



The Plan Bay Area

What is the Plan Bay Area?

- Plan Bay Area 2040 is a state-mandated, integrated long-range transportation and land use plan.
- As required by Senate Bill 375 (2008), all metropolitan regions in California must complete a Sustainable Communities Strategy (SCS) as part of a Regional Transportation Plan.
- In the Bay Area, the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG) are jointly responsible for developing and adopting a SCS that integrates transportation, land use and housing to meet greenhouse gas reduction targets set by the California Air Resources Board (CARB).

Plan Bay Area Goals

Table 1.2-6 Year 2040 Goals and Performance Targets

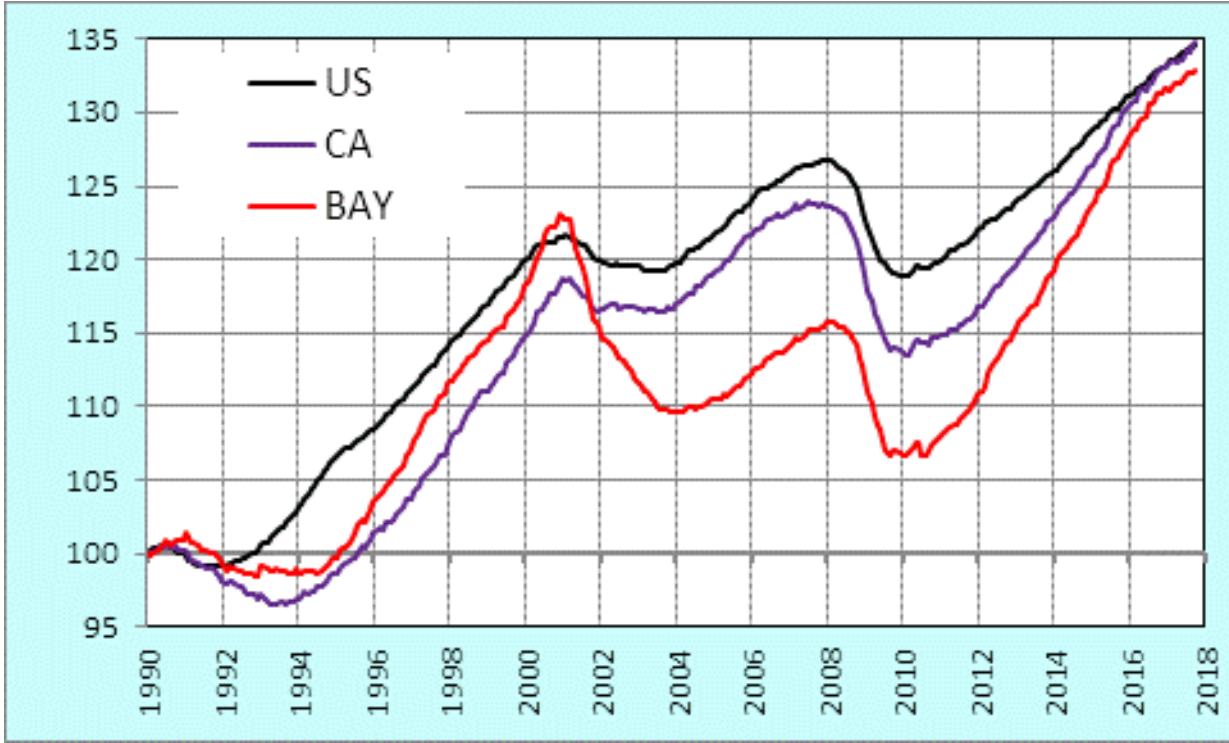
Goal	Performance Target
Climate Protection	Reduce per-capita CO2 emissions from cars and light-duty trucks by 15%
Adequate Housing	House 100% of the region's projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year
Healthy and Safe Communities	Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by 10%
Open Space and Agricultural Preservation	Direct all non-agricultural development within the urban footprint (existing urban development and UGBs)
Equitable Access	Decrease the share of lower income residents' household income consumed by housing and transportation (H+T) costs share for lower-income households by 10%
	Increase the share of affordable housing in PDAs, TPAs or high-opportunity areas by 15%
	Do not increase the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at risk of displacement
Economic Vitality	Increase by 20% the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit in congested conditions
	Increase by 38% the number of jobs in predominantly middle-wage industries
	Reduce per-capita delay on the Regional Freight Network by 20%
Transportation System Effectiveness	Increase non-auto mode share by 10%
	Reduce vehicle operations and maintenance costs due to pavement conditions by 100%
	Reduce per-rider transit delay due to aged infrastructure by 100%

The Issues We'll Cover

- The Bay Area is going to grow
- The Bay Area region is suffering from a growing shortage of housing
 - ❖ To address will require building a lot more homes each year than has occurred.
- A focus of the Plan is to reduce VMT (relatively) in order to reduce emissions of global warming gases from autos.
 - ❖ Reduction of VMT per capita occurs largely because of technology not the Plan
- Controversies:
 - ❖ Housing/land use decisions are the control of local city and county land use agencies.
 - ❖ Where to put the housing has confronted the region with conflict between open space preservation and local control

The Bay Area Economy is Growing Faster than the US Economy

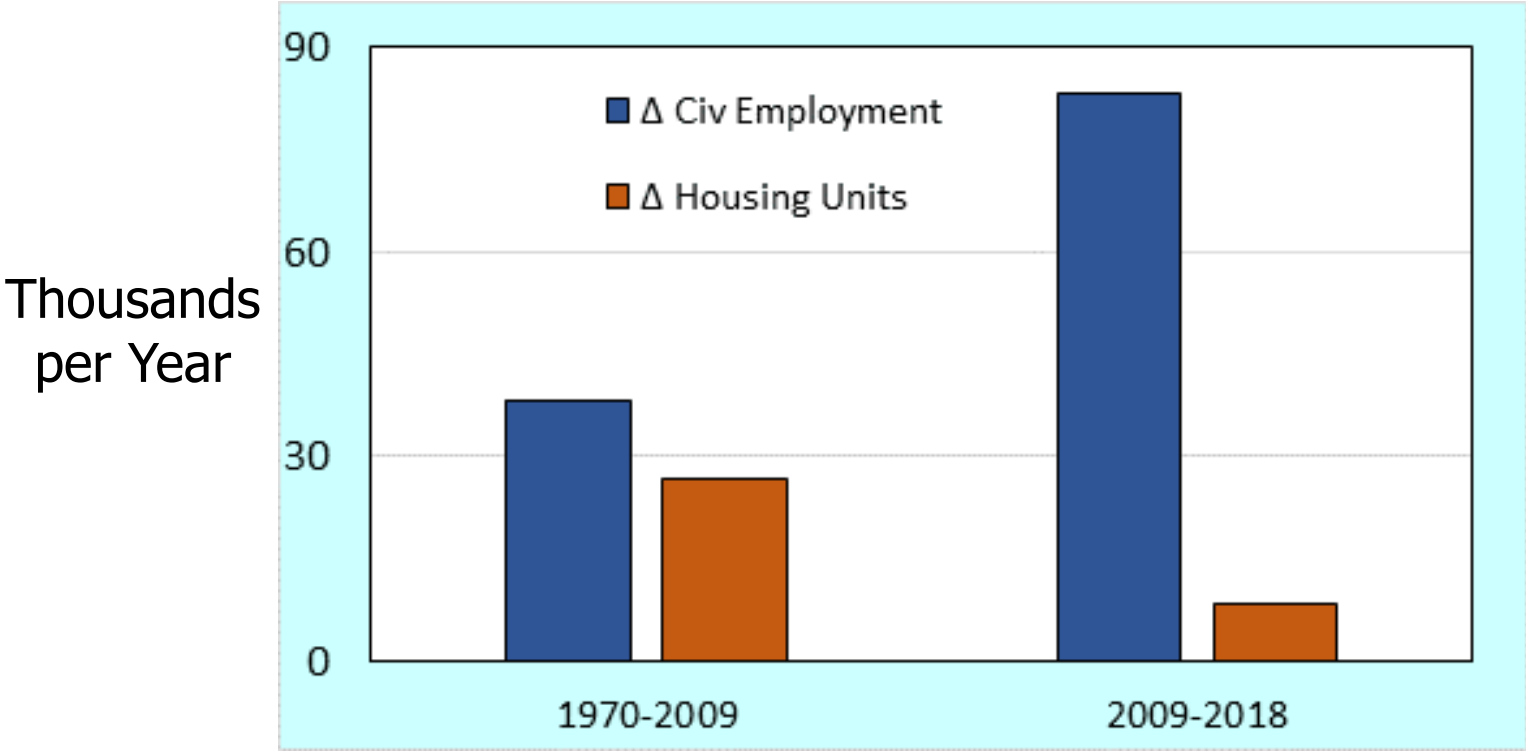
Employment Index
1990=100



Since June 2009 the differential growth rate is substantial.

