

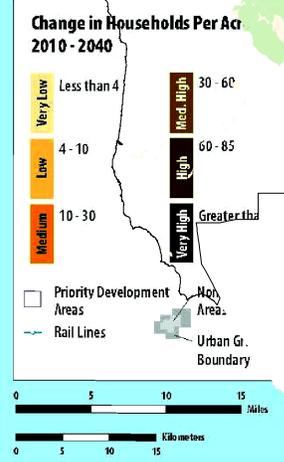
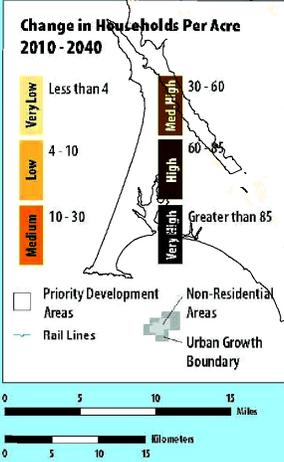
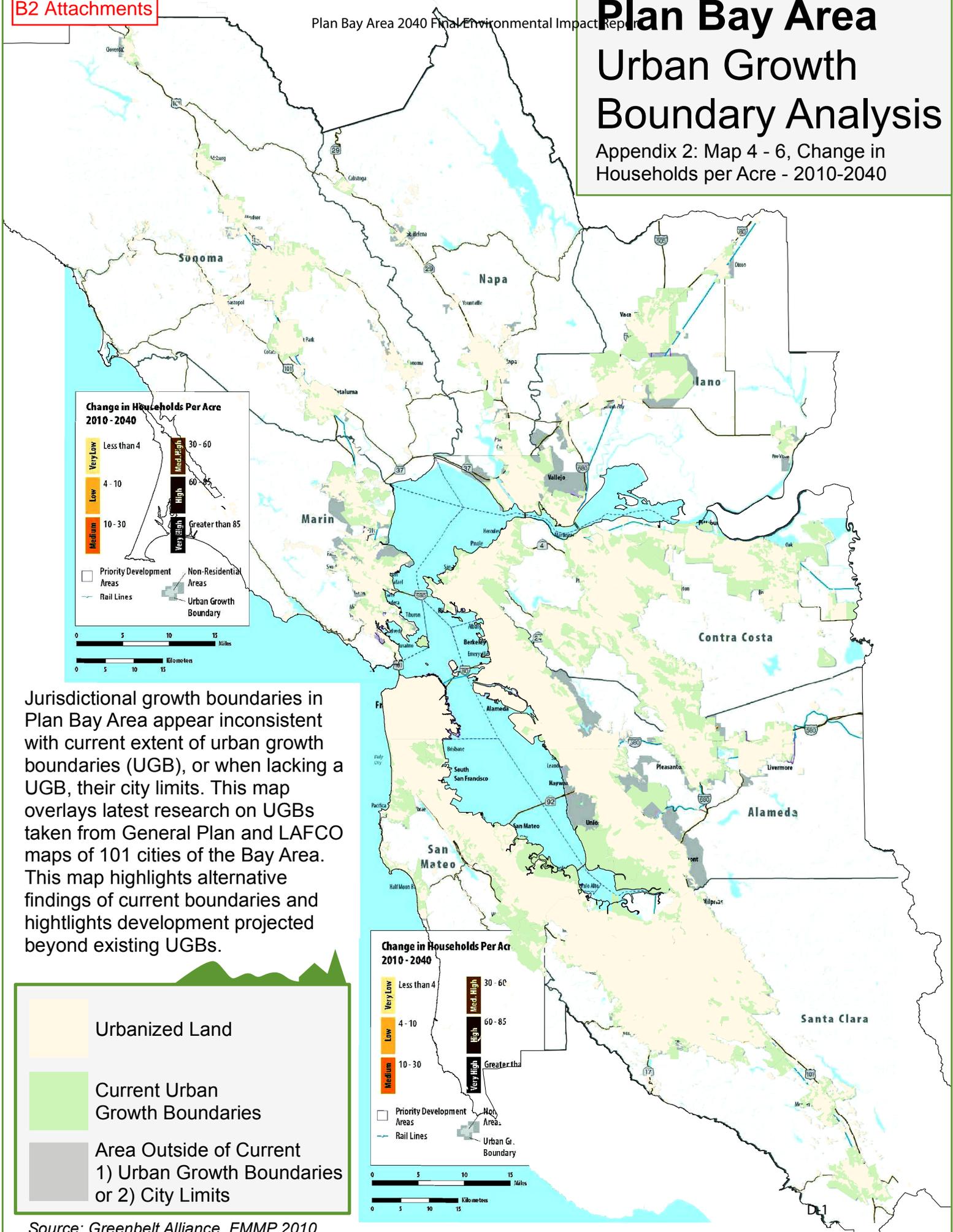
Appendix D:
Attachments from Organization Comments

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Plan Bay Area Urban Growth Boundary Analysis

Appendix 2: Map 4 - 6, Change in Households per Acre - 2010-2040



Jurisdictional growth boundaries in Plan Bay Area appear inconsistent with current extent of urban growth boundaries (UGB), or when lacking a UGB, their city limits. This map overlays latest research on UGBs taken from General Plan and LAFCO maps of 101 cities of the Bay Area. This map highlights alternative findings of current boundaries and highlights development projected beyond existing UGBs.

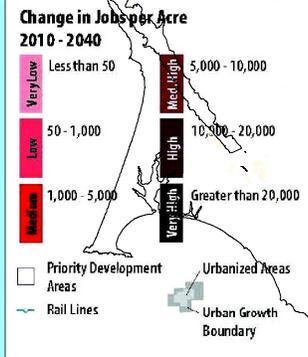
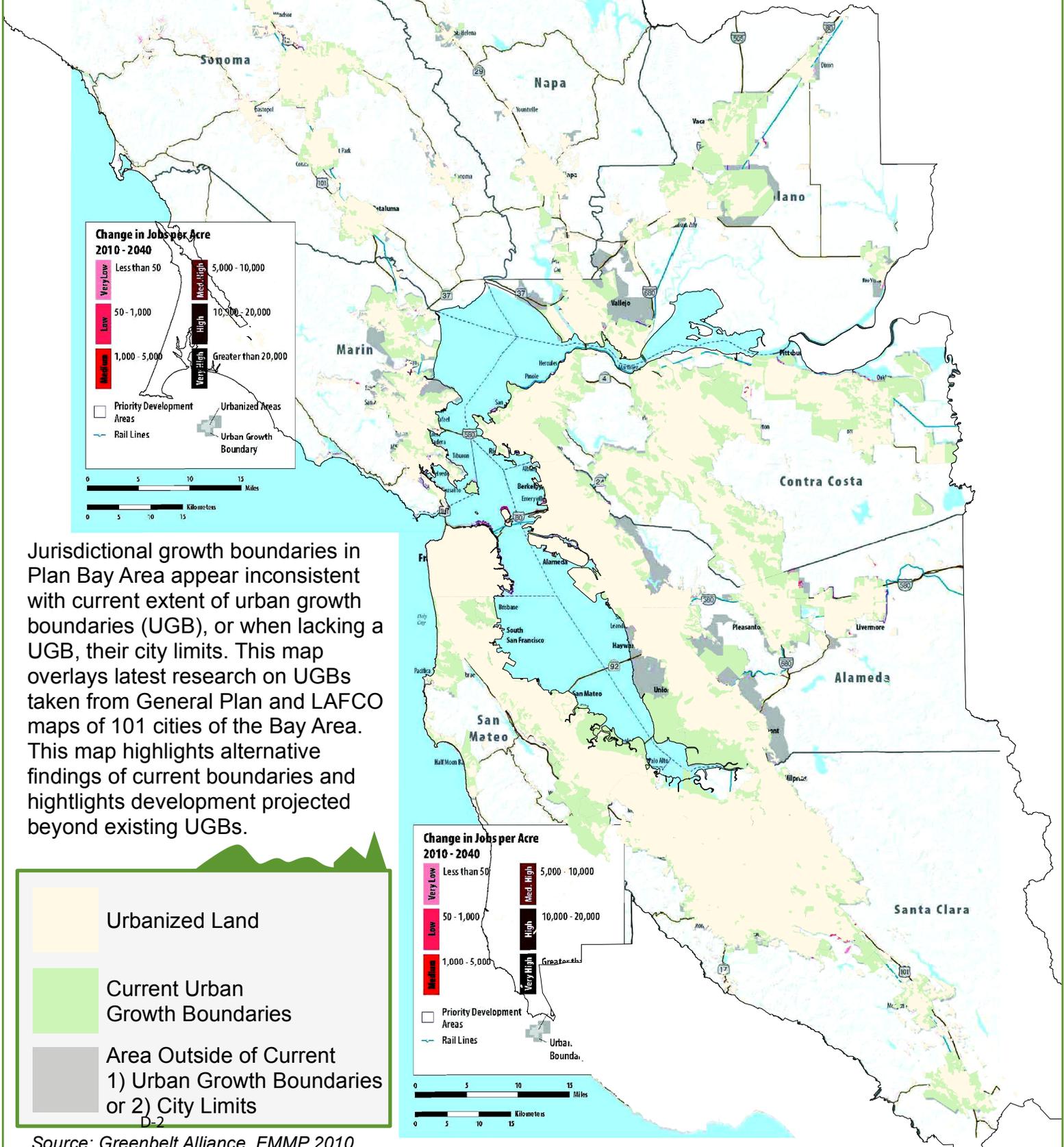
Urbanized Land

Current Urban Growth Boundaries

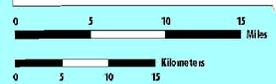
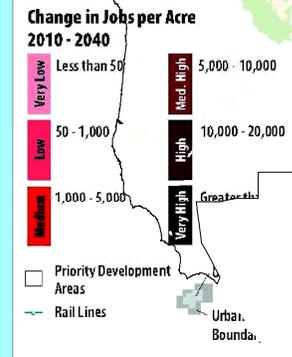
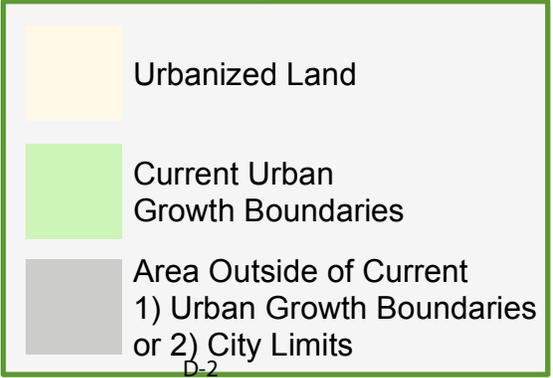
Area Outside of Current
1) Urban Growth Boundaries
or 2) City Limits

Plan Bay Area Urban Growth Boundary Analysis

Appendix 2: Map 4 - 6, Change in Jobs per Acre - 2010-2040



Jurisdictional growth boundaries in Plan Bay Area appear inconsistent with current extent of urban growth boundaries (UGB), or when lacking a UGB, their city limits. This map overlays latest research on UGBs taken from General Plan and LAFCO maps of 101 cities of the Bay Area. This map highlights alternative findings of current boundaries and highlights development projected beyond existing UGBs.

