 1.3 M fewer SOV =0 .65M new carpools
0.65 M* 48 wks/yr*5days/wk*2trips/day = 312 M trips saved annually
Assume carpooling adds 10% in commute distance: new distance traveled/trip is ~ 17 miles
GHG savings per trip = 15*.96 - 15.7*.48 ~ 6.9 GHG pounds per trip
Annual GHG savings = 1.3M * 480 * 15 * .96 - .65M * 17* 480 *.96 ~ 3,900 M lbs= 1.95 M ton GHG

4. Telecommute 1 day/ week for 20% commuters:
20% of SOV = 20% of 12.6 million = 2.52 M SOV commuters
48 wk/yr* 1day/wk*2 trips per day = 96 trips/commuter * 2.52 = 242M trips annually
Annual GHG savings = 242 * 15 * .96 ~ 3,480 M lbs = 874 M ton GHG - 1.74 M ton GHG