Years	US	CA	BAY
2009-2017	12.2	16.8	22.5

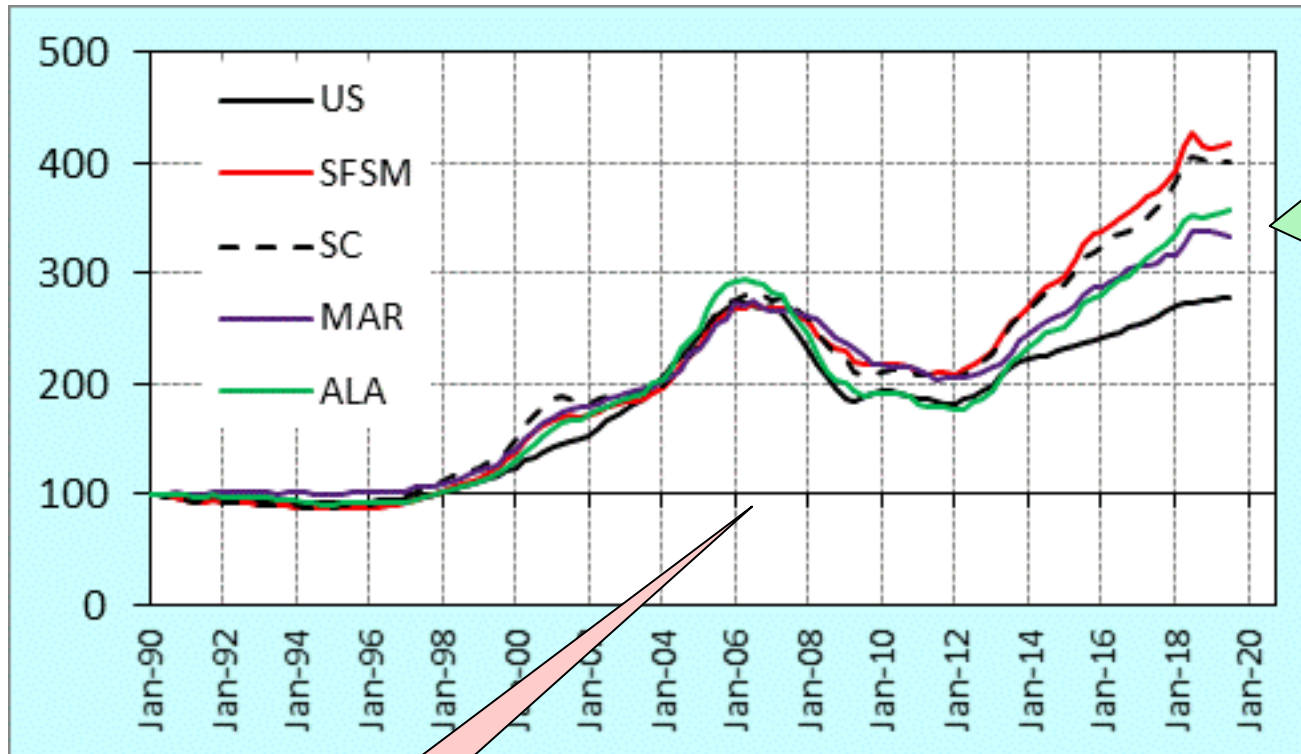
Households vs. Employment Growth



We are in the middle of a housing shortage region wide

Housing Prices

Index
Jan-1990
= 100



Housing Shortage

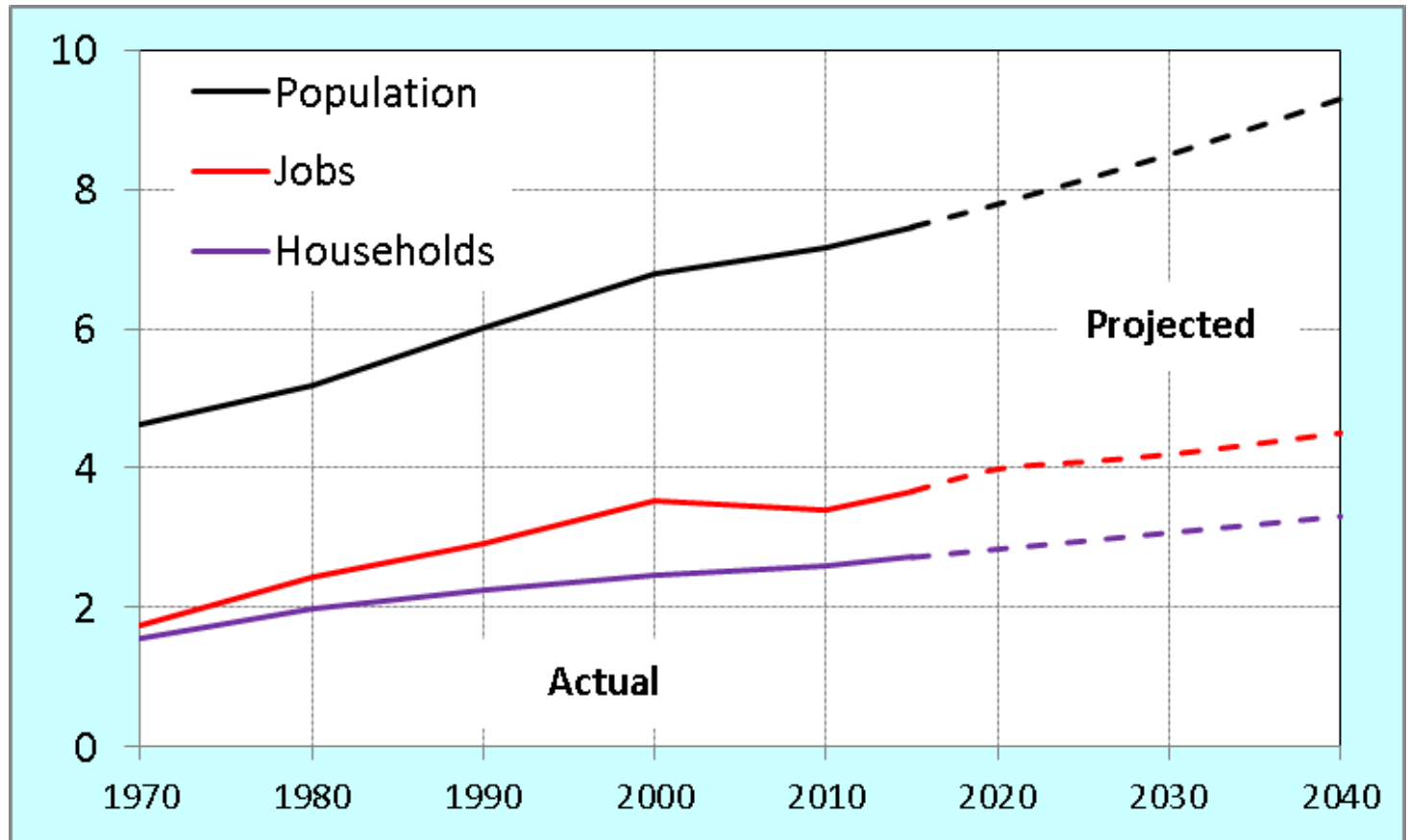
% Δ from Jan 2012

Housing Bubble

US	SF-San Mateo	Santa Clara	Marin	Alameda
54	101	95	64	102

Bay Area Plan - Projections

Millions of units



Implication

Year	POP	HH	Jobs
1980	5.2	2.0	2.4
1990	6.0	2.3	2.9
2000	6.8	2.5	3.5
2010	7.2	2.6	3.4
2015	7.5	2.7	3.7
2040	9.3	3.4	4.7
Annual Δ in 000			
1980-2000	80	25	55
2000-2010	37	14	-14
2010-2015	62	22	57
Plan Bay Area			
2015-2040	74	28	41

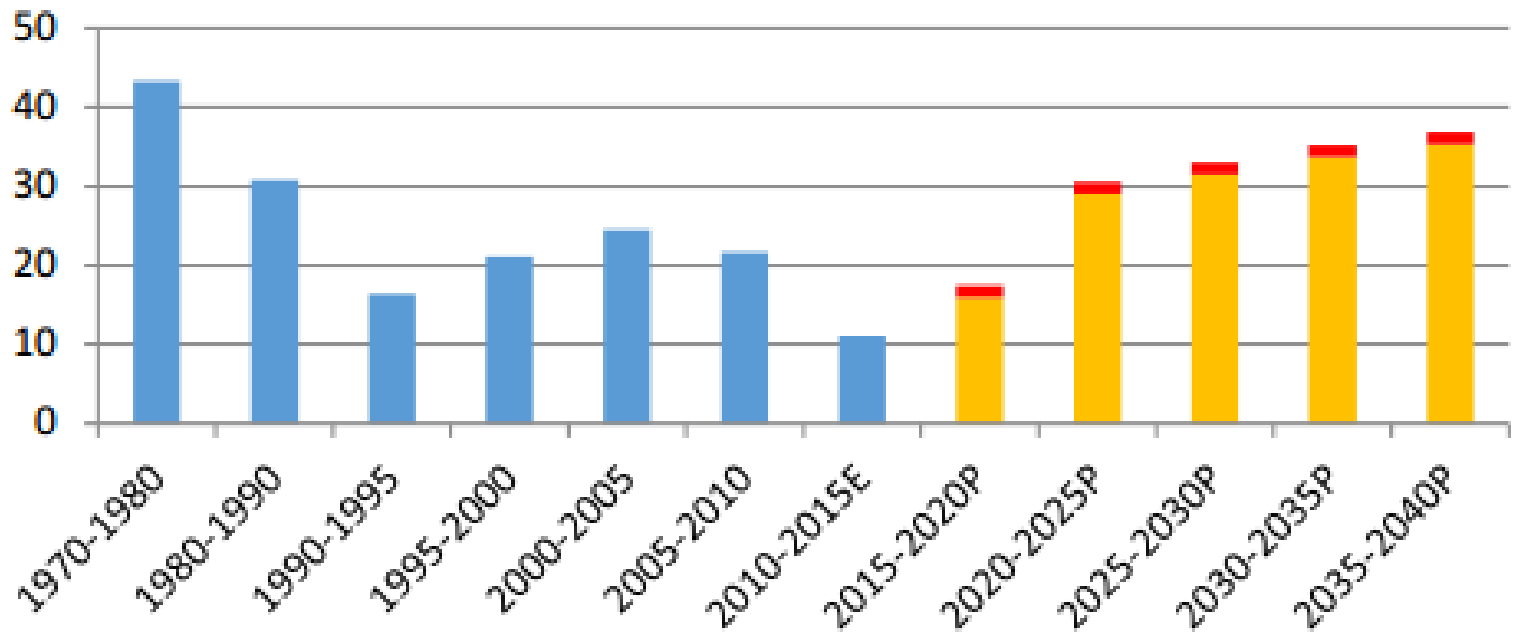
A lot of housing is going to need to be built to house the inflow of workers

These are the numbers underlying the graph on the prior page.
The key issue: the projected growth in required housing.