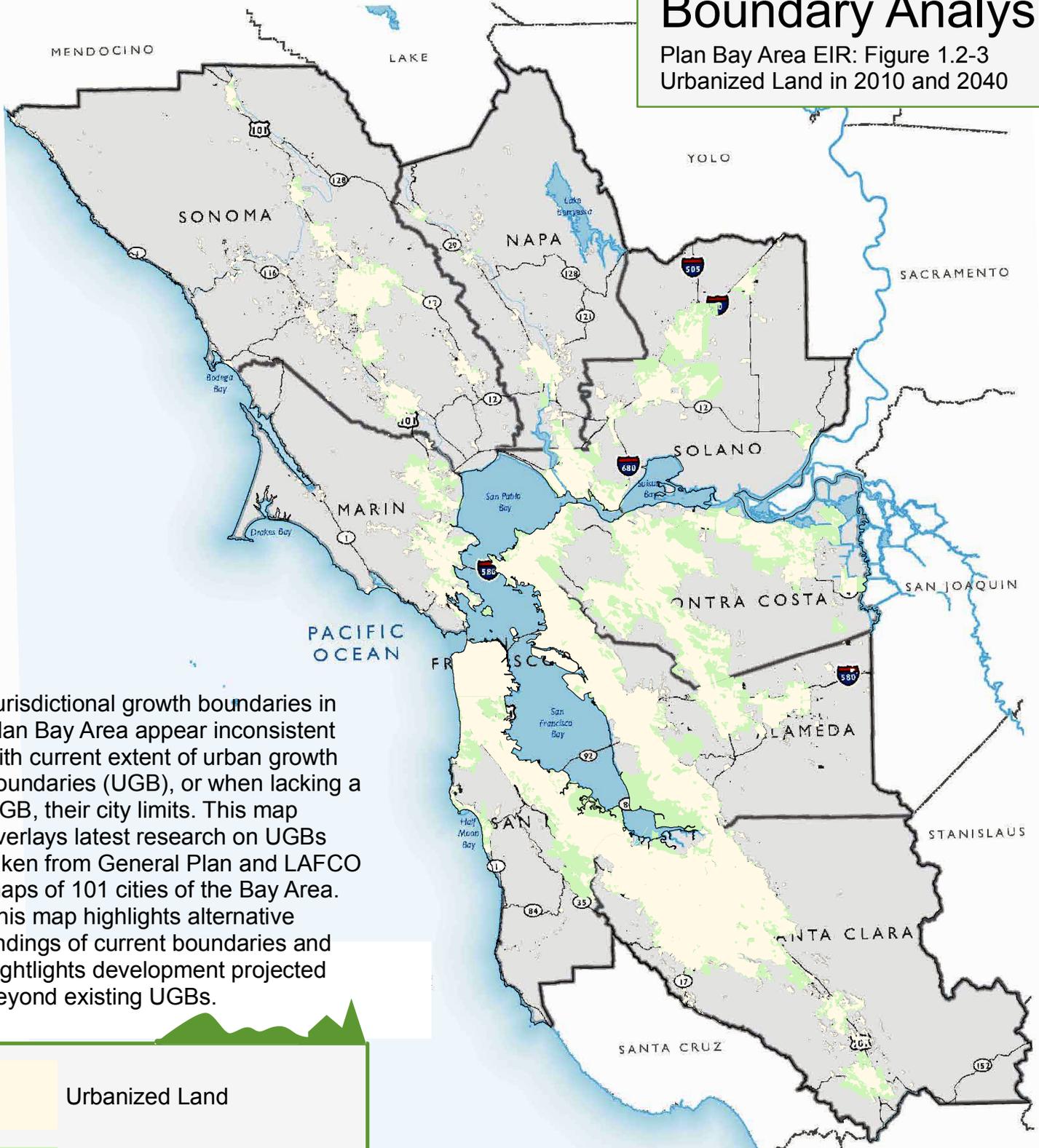


Plan Bay Area Urban Growth Boundary Analysis

Plan Bay Area EIR: Figure 1.2-3
Urbanized Land in 2010 and 2040

Figure 1.2-3

Urbanized Land in 2010 and 2040



Jurisdictional growth boundaries in Plan Bay Area appear inconsistent with current extent of urban growth boundaries (UGB), or when lacking a UGB, their city limits. This map overlays latest research on UGBs taken from General Plan and LAFCO maps of 101 cities of the Bay Area. This map highlights alternative findings of current boundaries and highlights development projected beyond existing UGBs.

- Urbanized Land
- Current Urban Growth Boundaries
- Preferred Scenario Urban Growth by 2040

Farmland Mapping & Monitoring Program (FMMP),
Cal-Atlas Geospatial Clearinghouse, 2012;



A REVIEW OF THE SAN FRANCISCO BAY AREA'S DRAFT PLAN BAY AREA/ SUSTAINABLE COMMUNITIES STRATEGY: MARKET DYNAMICS AND HOUSING PREFERENCES

April 2013





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On March 22, 2013, the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG) released Draft Plan Bay Area (Draft Plan) as the proposed Sustainable Communities Strategy (SCS) for the Bay Area. The preferred Sustainable Communities Strategy (“Draft Plan”). Draft Plan was developed as part of the region’s implementation of SB 375 and has been identified as the “Proposed Project” for purposes of the CEQA scoping currently underway for the Regional Transportation Plan (RTP), of which the SCS will ultimately be a part. The Draft Plan represents a combination of the “preferred” land use strategy and transportation investment program adopted by the agencies in May 2012. The preferred land use strategy was published as the Jobs-Housing Connection Scenario (JHCS). The JHCS contains the policy assumptions and rationale for the Draft Plan’s projected land use development pattern.

This report is not intended as a detailed “micro” analysis of the economic or regulatory feasibility of developing individual Priority Development Areas (PDAs) that form the basis of the Draft Plan. Rather, the purpose of this report is to assess the overall reasonableness of the fundamental land use and development assumptions and projections of the Draft Plan as currently configured, in terms of overall market feasibility. **The fundamental premise of the Draft Plan is to direct the vast bulk of future residential development in the region toward very high densities, generally in urban locations.** This analysis challenges how grounded the Draft Plan’s projections are in terms of both market realities and of widespread housing preferences among those who would live in the high-density transit hub buildings that would dominate the future landscape of Bay Area development.

As noted, this report does not delve into the minutiae of the Draft Plan, but addresses its overarching intent – to drive residential toward very high densities generally within core urban locations. This is driven by the plan’s reliance on PDAs to guide the placement and type of housing in the Bay Area going forward. PDAs are infill, transit-oriented areas within the many jurisdictions of the Bay Area identified by planners to absorb additional housing.

The minimum densities required by MTC and ABAG for qualifying as a PDA are what generate the radical skew toward high-density urban housing that characterizes the strictures of the Draft Plan. These approximately 170 urban, transit-oriented areas represent a small part of potentially developable Bay Area land, and, obviously, would push development toward existing urban cores.

There are seven main residential PDA types (see “Station Area Planning Manual” of October 18, 2007). The table below outlines these development types, lists the expected share and unit count of new housing unit creation through 2040 (per Draft Plan), and then lists the allowable density ranges for each type.

Development Type	Share	Units	Net Project Density			
			Low	High	Mid-Point	One-Fourth
Regional Center	15.0%	99,000	75	300	188	131
City Center	8.0%	52,800	50	150	100	75
Suburban Center	9.0%	59,400	35	100	68	51
Transit Town Center	13.0%	85,800	20	75	48	34
Urban Neighborhood	7.0%	46,200	40	100	70	55
Transit Neighborhood	8.0%	52,800	20	50	35	28
Mixed Use Corridor	19.0%	125,400	25	60	43	34
Totals	79.0%	521,400				
Averages			38	119	79	58
Weighted Averages			38	124	81	60

Notes: Weighted averages based on unit totals. An additional 21% (138,600) of units would be in rural and non-PDA areas. The above totals include only PDA types.

The critical effect of the PDA types governing residential development in the Bay Area would thus be a tremendous push toward far higher densities than have ever been the norm in the Bay Area.

The seven PDA types as mandated by regional by planners as acceptable within the regime of the Draft Plan have density ranges from 20 to 300 dwelling units per acre. In the table above we have applied mid-point values to the allowed density ranges for each PDA type. We also assumed typical densities of 1/4th the distance between the density ranges (e.g., at 75 units for the City Center PDA type’s 50-150 range instead of the mid-point of 100). Simple and weighted averages are similar given the distribution of PDA type housing shares. This results in a typical density of about 80 units to the acre in PDA areas using the mid-point figures and about 60/acre using the 1/4th-point figures.

Further exacerbating this move toward very high residential densities is that the Draft Plan would place 80% of new residential units to be within PDAs. (Note that 1% of PDA units would be in rural areas and 20% in non-PDA areas, both not included in the table above.) Since the PDAs are governed by the PDA types in terms of allowable densities, **this effectively means that about 80% of future residential units in the region will be at a minimum of 20 units per acre and at an average of something like 60 to 80 units to the acre.** And since the PDAs are mainly in urban core type locations within each county this means the norm in residential development in the Bay Area going forward would be mid-rise multi-level residential product within an urban mass transit node.

This would be an extraordinary shift from the historical norm since it would apply to the entire Bay Area, not just the highly urban, city center locales within major population centers where mid-rises and high-rises are typically seen. Even the lowest density allowed of 20 du/ac is a fairly dense product by current standards. This would leave no room for single family development in the PDAs and even preclude most current townhouse configurations. Some townhouse examples that would barely make the cut include Modern Ice in San Jose or Boulevard in Santa Clara. And this would be the bare minimum density. The rough average might be something more like a multi-level mid-rise (e.g., Elan in Dublin near a BART station). Yet far greater densities would be demanded at the high-end of the ranges as well, thus there would need to be many high-rises as well, a product type that has found no acceptance outside the city of San Francisco and, on a smaller scale, Downtown Oakland and more recently Downtown San Jose.

Certainly, many of these units and these high-density developments would be for rental product, but normal garden style apartment developments are typically at densities of about 25-40/acre. As with for-sale product, the mid-rise and high-rise configurations that will be necessary under the Draft Plan are normally found only in urban cores and even then have significant cost issues associated with them (see Builder Costs section below).

In the following analysis we present data that highlights where the policies and outcomes of the Draft Plan policies are unrealistic, based on faulty premises, at odds with market realities, or simply unworkable. We do this by addressing the following factors:

- Housing demand by life stage and what this means for housing preferences and market realities
- Consumer preferences among homebuyers and how these will affect market dynamics
- Builder costs and interest in urban product, which calls into question the reasonableness of the expectations and demands of the Draft Plan
- Critiques of key research, including the Draft Plan document itself and its key intellectual underpinning, a recent ULI white paper that centers on the single family home oversupply argument
- Macro housing trends to further imply the unlikelihood of a supply glut, at least for the nearer term
- Psychographic profile of Bay Area residents, to further address consumer preferences

Below is brief executive summary of our findings for each of these sections, followed by the data and analysis in support of these conclusions.