Plan Bay Area Table of Housing

Figure 12: Annual Housing Production, Historic and Projected
1970-2015 and 2015 to 2040

■ Historic Estimated ■ Related to household growth ■ In-commute increment



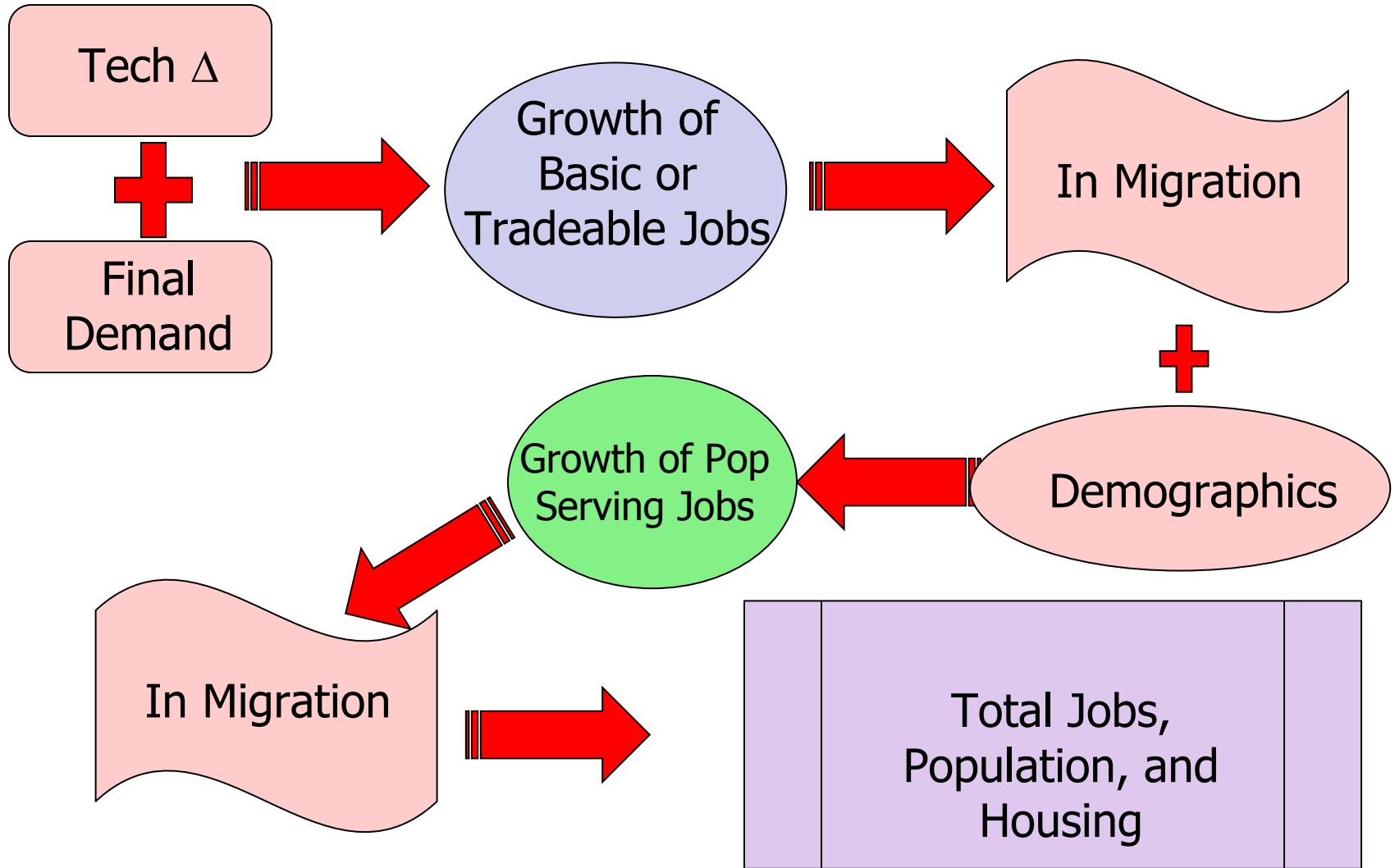
Issues to Consider

- 1) If economics can't accurately forecast the economy next year, how can it provide guidance about 2040?
- 2) Regional agencies (MTC & ABAG) making the projections don't control land use and where housing is built.
- 3) What are we going to do with all of the cars?

If Economics Can't Accurately Forecast Next Year, How can it Provide Guidance about 2040?

- When looking 25 years into the future, the purpose of economic “projections” is to provide guidance to decisions where such information is relevant. Example:
 - ❖ Land use planning on a regional scale
 - ❖ Power plant construction
 - ❖ Pensions
 - ❖ Social Security and Medicare
- The underlying economic trends in the U.S. and the Bay Area vs. the US, indicate that the Bay Area will continue to grow in jobs, population, and households faster than the rest of the country.
- Such a growth rate imposes challenges regarding how to manage the growth that are best considered in the near term.

Model of Long Term Regional Economic Growth



Modeling Steps

- Bureau of Labor Statistics Long-term Growth Projections of jobs by detailed industry
- Bay Area share of tradeable jobs in the U.S.
- Relationship of tradeable Jobs to population-serving jobs sometimes called a “multiplier.”
- Demographic variables (cohorts by age, race, and gender)
 - ❖ Provides basis for projections of births and deaths
 - ❖ Demands for various in population-serving jobs

National Input – Output Matrix

Economic Activities	1	2	3	...	N	Exports	Final Demand	Total Output
1								
2								
3								
...								
N								
Imports								
Total Inputs								

From
Prior
Lecture

- ❖ Industries sell their output to many other industries, including their own
- ❖ Some output is not sold within the US (a.k.a. "exports")
- ❖ Some inputs are not bought from US producers (a.k.a. "imports")
- ❖ One of the more important "industrial inputs" is labor
- ❖ Many industries sell some of their goods and services to "U.S. consumers"

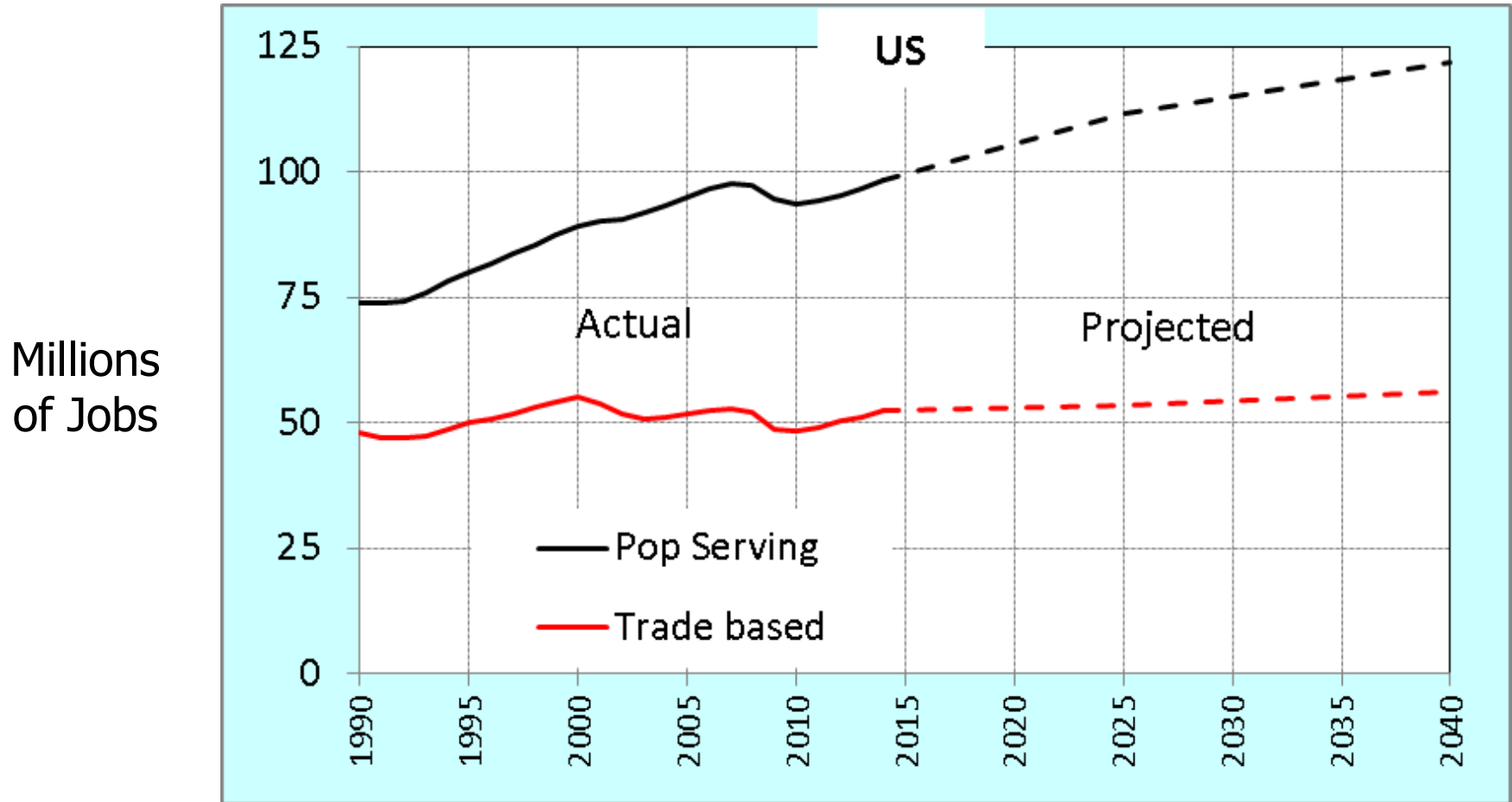
Considerations

- The purpose is to provide guidance on “totals”
 - ❖ Total Population
 - ❖ Total Jobs
 - ❖ Total Housing
- The accuracy of the many details in the model is subject to many revisions given the number of “known unknowns” related to technological change
- Given the need to consider long term planning issues for the region, what is the alternative?

The Real List of "Tradeable" Industries

63 Trade Based Industries		
Agriculture, forestry, fishing, logging and hunting	Machine Shops and Threaded Product Manufacturing	Warehousing and Storage
Mining	Other Fabricated Metal Product Manufacturing	Software Publishers
Fruit and Vegetable Preserving and Specialty	Machinery Manufacturing	Motion Picture and Sound Recording
Animal Slaughtering and Processing	Computer and Peripheral Equipment Manufacturing	Broadcasting (except internet)
Bakeries and Tortilla Manufacturing	Communications Equipment Manufacturing	Telecommunications
Other Food Manufacturing	Semiconductor and Electronic Component Manufacturing	Legal Services
Beverage and Tobacco Product Mfg	Electronic Instrument Manufacturing	Accounting, Tax Preparation and Bookkeeping Services
Textile and textile product mills	Other Computer & Electronic Products	Architectural, Engineering and Related Services
Apparel Manufacturing	Electrical Equipment and Appliance Manufacturing	Computer Systems Design and Related Services
Leather and Allied Products Manufacturing	Aerospace Product and Parts Manufacturing	Management, Scientific and Technical Consulting
Wood Product Manufacturing	Other Transportation Equipment Manufacturing	Scientific Research and Development Services
Paper Manufacturing	Furniture and Related Product Manufacturing	Other Professional, Scientific and Technical Services
Printing and Related Support Activities	Medical Equipment and Supplies Manufacturing	Management of Companies and Enterprises
Petroleum and Coal Products Manufacturing	Other Miscellaneous Manufacturing	Employment services
Pharmaceutical and Medicine Manufacturing	Merchant Wholesalers, Durable Goods	Performing arts, spectator sports, museums, and
Other Chemical Products and Preparation Manufacturing	Merchant Wholesalers, Nondurable Goods	Amusement, gambling, and recreation industries
Plastics and Rubber Products Manufacturing	Wholesale Electronic Markets and Agents and Brokers	Accommodation
Cement and Concrete Product Manufacturing	Air Transportation	Department of Defense
Other NonMet. Mineral Prod.	Truck Transportation	Other Federal Government
Primary Metal Manufacturing	Other transportation and support activities	State Government Education
Architectural and Structural Metals Manufacturing	Couriers and Messengers	Other State Government

US Employment Projected by the BLS

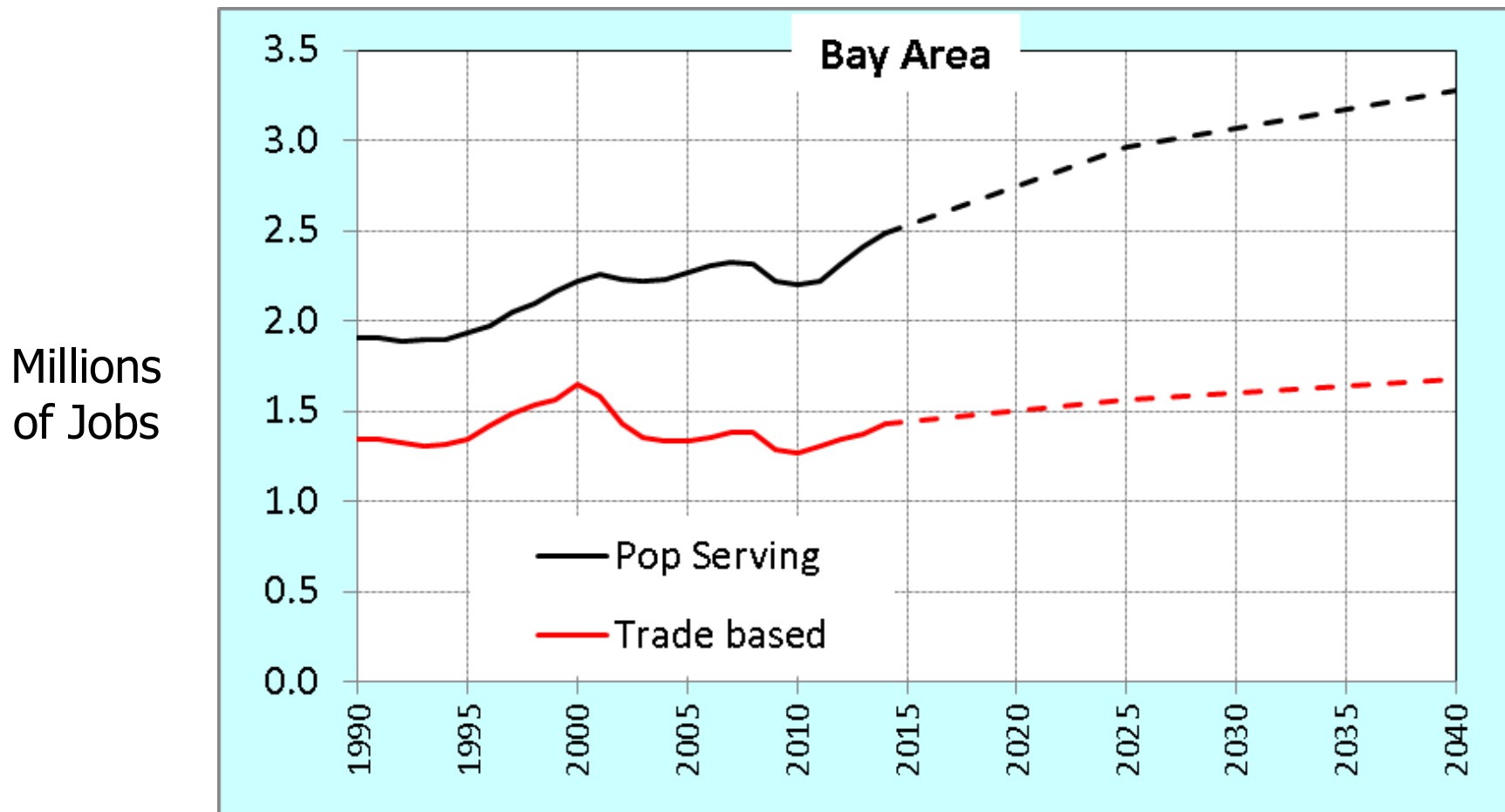


Detailed Projections by Industry are Regularly Estimated by the U.S. Bureau of Labor Statistics

Considerations

- “Full Employment” assumed
 - ❖ It’s a “control total”
 - ❖ There is no predicting the timing or depth of future recessions
 - ❖ Primary total employment determined by demographics and labor force participation rates
- Population serving totals are based on long-term trends in demand for services
- Tradeable jobs + Population Serving Jobs = Total jobs (or employment)
 - ❖ Demands for and production of goods is tied to industry studies, including import competition and this is where ex post reviews indicate largest variances.
 - ❖ Input-Output analysis is used for this purpose

Bay Area Employment Projected by the CCSCE



The are the Economic Projections Underlying the Plan Bay Area

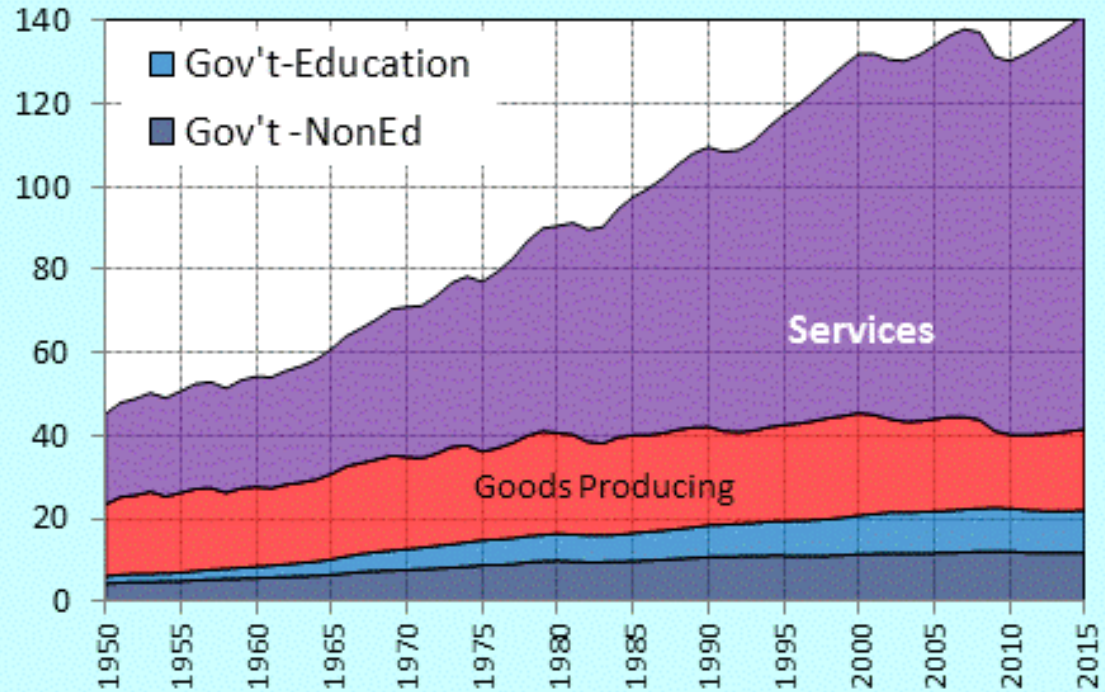
Trade Based Industry Growth

Trade Based Job Growth 2014-2040 (in %)			
Area	Increasing	Decreasing	Total
US	18	-21	7
Bay Area	33	-9	17

- 1) In the U.S. about 1/2 of the industries are expected to experience growth in jobs and about 1/2 expected to decline (BLS).
- 2) The above table tells us the mix of jobs in these industries in the Bay Area leads to faster growth in total of these jobs

Structure of Employment since 1950

Employment
in Millions



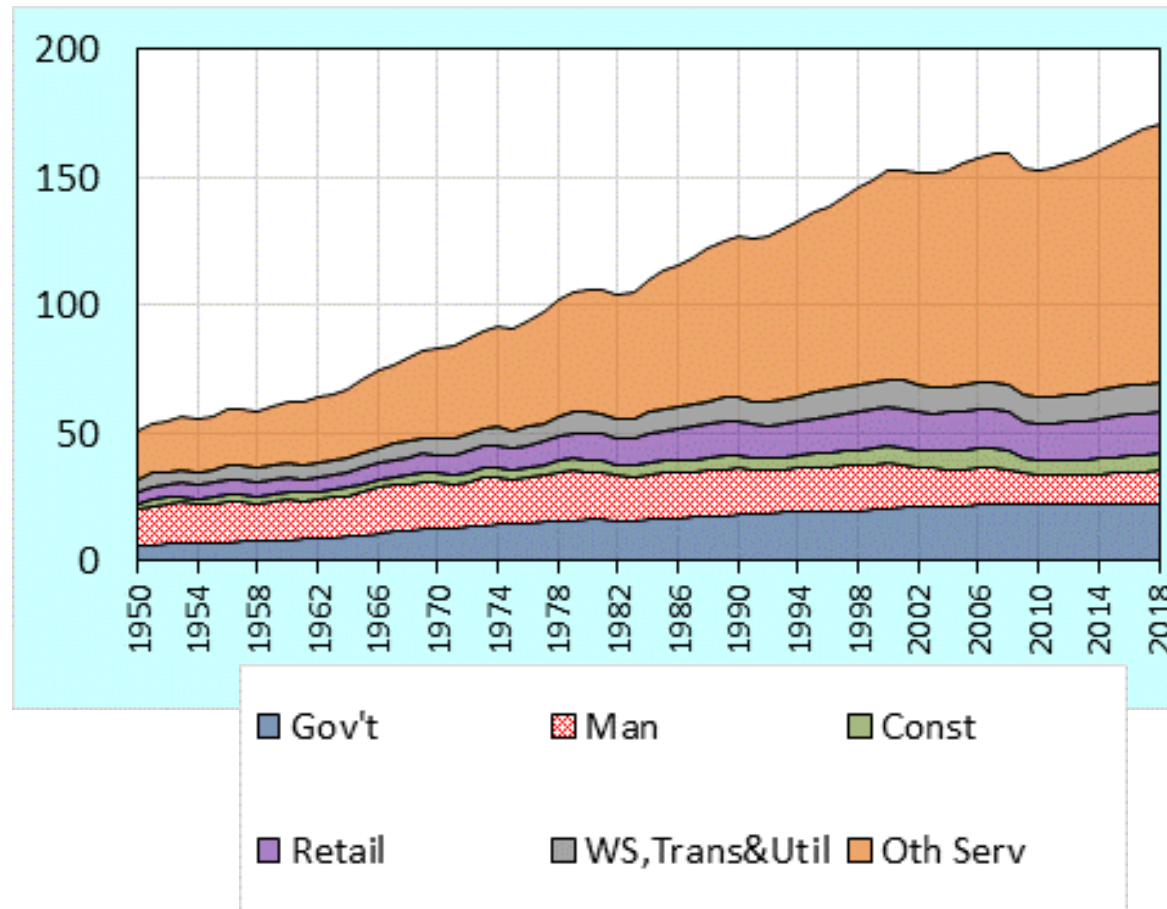
Data on US Employment

Based on some different definitions of "Trade Based" vs. "Goods Producing," because some services are trade based

Indicates the same general trend in the proportion of employment that is population serving based.