EXECUTIVE SUMMARY

- **Location Analysis.** The Priority Development Areas (PDAs) that form the bulk of residential development that would occur in the future are shown in a series of maps issued as part of the Draft Plan. This demonstrates that these locations tend toward urban locales, thus concentrating residential development in environments where most people do not want to live. Even in the Bay Area, most residents prefer suburban housing locations. They want lively and varied suburban environments, to be sure, but they want good schools, low crime, and the quality of life factors that are generally found in the suburbs.
- **Demand by Life Stage.** Estimates of actual housing demand by key life stage groups – young and mature families, singles, empty nesters, etc. – show diverse demand with most not a good fit for high-density and urban locations. Family demand is still critical in the Bay Area despite the expected gradual decrease in family households over the coming decades. Families represent about 40% of estimated housing demand, more when we factor in the “pre-families” represented by younger households (households that will either soon become family-based demand or will choose a housing option based on this expectation). Further, younger households most likely to prefer higher density urban product will be least able to afford this product given its high costs. Most of these people will not want to be long-term urban renters, meaning product designed for them will have high turnover rates and be particularly susceptible to relatively shorter term demographic shifts.
- **Consumer Preferences.** Clearly and consistently, most people prefer to live in relatively lower density housing product in suburban locations. Our own recent survey of actual active home shoppers shows this is abundantly true for Bay Area residents, whose views are not much different from respondents from across the country. High-density urban product is effectively a niche market. An important niche and perhaps a growing one, but still a small part of the landscape. This means the projections embodied in the Draft Plan are dramatically at odds with the very people these policies are designed to house. Though not all of us can live exactly where and how we want, preferences drive the market and “top down” strategies clearly at odds with these desires are their own peril.
- **Builder Costs.** An examination of the costs of building high-density housing through a survey of builders and developers active in the region reinforces the niche nature of high-density urban product. It is extraordinarily expensive to build such product. This means high-density usually equals high pricing, making it a poor answer for mass housing. For this reason very few builders or developers are currently interested in pursuing high-density product options, and when they are it is always in core urban locations surrounded by, or able to appeal to, the kind of very affluent households that can afford this product. Even for renters, very high densities will typically translate into very high rents, and thus will only make economic sense in islands of “A” locations mainly in the closer-in part of the region.

- **Draft Plan and Single Family Inventory.** We critically examine two key research documents, the Draft Plan document itself and a recent article by a demographic researcher that concludes a glut of single family homes is approaching, which is a critical foundation of the Draft Plan. Though the premise that a coming demographic wave of younger households (Gen Y and the Millennials) will shift demand more toward higher density urban product is likely true to some degree, the argument that this will leave a glut of excess single family supply in its wake is far from certain. We challenge this argument from a variety of angles (e.g., home ownership estimates, attitudes about transit oriented neighborhoods). These challenges call into question the assumptions of this argument, and therefore its conclusion of a coming single family oversupply which demands an unyielding focus on higher densities. We also address this argument through an examination of current inventory trends as well as a recap of the consumer preference data that refute the argument's attitudinal basis.
- **Macro Housing Market.** Recent housing market trends in the Bay Area show a deep decline in activity in recent years. As demand continues to normalize, this cannot help but lead to some level of pent-up demand that will absorb the expected modest increase in housing construction over the next several years. The Bay Area is a chronically undersupplied market, and the aberration of the housing bust of the last few years cannot mask that. While this pent-up demand will be general, and much will be for higher density options, single family activity has been very limited of late. This should naturally lead to much of this eventual pent-up demand for lower density product as the inventory overhang of the hot market is absorbed.
- **Psychographic Profile.** The nature of households in the Bay Area will have a strong influence on its housing decisions. Psychographic data show the region to be quite diverse, as shown by the consumer preference data, indicating diversity of housing types is appropriate. Though there are plenty of potential urban dwellers in the top psychographic profiles in most Bay Area MSAs, survey results have consistently shown that most people still hold to a single family ideal. This even includes many younger more urban households and, of course, many of these younger households will shift their focus toward conventional housing and suburban locations as they age.

We believe this analysis indicates that not only is a diverse housing profile in the Bay Area needed and more responsive to its residents, but an over-emphasis on high-density urban housing is unfeasible and misguided. Again, the goals of SB 375 and the Draft Plan – to help control pollution through transportation policies – are worthwhile. But there are multiple methods to achieve these goals. Higher gas mileage standards, incentives to induce more telecommuting, disincentives to long distance commutes, etc. Creativity is demanded, but multiple methods need to be found. Ultimately, do we alter how we drive or work or tax ourselves, or do we dramatically change where and how we *live*?

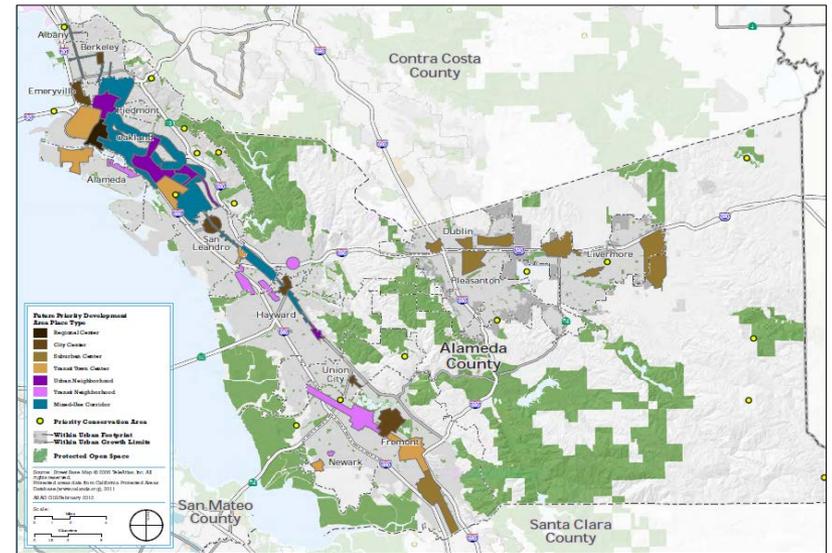
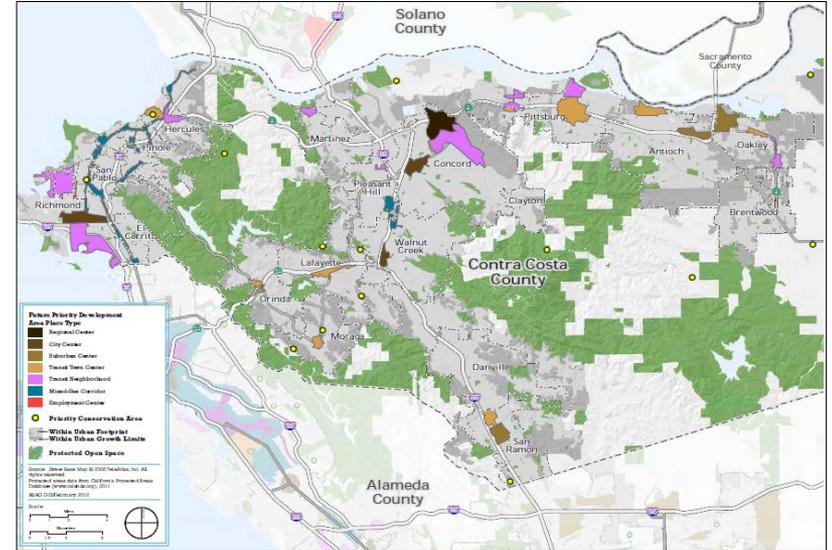
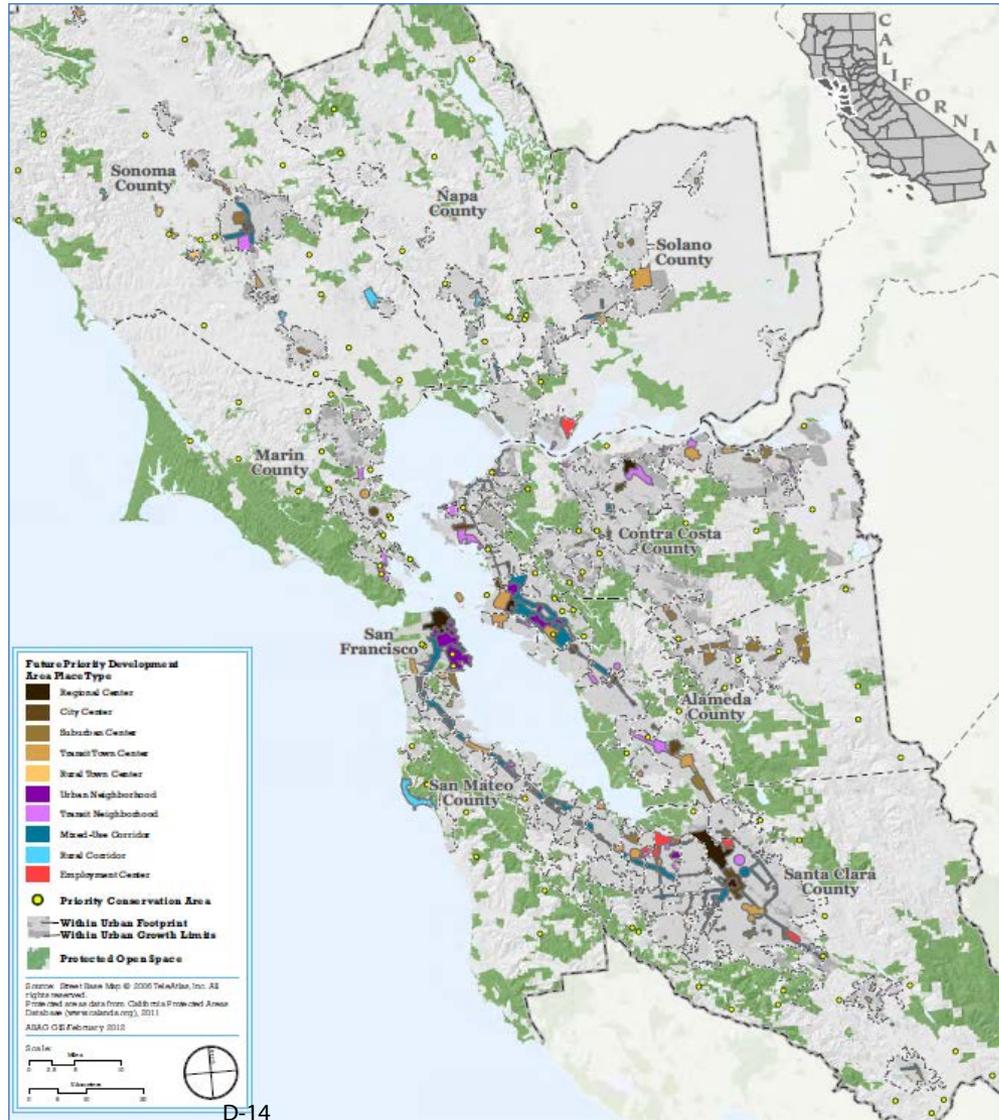