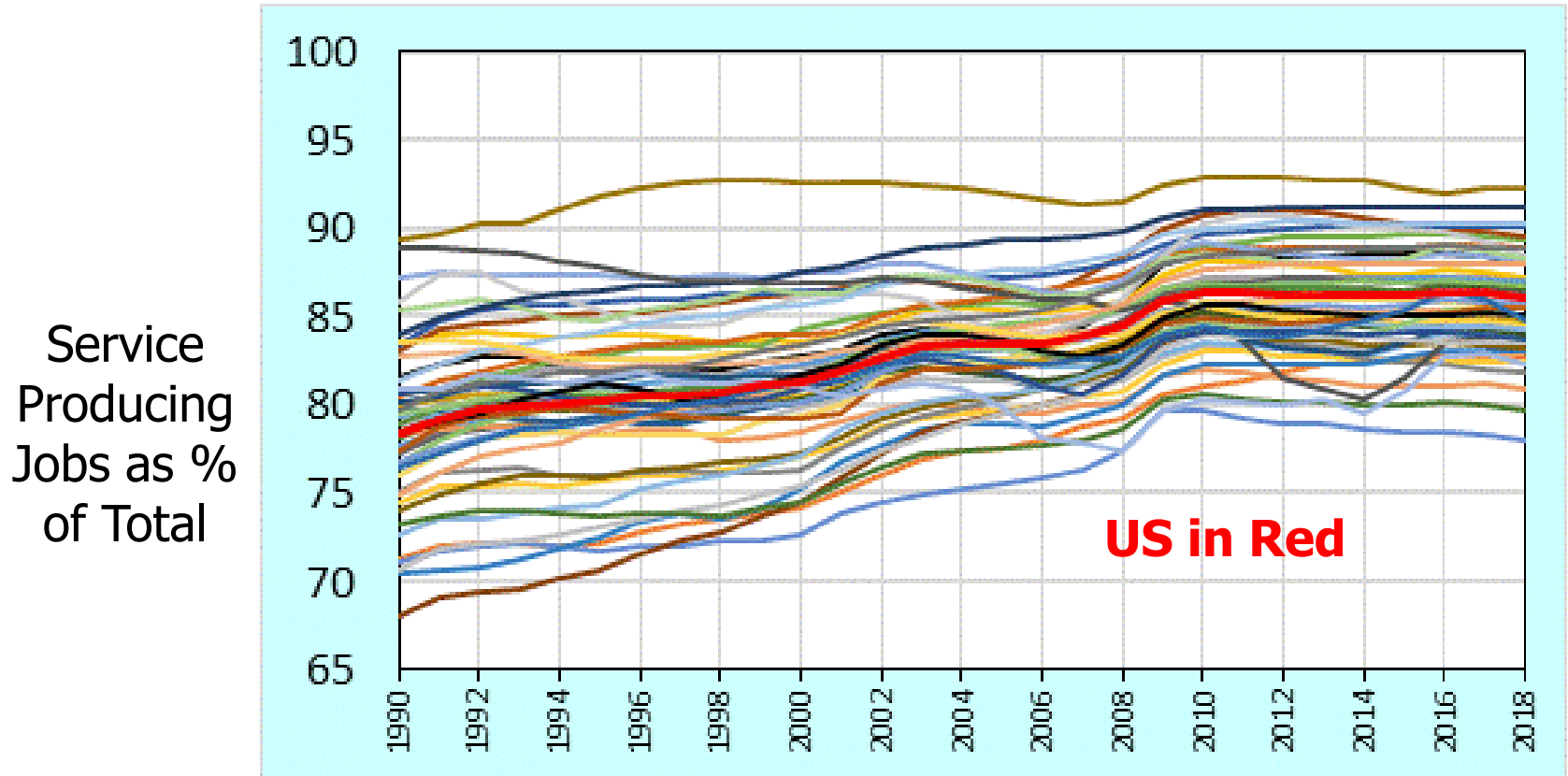
What about the Structure of Employment over Time?

Employment
in Millions



- Growth of employment has been dominated by the growth of employment in the “services” sector, which is largely providing “non-tradeable” services
- Manufacturing employment continues to shrink