LOCATION ANALYSIS – PRIORITY DEVELOPMENT AREAS

MAPS OF PRIORITY DEVELOPMENT AREAS

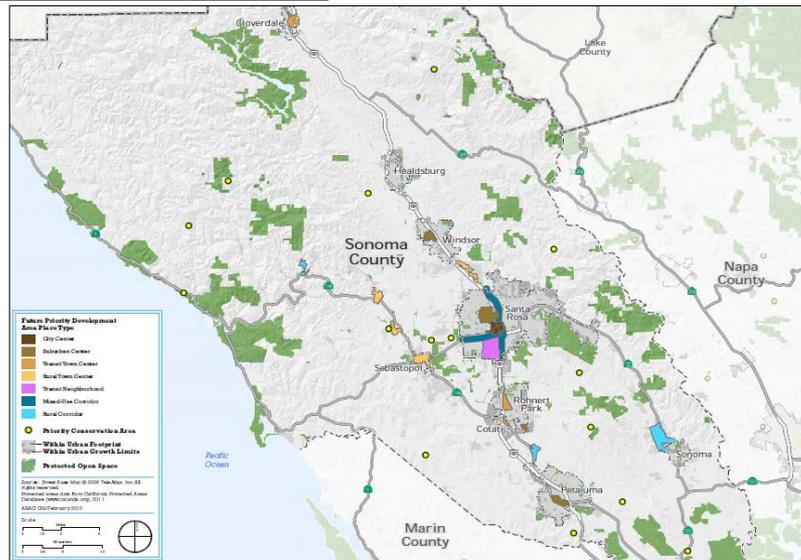
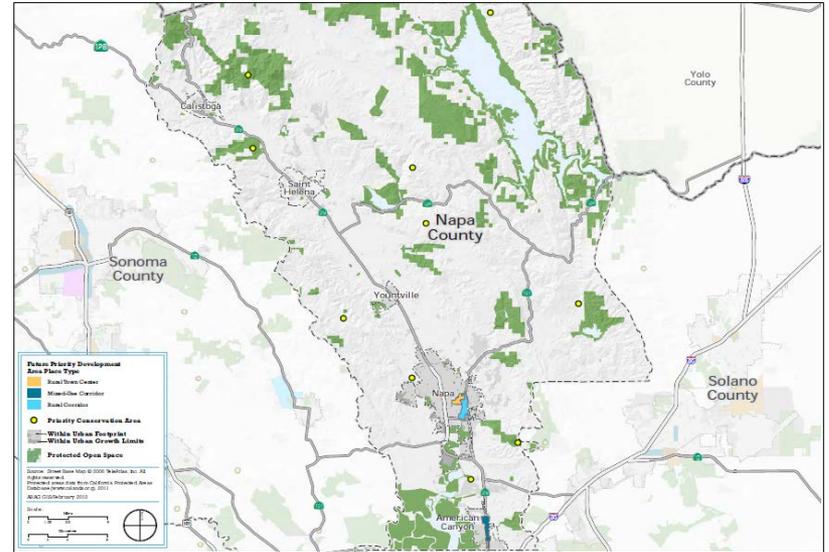
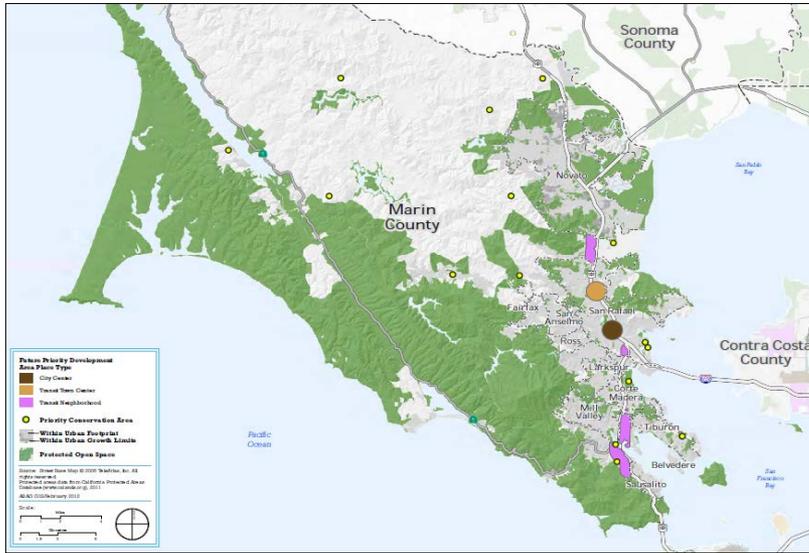
Plan Bay Area 2040 Final Environmental Impact Report

The maps here and on the following page portray the Priority Development Areas (PDAs) per the Plan Bay Area action plan that would implement the goals of the SCS. See the “Jobs-Housing Connection Scenario” draft of March 9, 2012 for details. The urban infill, transit-orientation of the PDAs is evident.



D-14

PDA maps continued.



Source: One Bay Area JBREC

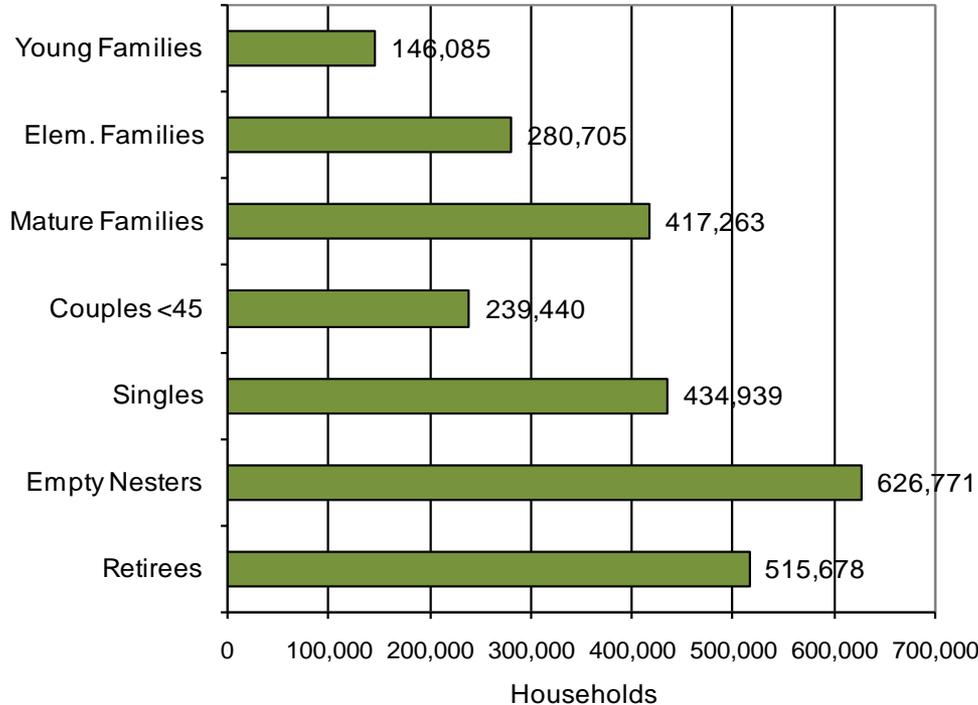
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DEMAND AND LIFE STAGE

Older buyers, including Empty Nesters and Retirees, comprise the largest household groups in the Bay Area. However, the **combined Family groups which comprise 32% of the households** in the Bay Area, have the **highest propensity to buy homes**.

2011 Summary Distribution of 2,660,880 Households in Bay Area

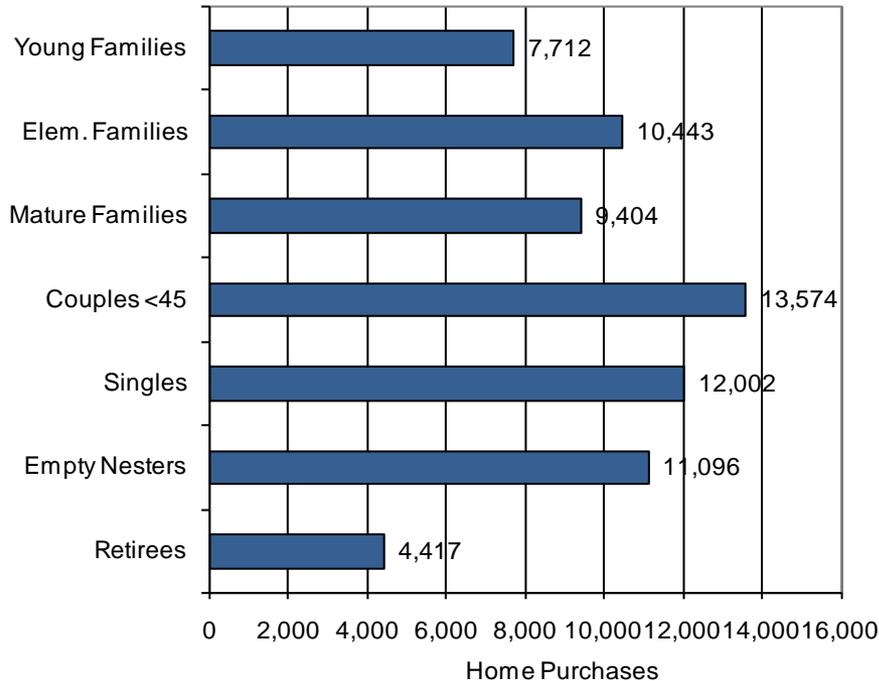


- John Burns Real Estate Consulting estimates housing demand by specific buyer segments (see charts that follow). This proprietary model estimates the depth of total for-sale housing demand – including new and resale homes – by life stage and price point by utilizing demographic data and known sales activity information. The model evaluates structural demand only, and does not assess competitive supply, which could influence demand. The estimates detailed below were conducted in late 2010 and thus speak to 2011 demand, but these results are entirely applicable for the near-term at least given the maturity and relatively stable demographics of the Bay Area. Product demand, as is well understood, generally follows the life stage demand detailed below (e.g., families prefer single family homes and suburban more often than not, etc.).

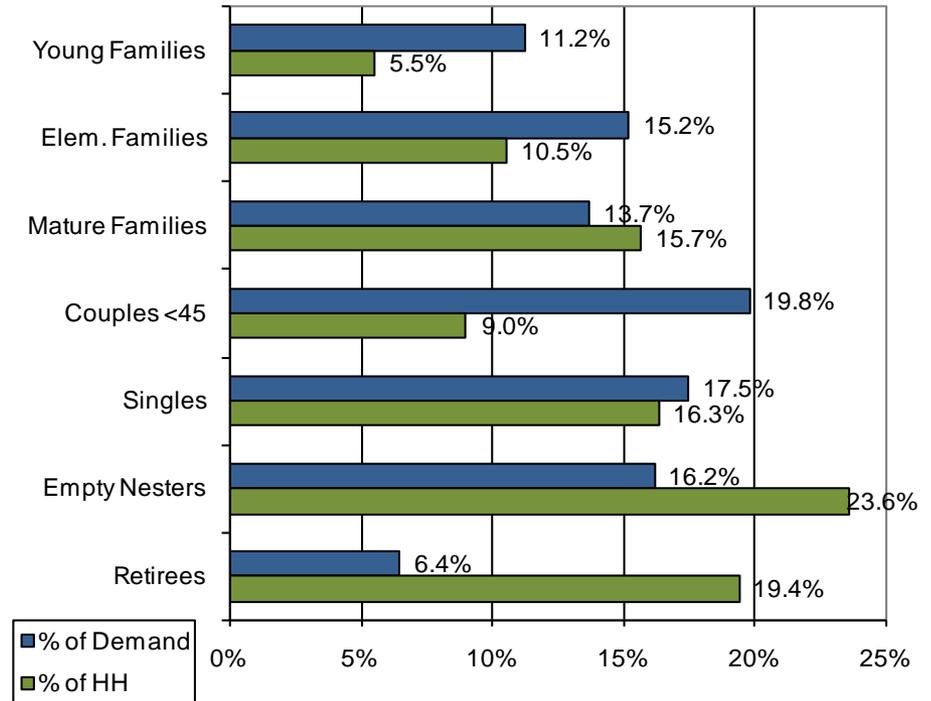
- For 2011, Empty Nesters comprise the largest household group, followed by Retirees. The combined Families groups – those households with children under the age of 18 and who have the greatest propensity to buy a home – represent nearly 845,000 households. The younger portion of the Couples under 45 segment are usually “pre-families” and this will impact their housing desires as well.

The Families' share of home buying activity in 2011 is 40% of the market, which is higher than their share of households. Couples Under 45 and Empty Nesters will also have a greater share of home purchases than overall households.