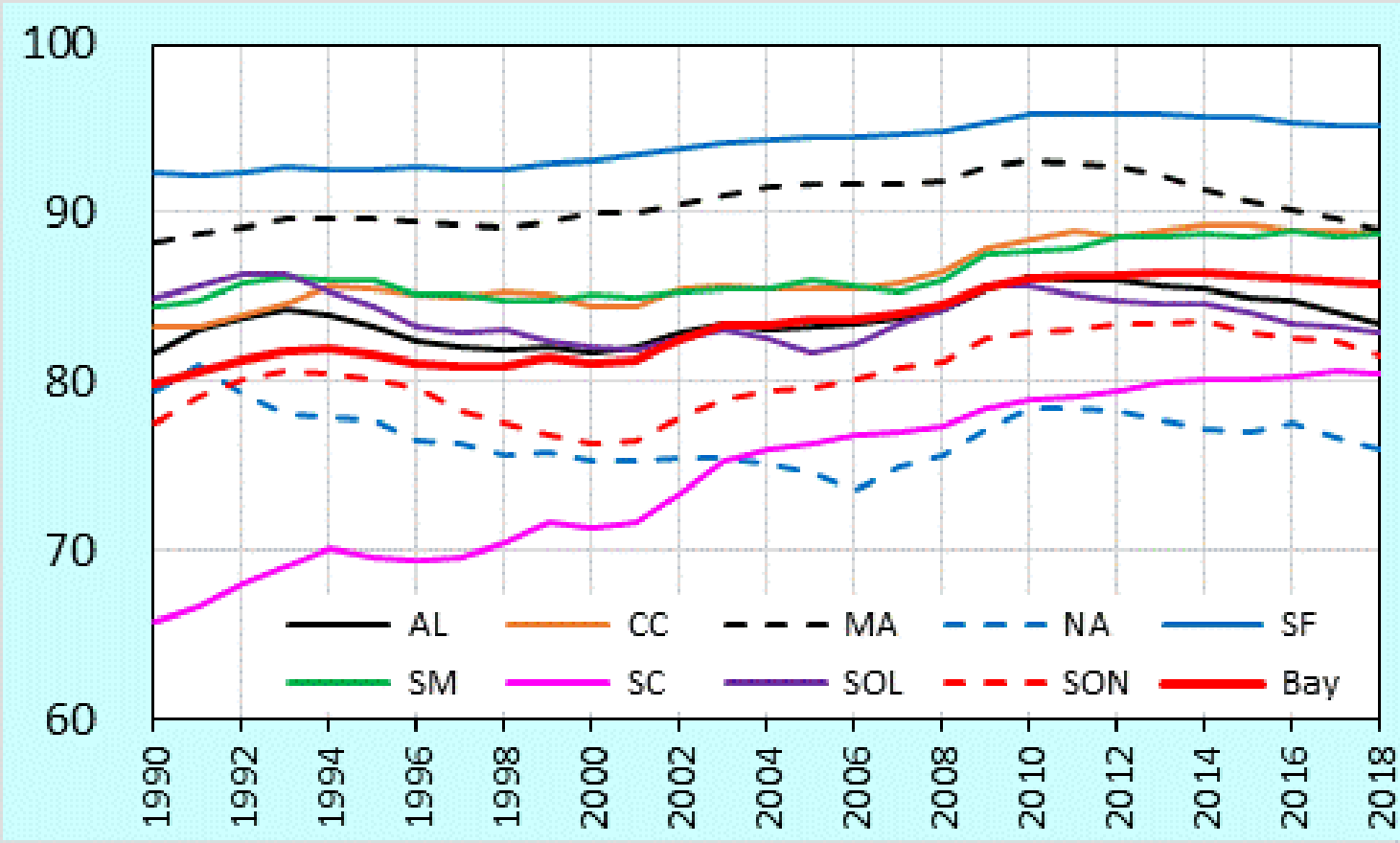
Service Producing Jobs by State



The underlying trends in labor force structure are experienced in every state

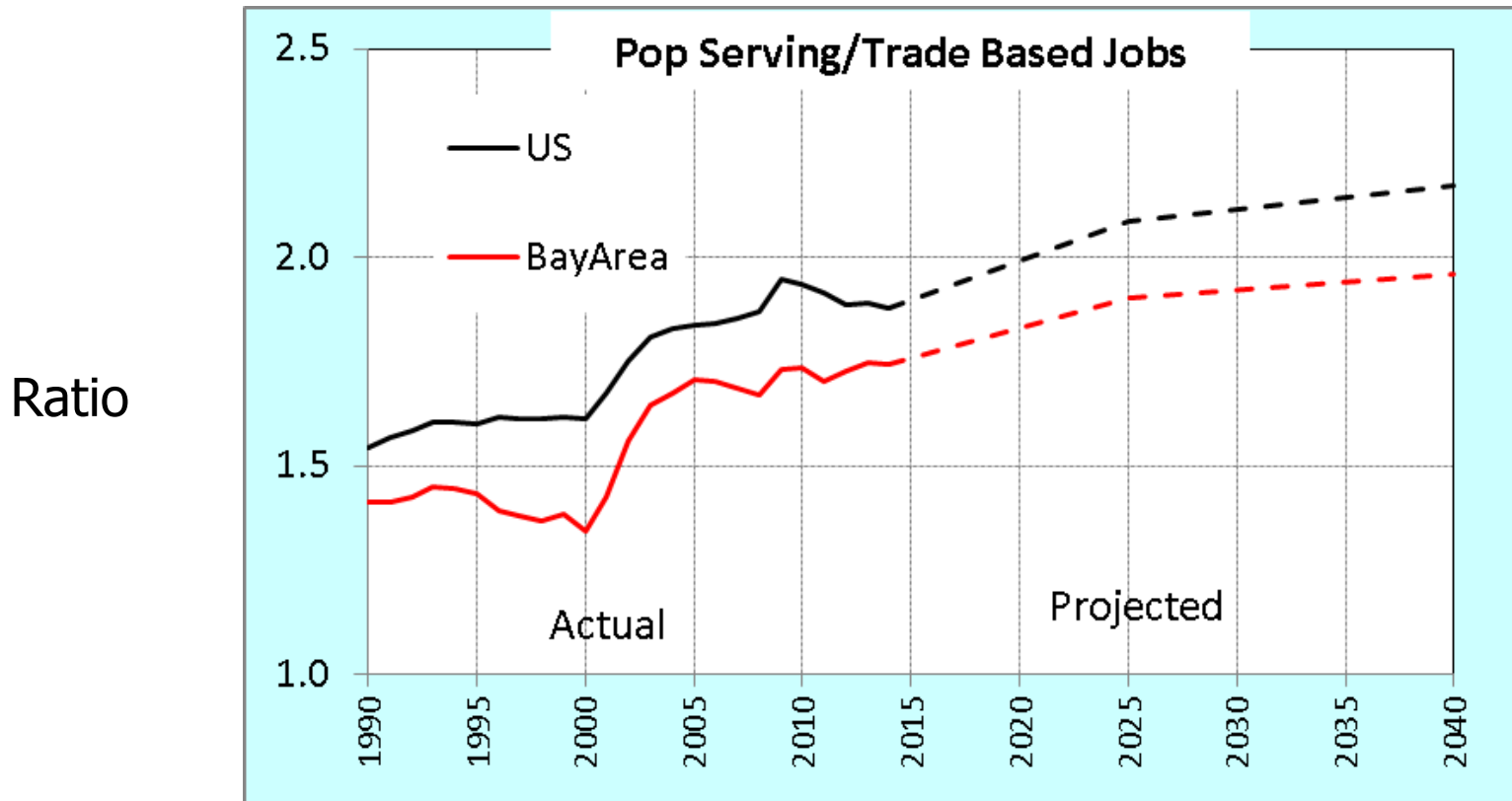
Service Producing Jobs by Bay Area County

Service Producing as % of Total



Trends in labor force structure are shared even at the regional level.

Population Serving Jobs/Trade Based Jobs



- 1) The ratio is sometimes referred to as a “multiplier.”
- 2) Note the consistency in the trends over time between the US and Bay Area.
- 3) A reasonable question: will history provide sufficient guidance?

US and the Bay Area Job Growth

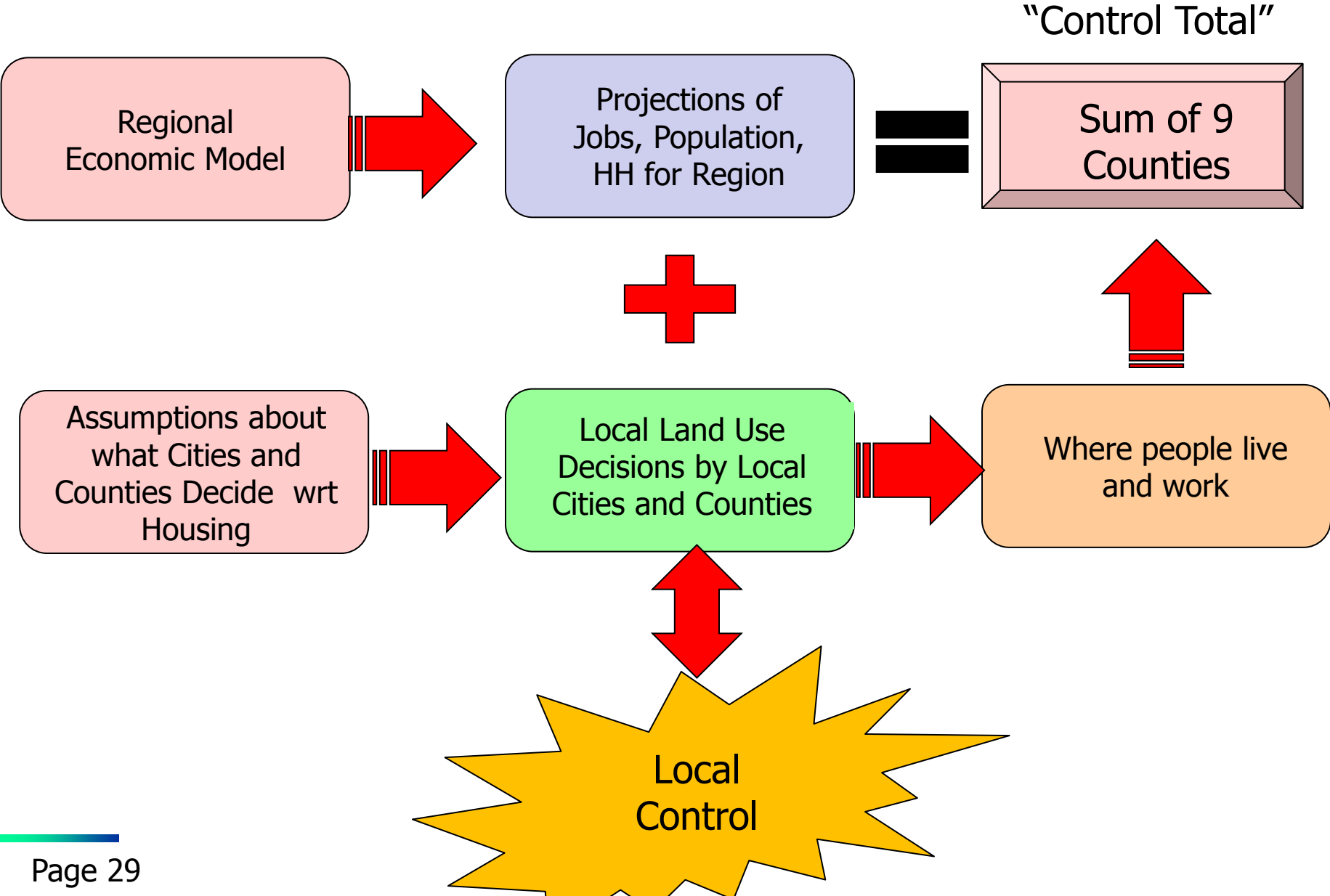
Job Growth by Segment 2014-2040			
Millions of Jobs			
Area	Trade Based	Pop Serving	Total
US	3.8	23.4	27.2
Bay Area	0.2	0.8	1.0
Percent Increase			
US	7	24	18
Bay Area	17	32	27

This is the key component of the Plan. Virtually everything else in the plan is based on this table.

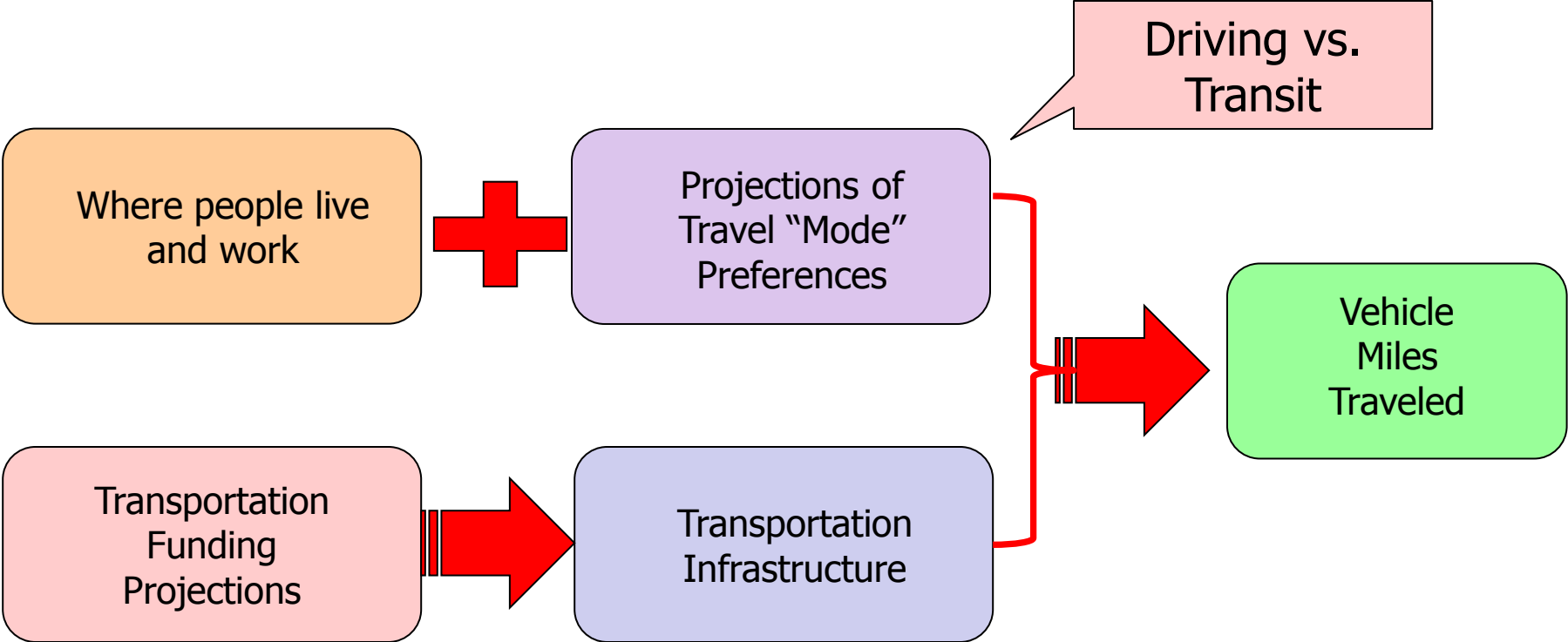
Issues to Consider

- 1) General Modeling Issues
- 2) Green House Gas Emissions
- 3) Where will people live?
- 4) Lack of affordable housing
- 5) Congestion
- 6) NIMBYISM