2011 Summary of Annual Home Buying Demand (68,649 Homes) in Bay Area



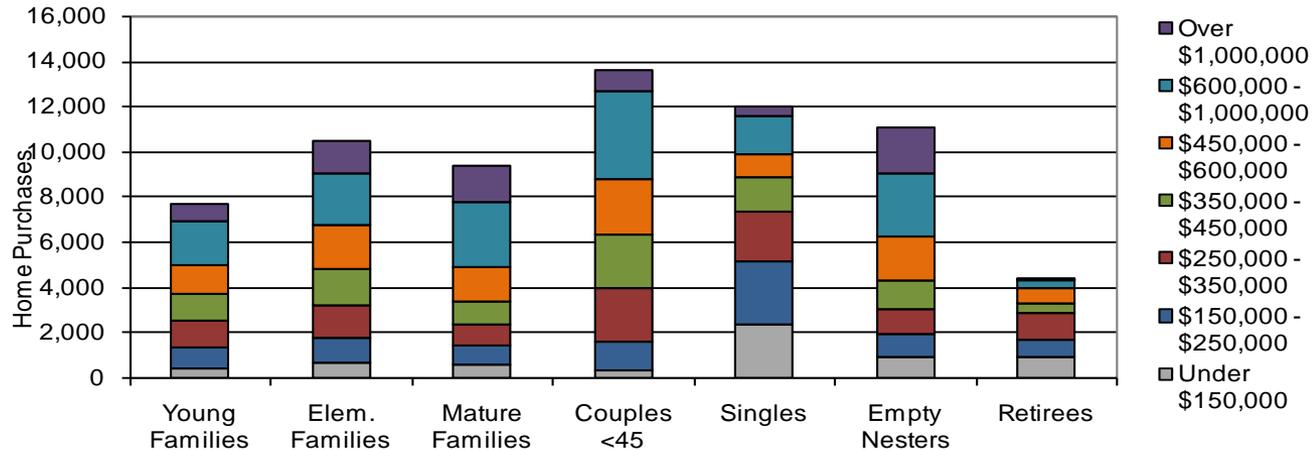
2011 Percentage of Buying Demand (68,649 Homes) in Bay Area



- For 2011, total homes sales (new and resale) are projected to be approximately 82,100 in the Bay Area MSA. Investors are projected to be 13,451 of these sales. Couples Under 45 (who will often be planning families), Singles and families will dominate the remaining 68,649 home purchases in 2011. Even ignoring the “pre-family” portion of the younger couple segment, the combined family segments total two of every five units of housing demand. These segments represent very unlikely high-density residents, but, as seen in the consumer preference data in the next section, potential homebuyers very generally tend to prefer more traditional housing product.

Demand for housing in 2011 is spread throughout this market, with 34% of the sales occurring in the price points above \$600,000.

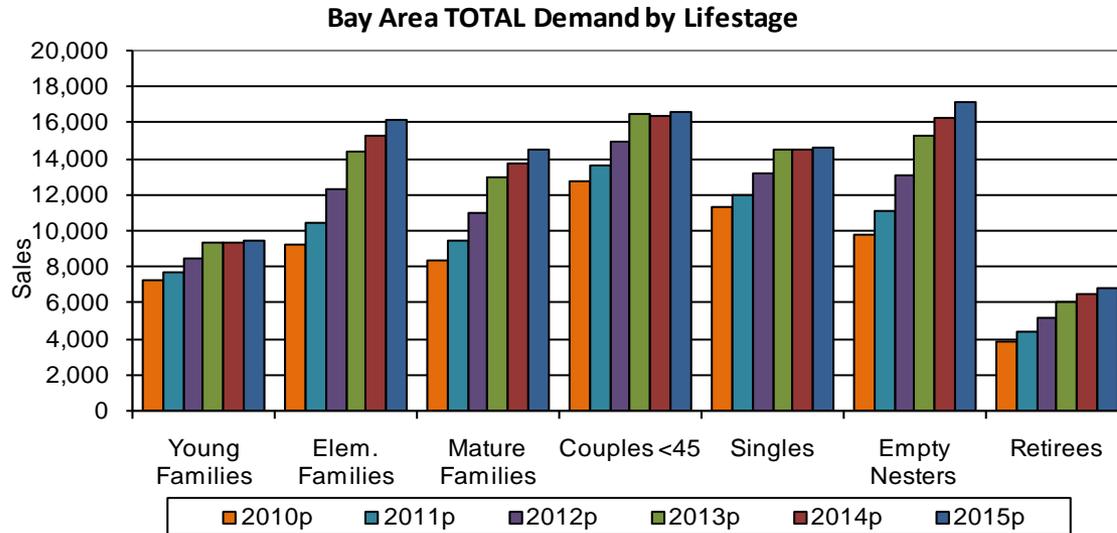
2011 Annual Home Buying Demand (68,649 Homes) by Price Point and Household Composition



Bay Area	Young Families	Elem. Families	Mature Families	Couples <45	Singles	Empty Nesters	Retirees	Total	% of Total
Under \$150,000	411	637	581	365	2,328	966	963	6,251	9.1%
\$150,000 - \$250,000	924	1,139	863	1,239	2,833	1,009	690	8,697	12.7%
\$250,000 - \$350,000	1,210	1,407	893	2,380	2,202	1,077	1,211	10,380	15.1%
\$350,000 - \$450,000	1,178	1,636	1,055	2,338	1,490	1,257	436	9,391	13.7%
\$450,000 - \$600,000	1,296	1,899	1,508	2,415	1,039	1,908	681	10,746	15.7%
\$600,000 - \$1,000,000	1,939	2,280	2,840	3,900	1,691	2,830	435	15,916	23.2%
Over \$1,000,000	754	1,445	1,663	936	419	2,050	2	7,268	10.6%
Total	7,712	10,443	9,404	13,574	12,002	11,096	4,417	68,649	100%
% of Total	11%	15%	14%	20%	17%	16%	6%	100%	

- In general, the younger households that tend to prefer higher densities and more urban environments are least able to afford such product since its high building and land costs (see discussion below) translate into high sales prices. For instance, about three-quarters of demand from single households, the most obvious high-density buyer, is priced under \$450,000, a comparatively affordable price point in the Bay Area.

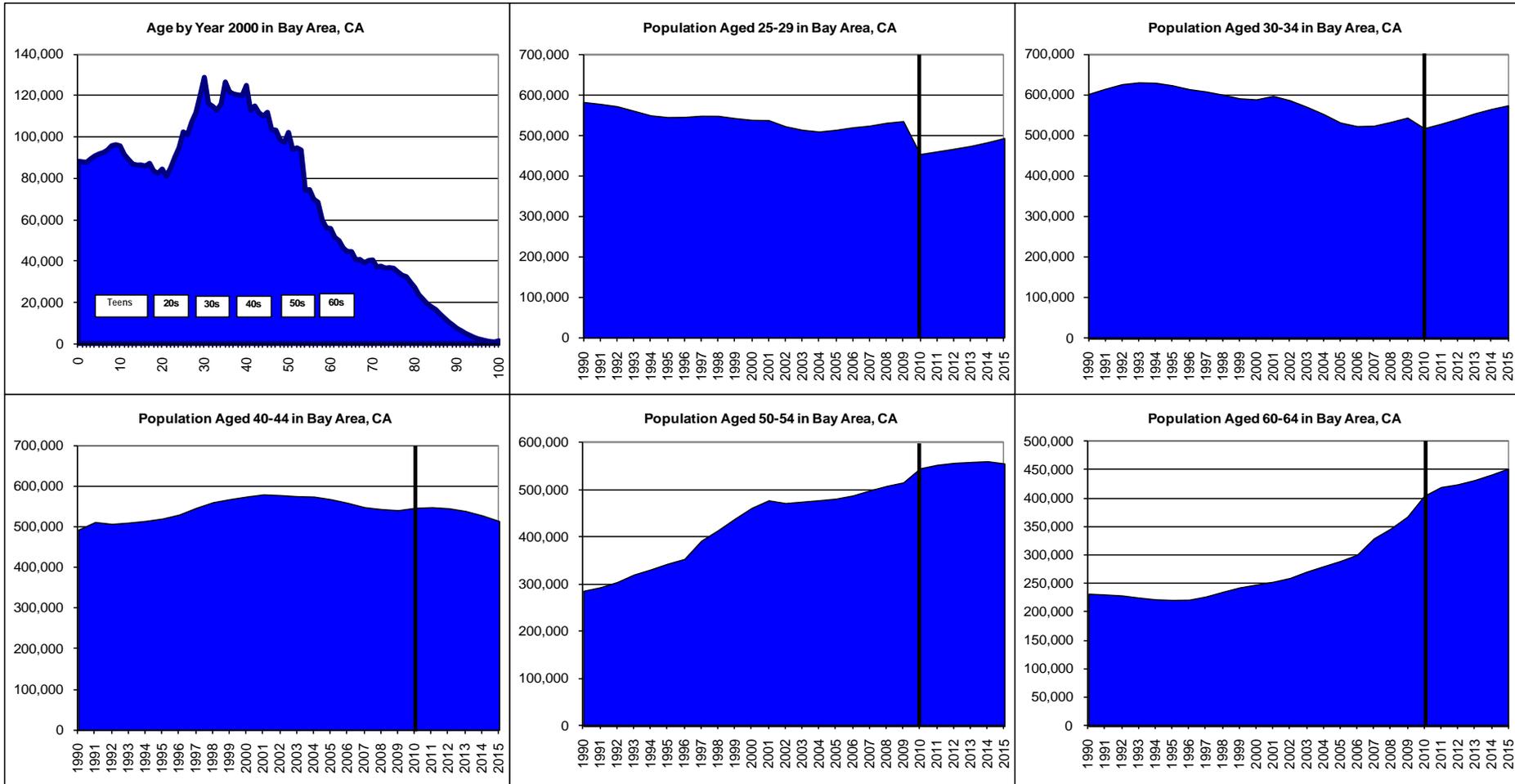
Demand for new and resale homes is expected to grow steadily over the next five years to 114,000 (including sales to investors; 95,322 excluding investor sales) homes in 2015.



	TOTAL						2015p % of Total
	2010p	2011p	2012p	2013p	2014p	2015p	
Young Families	7,249	7,712	8,503	9,353	9,331	9,410	9.9%
Elem. Families	9,218	10,443	12,261	14,364	15,269	16,155	16.9%
Mature Families	8,301	9,404	11,042	12,935	13,750	14,549	15.3%
Couples <45	12,759	13,574	14,967	16,462	16,423	16,563	17.4%
Singles	11,281	12,002	13,234	14,556	14,521	14,645	15.4%
Empty Nesters	9,795	11,096	13,029	15,263	16,225	17,166	18.0%
Retirees	3,900	4,417	5,187	6,076	6,459	6,834	7.2%
TOTAL	62,503	68,649	78,223	89,009	91,978	95,322	100.0%
% Chg from 2010		9.8%	25.2%	42.4%	47.2%	52.5%	

- The majority of future demand will continue to come from Empty Nesters, Couples Under 45, Singles and Elementary and Mature family groups. Each of these life stage groups will represent approximately 15% or more of the total demand in the Bay Area MSA in 2015. The key point here is that demand at least over the near-term future will look very much like demand at present.

Population growth in the Bay Area will be strongest for the younger and older demographics. That is, the region will follow the national trend toward generally increased demand for retiree housing as well as for relatively higher density and more urban housing given an assumed Millennial and Gen Y preference for such housing. However, what this section also makes clear is the essential diversity of housing demand in the Bay Area. Regionally, the Bay Area has a diverse life stage profile and, regardless of youthful attitudes, housing preferences closely follow life stage realities.





CONSUMER PREFERENCES

John Burns Real Estate Consulting conducted a national survey of potential homebuyers in late 2011. Over 20,000 potential consumers responded to this survey that included 90+ questions covering the most important characteristics of home design and style, and product and community preferences. For the purposes of this analysis, the key questions center on how consumers feel about the higher densities and more urban-oriented product options that dominate the Draft Plan. While there is the potential for some skew in the results since respondents were primarily surveyed in sales offices of larger national and regional builders, potential homebuyers is an ideal sample for testing residential attitudes. Further, capturing more buyers associated with urban infill sites would not likely alter the basic tenor of the results since there are comparatively few such developments to sample from. That these attitudes reflect home shopper rather than the general population, that is, is undeniable, but that this is an ideal sample from which to test housing preferences is also clear.

The results detailed below are from respondents from within the Bay Area, including the San Francisco, Oakland, San Jose, and Vallejo metro areas. We have also included results from the national sample for comparisons. The national sample size is 20,037. The full regional (Bay Area) sample size is 777, with some MSA-level subsamples seen below for certain questions.

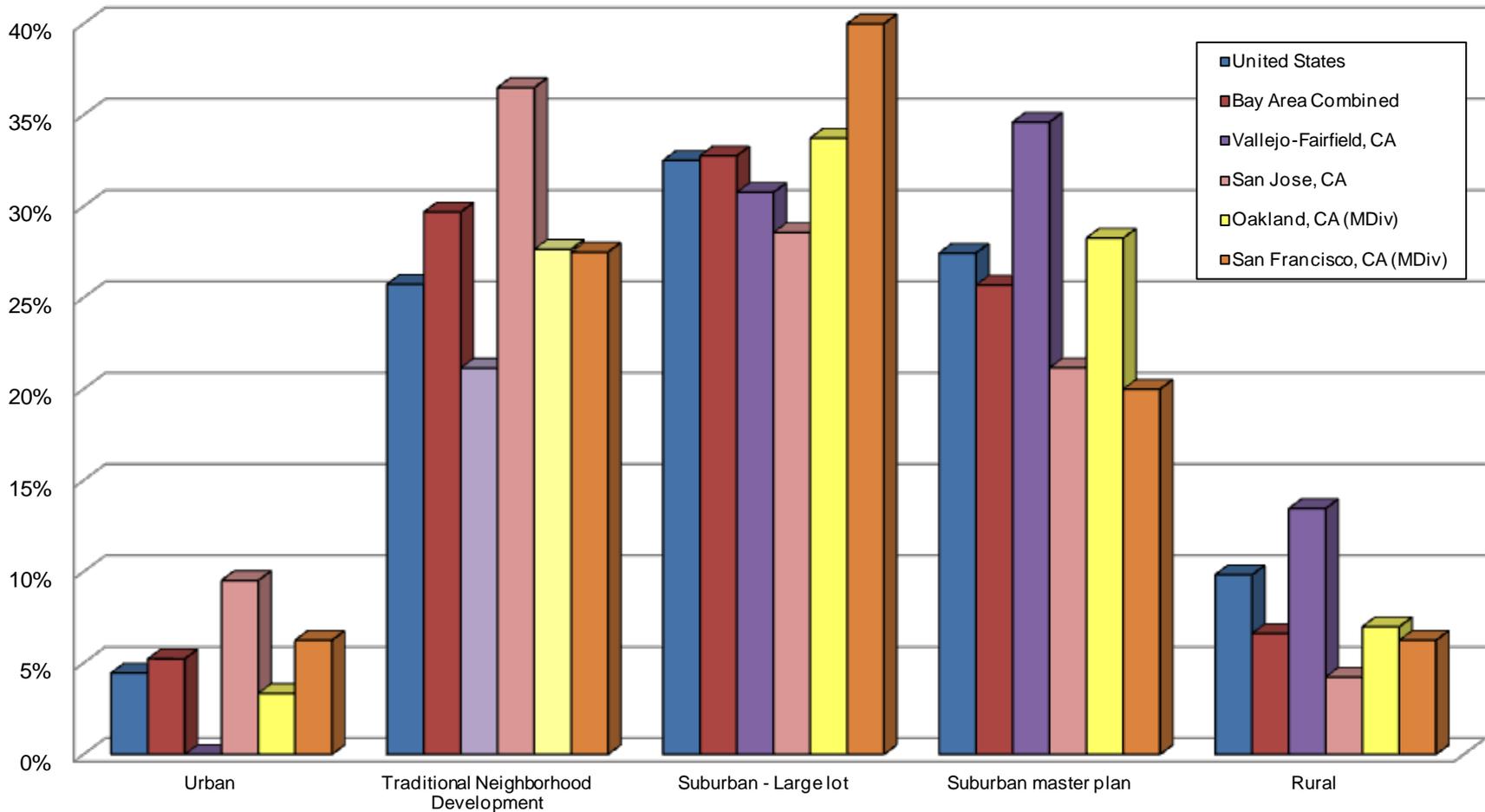
The resulting overview of homebuyer attitudes and product and community preferences are clear. **Bay Area home buyers are a very diverse group, but generally they favor the following:**

- **suburban locations** over urban ones
- **lower density** and more **conventional** housing product
- **equal or larger homes** than they currently reside in
- **larger home sizes than high-density housing can easily accommodate**
- **more rooms** than higher densities can typically handle
- **yard and storage space** that cannot be satisfied at higher densities
- the potential for many **multi-generational** households that will require larger spaces and room counts

In fact, Bay Area respondents to our survey are not dramatically different in their outlooks and situations from our national sample.

The chart below compares the United States, combined Bay Area, and segments of the Bay's consumer survey results in terms of ideal community lifestyle. Bay Area results are generally consistent with the US average, favoring TND and suburban lifestyle over urban (and, for that matter, rural) lifestyles.

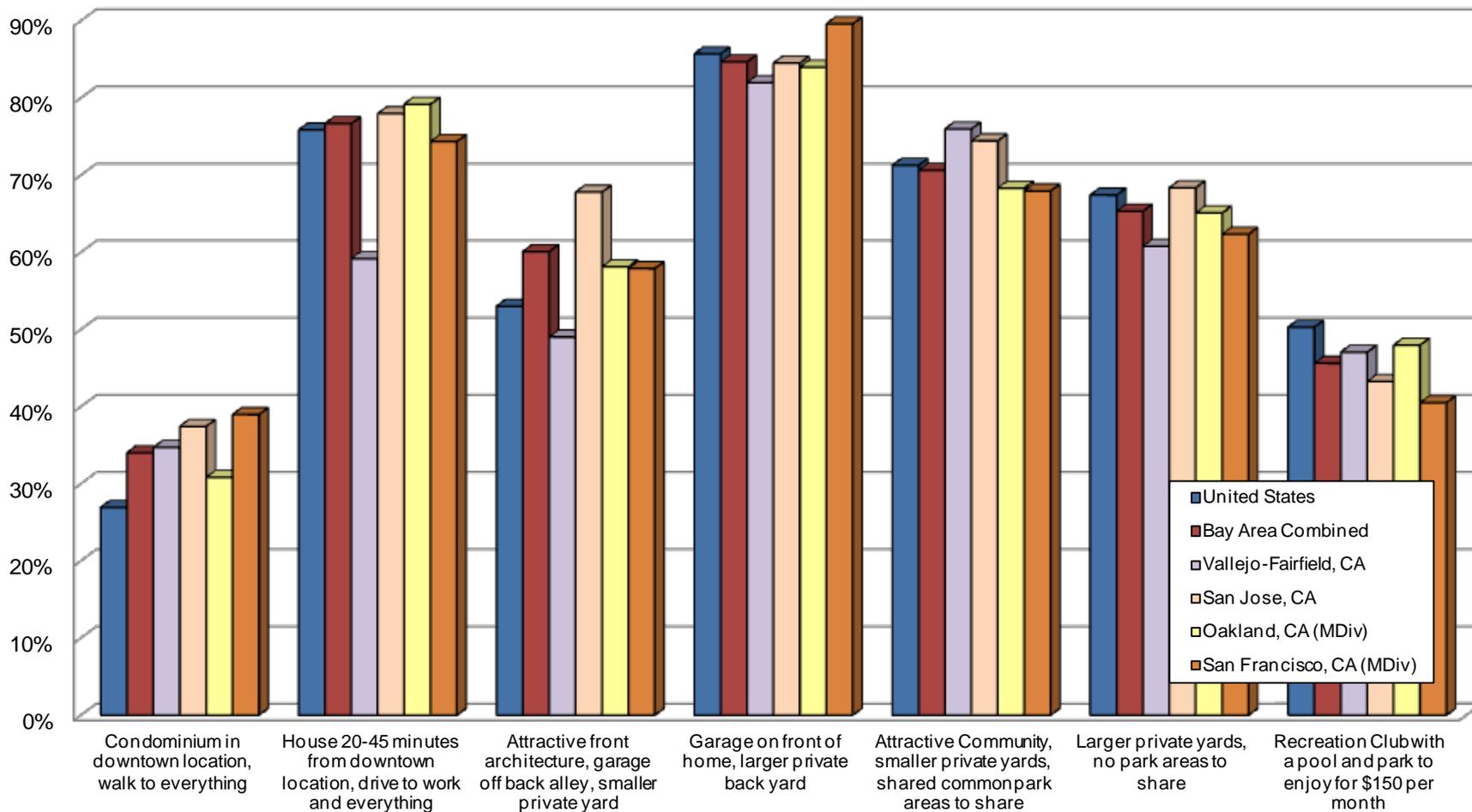
What is your ideal Community Type/Lifestyle?



Source: John Burns Real Estate Consulting

The chart below compares the US, Bay Area combined, and segments of the Bay's consumer survey results in terms of the home style they would prefer. Bay Area results are generally consistent with the US average, favoring a house 20-45 minutes from Downtown at a two-to-one ratio over a condominium in a downtown location.

Which Home Style Would You Most Likely Choose When You Purchase Your Next Home?