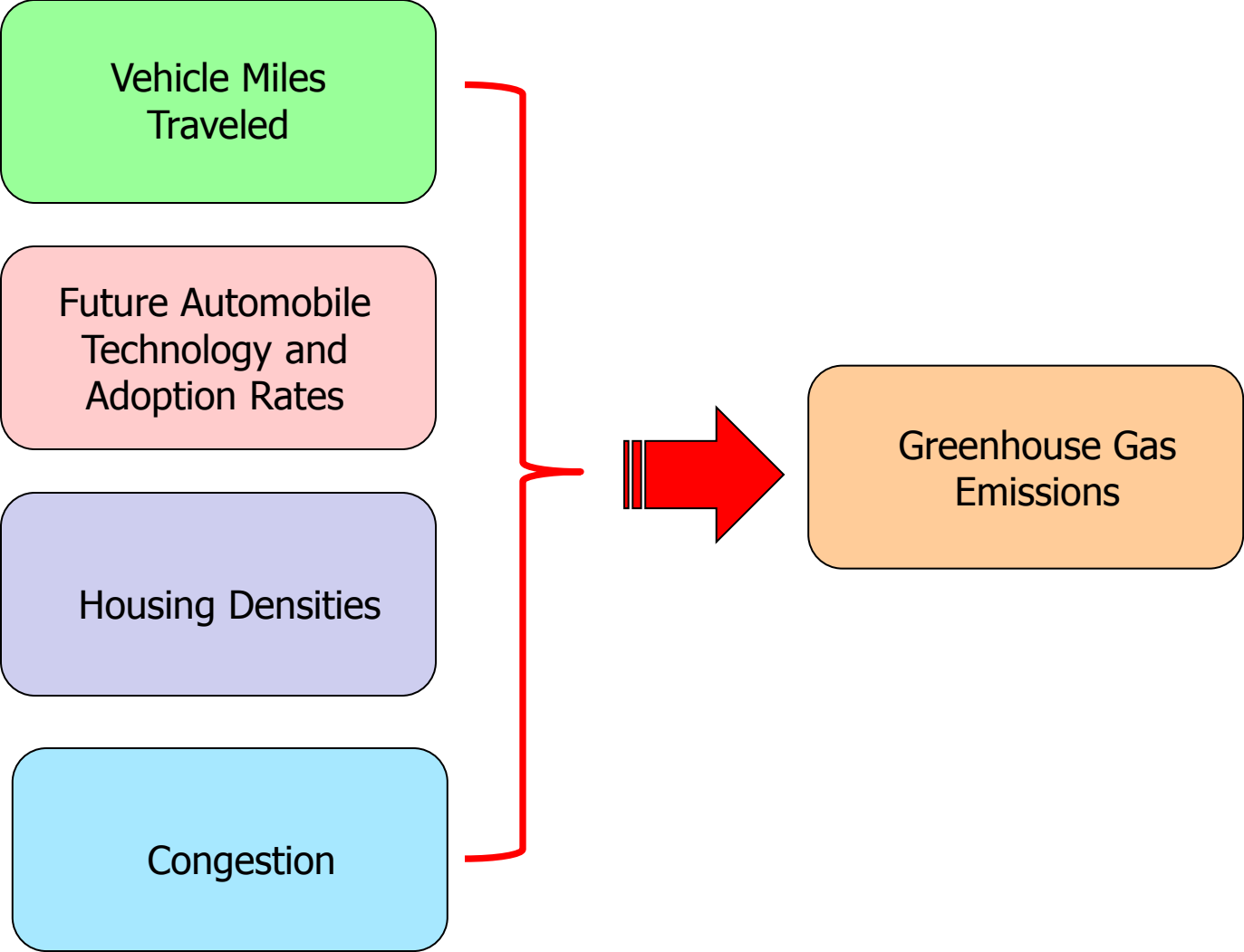
General Framework I



General Framework II



General Framework III



VMT, Technology, and Air Pollution

Table 2.4-4 Annual Levels of Gasoline and Diesel Consumption

Vehicle Category	2015		2040		Net Change	
	Gasoline (million gal/year)	Diesel (million gal/year)	Gasoline (million gal/year)	Diesel (million gal/year)	Gasoline (million gal/year)	Diesel (million gal/year)
Passenger Vehicles	2,063.2	12.2	1,322.3	12.0	-740.9	-0.2
Trucks	99.1	411.6	55.0	555.6	-44.2	144.1
Buses	15.1	53.2	20.3	33.8	5.2	-19.3
Other Vehicles	13.7	0.2	12.5	0.4	-1.2	0.2
All Vehicle Types	2,191.1	477.1	1,410.0	601.8	-781.1	124.7
MTC Climate Policy Initiatives (Passenger Vehicles) ¹	-	-	-	-	-265.6	-2.4

Notes: gal = gallons

Detailed calculations are provided in Appendix C.

¹ Reductions in gasoline and diesel consumption resulting from implementation of MTC's Climate Policy Initiatives were based on the reductions in carbon dioxide emissions estimated by MTC.

Source: Compiled by Ascent Environmental 2017.

Underlying this Table: how much people drive and automobile engine technology

VMT vs. Population

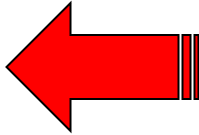
County	VMT (Millions)		% Δ	
	2015	2040	VMT	POP
Alameda	38.3	46.9	22.4	27.8
Contra Costa	22.2	26.9	21.1	26.7
Marin	6.5	7.2	11.3	6.8
Napa	2.8	3.3	16.4	14.2
San Francisco	8.7	10.5	20.5	27.2
San Mateo	16.4	19.1	16.5	19.1
Santa Clara	40.7	50.1	23.2	32.7
Solano	12.3	15.1	22.6	20.8
Sonoma	9.9	11.6	17.7	22.8
Total	157.9	190.8	20.8	26.3

Notice:

- VMT is going up but at a slower rate than population except Marin, Napa, and Solano counties
- VMT is going up but gasoline consumption (prior page is going down)

Congestion and Transit Assumptions

Item/Estimate	2015	2040	%Δ
Daily Transit Boardings	2,279,000	3,208,900	40.8
Daily Vehicle Miles of Travel	158,406,800	191,528,600	20.9
Daily Vehicle Miles of Travel per Capita	20.9	20.0	-4.3
Total Daily Vehicle Trips	21,227,800	26,018,900	22.6
Daily Vehicle Hours of Recurring Delay	353,200	531,100	50.4
Daily Vehicle Hours of Recurring Delay (Freeway)	222,800	323,400	45.2
Daily Vehicle Hours of Recurring Delay (Expressways)	99,200	126,400	27.4
Daily Vehicle Hours of Recurring Delay (Other)	31,300	81,300	159.7
Daily Vehicle Hours of Non-Recurrent Delay	144,900	188,000	29.7
Total Daily Vehicle Hours of Delay	498,100	719,100	44.4
Typical Weekday Personal Trips			
Drive Alone	19.6	19.9	1.5
Carpool	21.8	22	0.9
Transit	38.9	38.1	-2.1
Walk	21.5	21.2	-1.4
Bike	13.4	13.4	0.0
All Modes	22.3	22.6	1.3

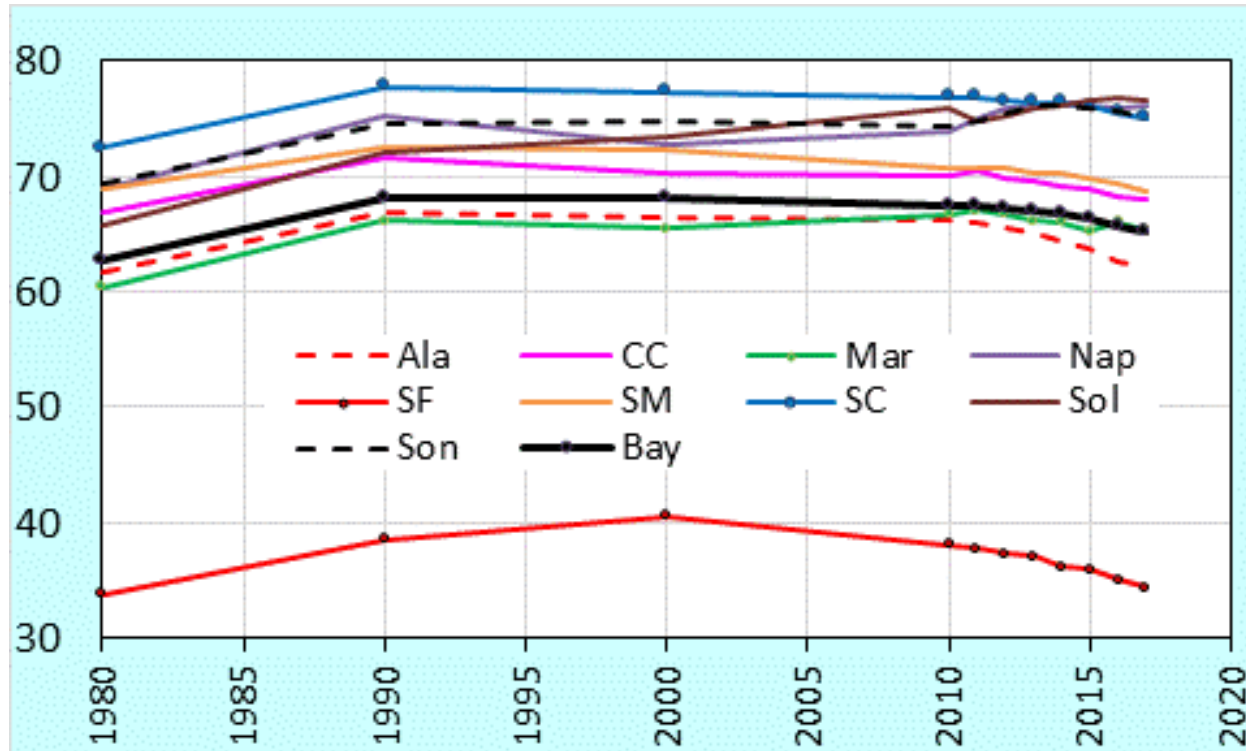


Recall Employment and Population is projected to grow 27%. What does assumptions does this incorporate?

Far higher utilization of transit than in the past.