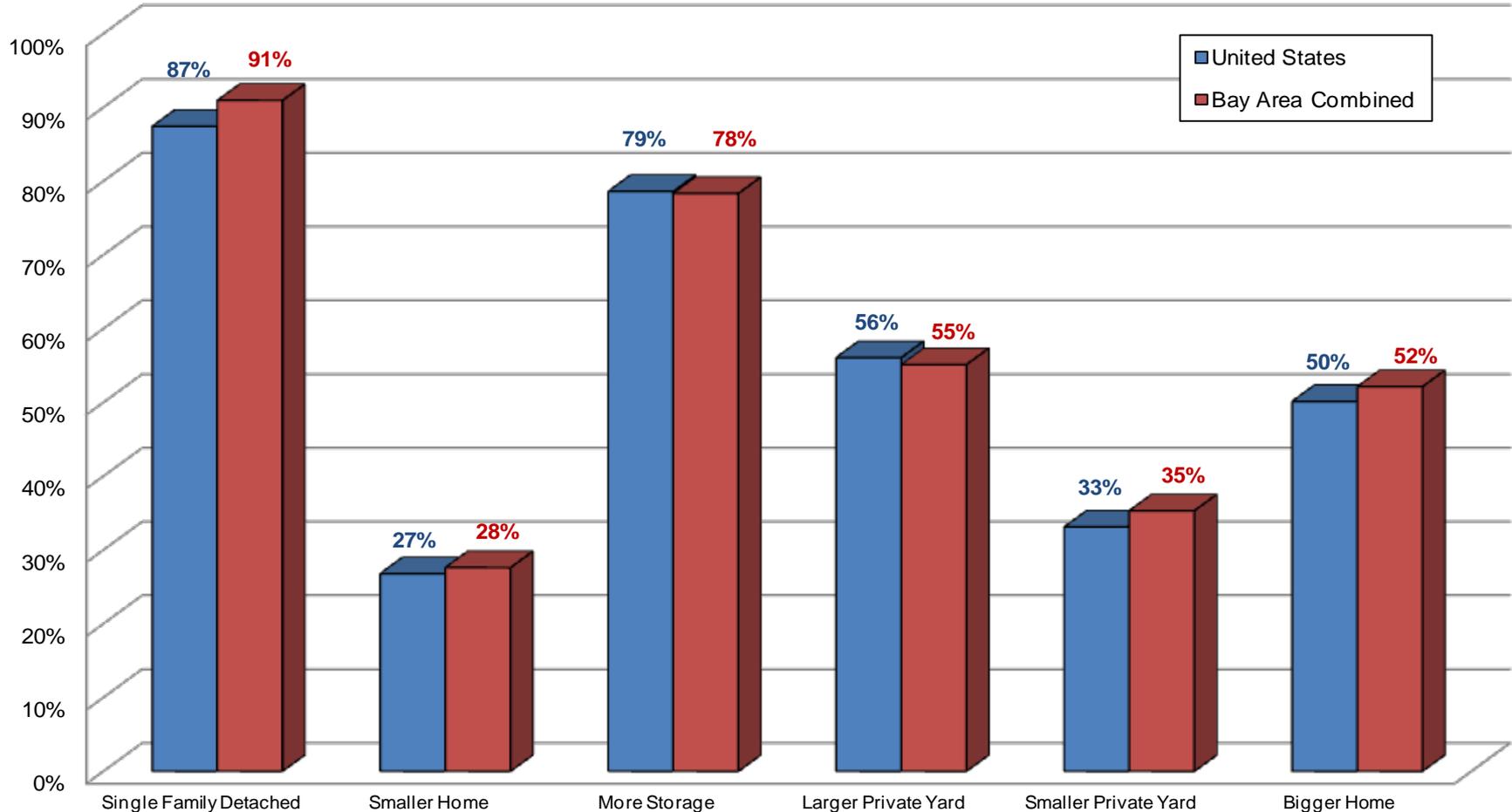


Source: John Burns Real Estate Consulting

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A single family home is the most important feature of a new home purchase for Bay Area respondents (as well as the US average), followed by more storage space. More than nine of ten respondents ranked a single family detached home as important or very important to them. While this is often aspirational in the Bay Area, it is still strongly indicative of preferences. Desires for detached homes, more storage, and private yards are all strong and virtually impossible to satisfy at high densities.

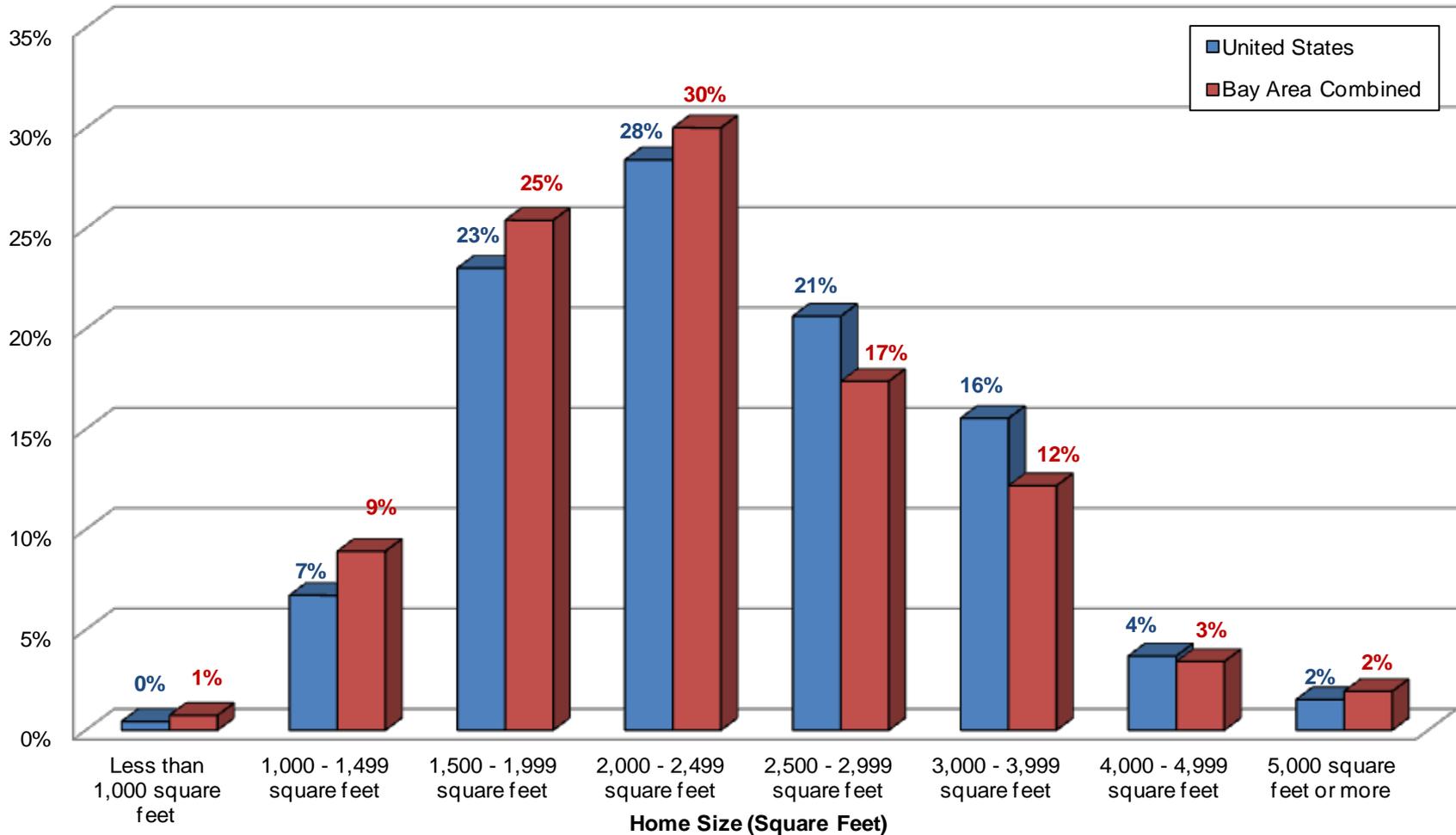
Rate the importance of the following when purchasing your next home



Source: John Burns Real Estate Consulting

Few high-density options can accommodate many units below about 2,000 SF and 64% of respondents favor homes above this size. It is likely that much of the recent shrinkage in average home sizes is at least as much a result of buyers looking for more affordability as it is buyers truly desiring smaller homes.