Driving Alone – Bay Area

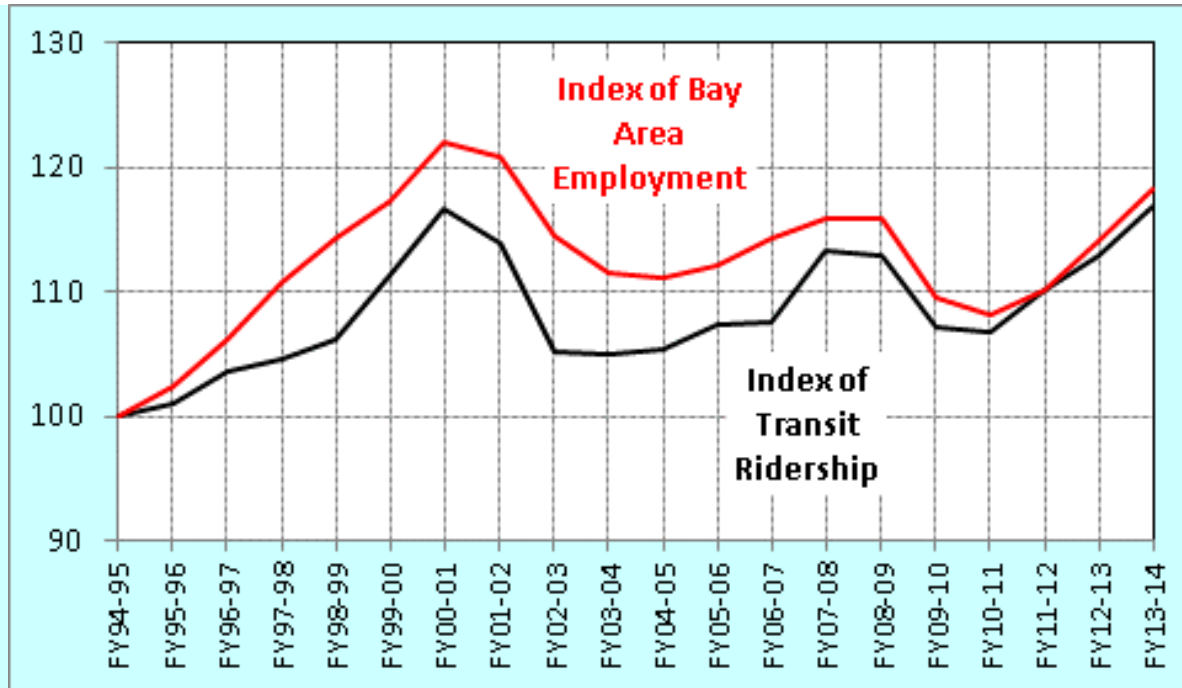
% of Workers Driving Alone



Other than SF, a majority of workers are commuting by driving alone, a trend that has been relatively constant since 1990

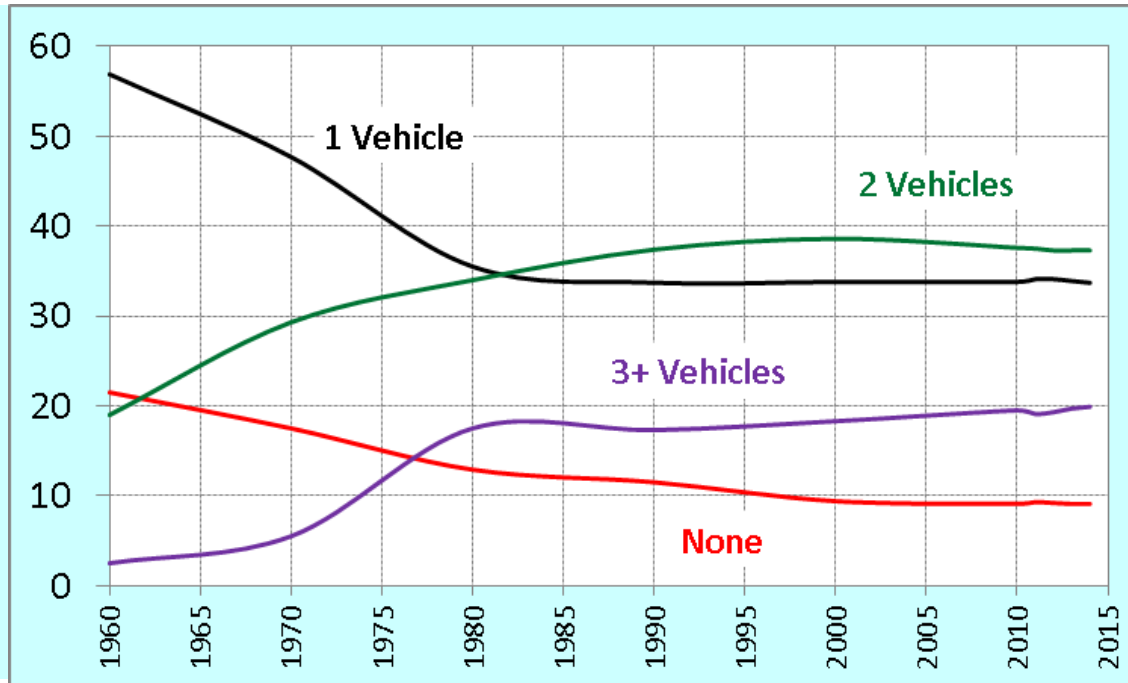
Employment vs. Transit– Bay Area

Index of
Transit
Ridership
and
Employment



US Vehicle Ownership Data

% of House Holds with



- As cars have become less relatively cheaper, households have purchased more of them

Auto Ownership Assumptions in the Plan

Projection Assumption	2015	2040
Total Households	2,760,500	3,426,700
Share of Households with No Autos	10%	11%
Share of Households with One Auto	33%	34%
Share of Households with Multiple Autos	57%	55%
Average Number of Vehicles by Household	1.74	1.70

Where People Live: Out vs. Up

- The stated goal: “Open Space and Agricultural Preservation” has consequences
 - ❖ If the region within the boundaries of open lands has limited land for building single family dwelling units, then the alternative is to build up.
 - That’s math
 - It’s called high density housing
 - If placed near transit “nodes” (i.e., train stations) it’s called “Transit Oriented Development”
 - It can also satisfy providing “more affordable” housing and lead to increasing transit ridership

Transit Oriented Development (TOD)

- Concept has been around for decades, in part, because of past federal funding to promote affordable housing
- This means the federal government has done studies (lots of them) on “the benefits and costs of TODs”
 - ❖ Key benefit: TODs increase transit ridership
 - ❖ Key caveat: TODs have no measurable impact on peak-hour traffic congestion
 - ❖ Potential benefit: TODs increase the supply of more affordable housing (i.e., apartments).
 - ❖ Key cost: TODs increase local congestion in the vicinity of TODs because local traffic congestion is a function of housing density.
 - ❖ Potential impact: depending on local government funding structures, TODs may negatively impact provision of local gov’t services.

Plan Bay Area has Assumed TODs

- Concept has been around for decades, in part, because of past federal funding to promote affordable housing
- This means the federal government has done studies (lots of them) on “the benefits and costs of TODs”
 - ❖ Key benefit: They increase transit ridership
 - ❖ Key caveat: They have no measurable impact on peak-hour traffic congestion because transit ridership is such a small percentage of total commute trips in most regions.
 - ❖ Potential benefit: increase supply of more affordable housing (i.e., apartments).
 - ❖ Key cost: they increase local congestion in the vicinity of TODs because local traffic congestion is a function of housing density.
 - ❖ Potential impact: depending on local government funding structures, may negatively impact provision of local gov’t services.

Empirical reality: Not everyone who lives in a TOD uses transit.

Why Do TODs Increase Traffic Locally

- Not everyone living in high density housing chooses to use public transit
 - ❖ It's an empirical question.
- Higher population density increases the demand for goods and services locally. As a consequence:
 - ❖ There is an increase in local traffic associated with high density housing, some of it is direct, some of it is indirect.
- Since TODs increase transit ridership, why doesn't this reduce peak hour traffic congestion
 - ❖ Substitution effects: peak hour traffic is not effected by transit expansion
 - ❖ Materiality: transit usage is so low as a percent of total commute trips, an increase in transit usage has only a small effect on total auto trips.

High Level Assessment of Plan

Issue	Goals and Outcomes	
	No Plan	Regional Agreement
Economic growth	Same under both	
Open space preservation		
Peak Hour traffic congestion	Deteriorates under both significantly	
Transit utilization	Past trends continue	Large growth in transit utilization
Local traffic congestion	Deteriorates where housing is built	
VMT	Reduction largely dependent on Technology not land use	
Affordable housing	Higher land prices	Relatively more affordable units
Housing demand outside the region	Higher in San Joaquin and San Benito counties	Not as high in San Joaquin and San Benito counties

Cities and Counties vs. the Region

- Some local land use agencies (cities and counties) have fought the “allocation” of housing by geography
 - ❖ They don't want the additional local traffic associated with TODs
 - ❖ There are concerns about impacts on local school, city, and county budgets that have not been addressed
 - ❖ There are concerns about local control over land use

This is THE political fight over the implementation of Plan Bay Area

This position is frequently referred to as NIMBYism for “Not in My Backyard.”

Given the growth of the region it means the housing will go elsewhere in some form, if allocations are not imposed.

Housing “Allocations” and Assumptions

County	2015	% in TPA	Proposed	% in TPA	Δ in HHs
Alameda	585,000	52%	734,000	56%	149,000
Contra Costa	387,000	13%	475,000	15%	89,000
Marin	107,000	10%	112,000	10%	5,000
Napa	49,000	0%	55,000	0%	6,000
San Francisco	389,000	99%	484,000	100%	95,000
San Mateo	271,000	40%	318,000	44%	47,000
Santa Clara	649,000	39%	861,000	46%	212,000
Solano	141,000	5%	169,000	5%	28,000
Sonoma	183,000	7%	219,000	7%	36,000
Bay Area	2,760,000	41%	3,427,000	45%	666,000

This table is the “Heart and Soul” of the Plan Bay Area and where “controversies” will occur.

Conclusions

- Plan Bay Area is NOT really about reducing GHG emissions
 - ❖ GHG reduction is largely determined by technological change not land use decisions
- Plan Bay Area is not really about reducing peak hour traffic congestion
 - ❖ All of the alternative scenarios considered have significant increases in peak hour traffic and increases in commute times.
- Plan Bay Area is really about economic growth and land use
 - ❖ The economic growth of the Bay Area is going to continue
 - ❖ Newly arriving residents will want housing
 - ❖ The question is what kind of housing is built and where it is built.
 - ❖ If we want to preserve open spaces and don't want high density housing in our suburban communities, it'll have to be built outside the 9 counties.