Expected Next Home Size Range

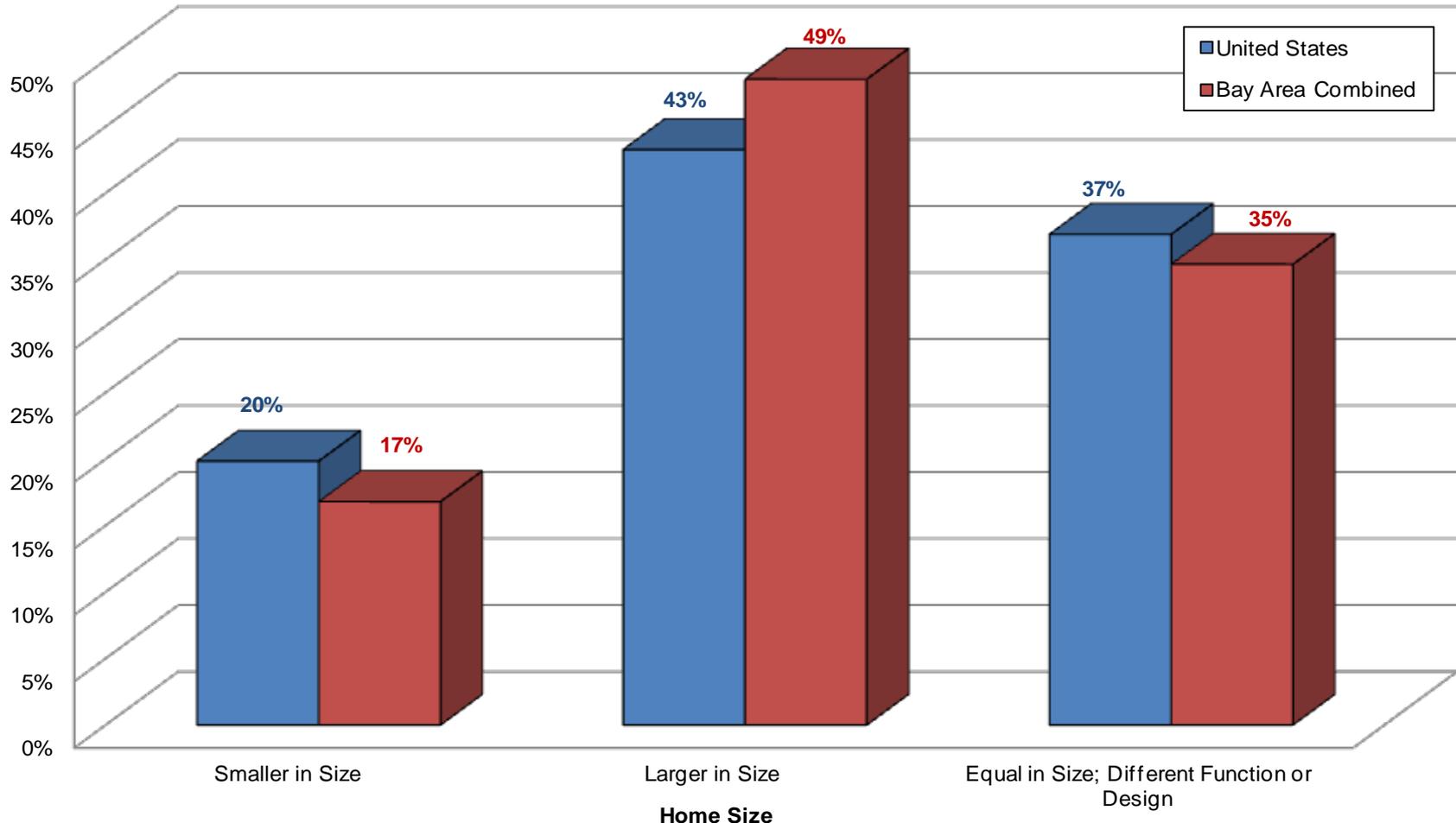


Source: John Burns Real Estate Consulting

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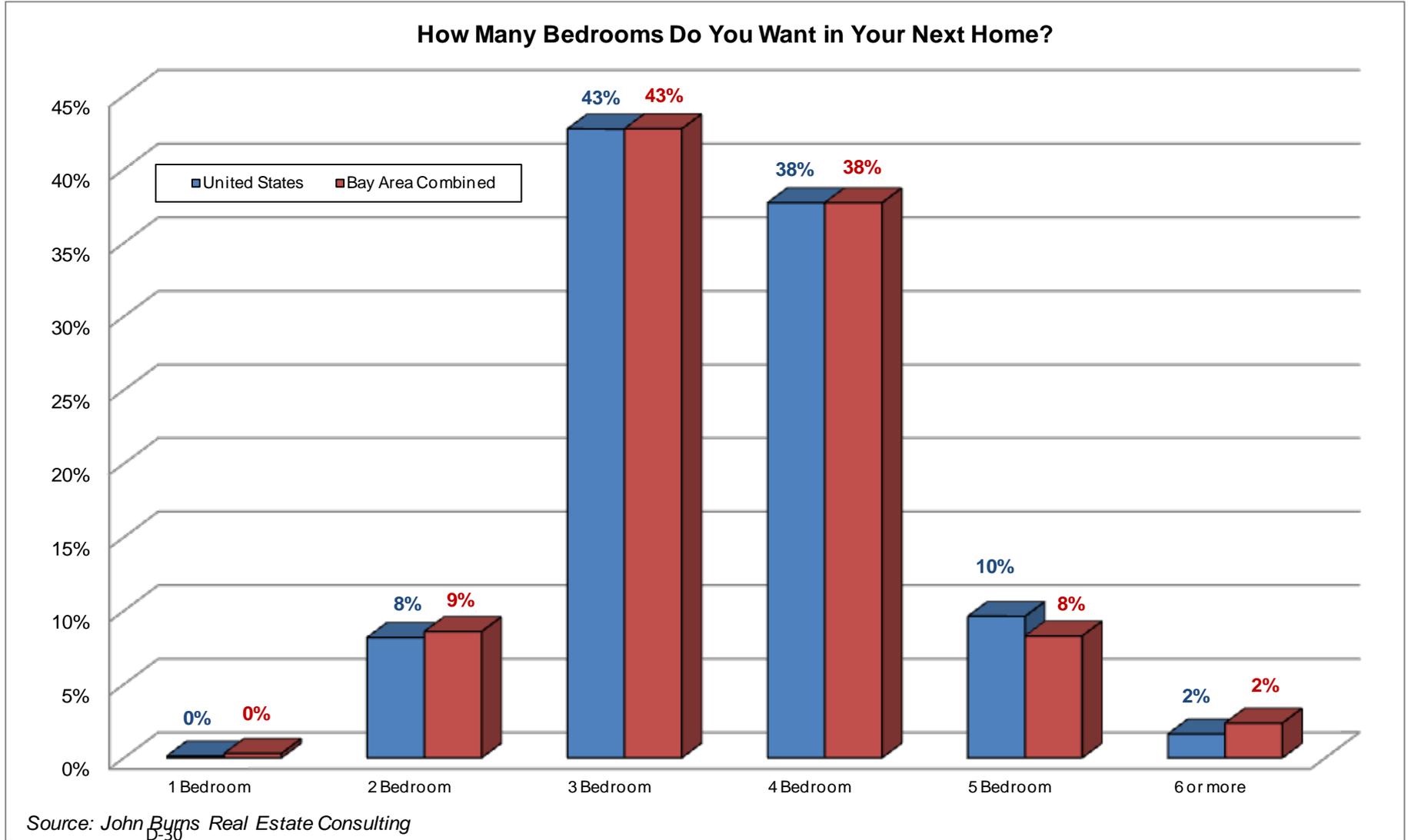
A greater percentage of Bay Area respondents want to purchase a larger home than the US average, and a smaller percentage want to purchase a smaller home than the US average. Most importantly for this analysis, over 80% of respondents are looking for **equal or larger home sizes**, something that would be extremely difficult to accommodate in a general surge toward higher density development across the region.

What do you want your next home size to be?

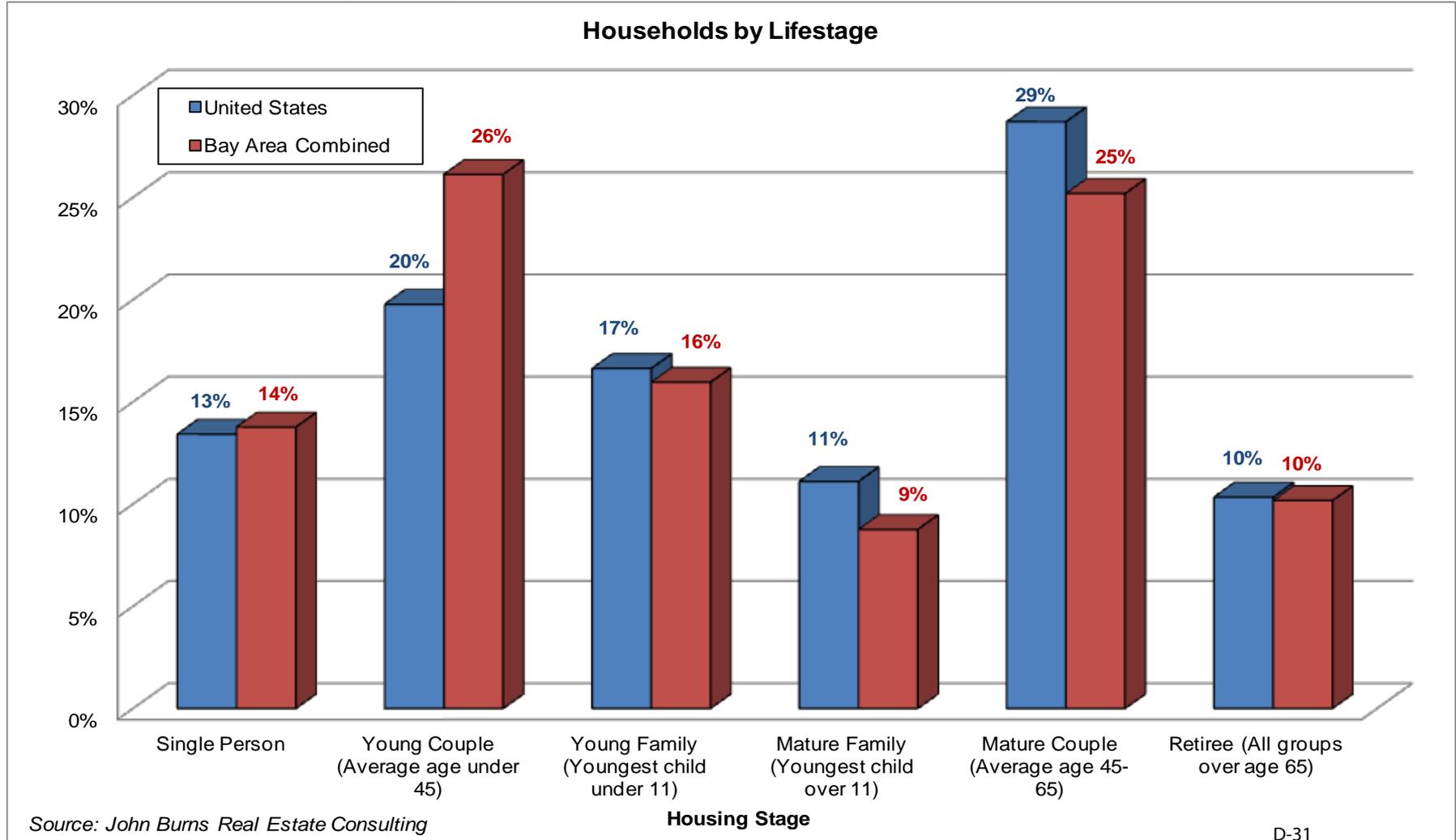


Source: John Burns Real Estate Consulting

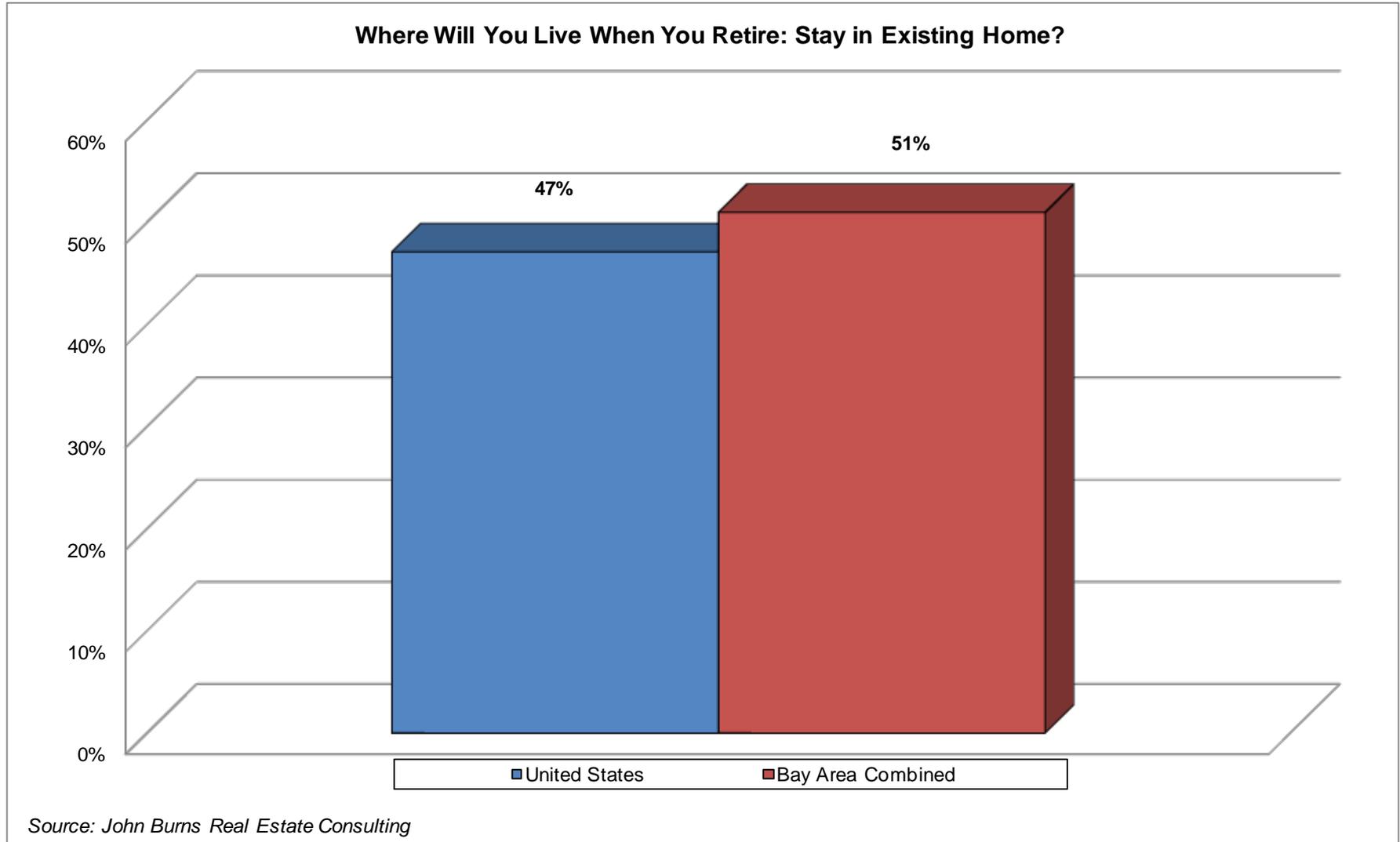
Bay Area results are generally consistent with the US average in terms of bedroom count, favoring three and four bedroom homes over other bedroom options. Some of these respondents may be looking to use “extra” rooms as home offices or hobby spaces, but, regardless of use, these room counts are hard to accommodate at higher densities.



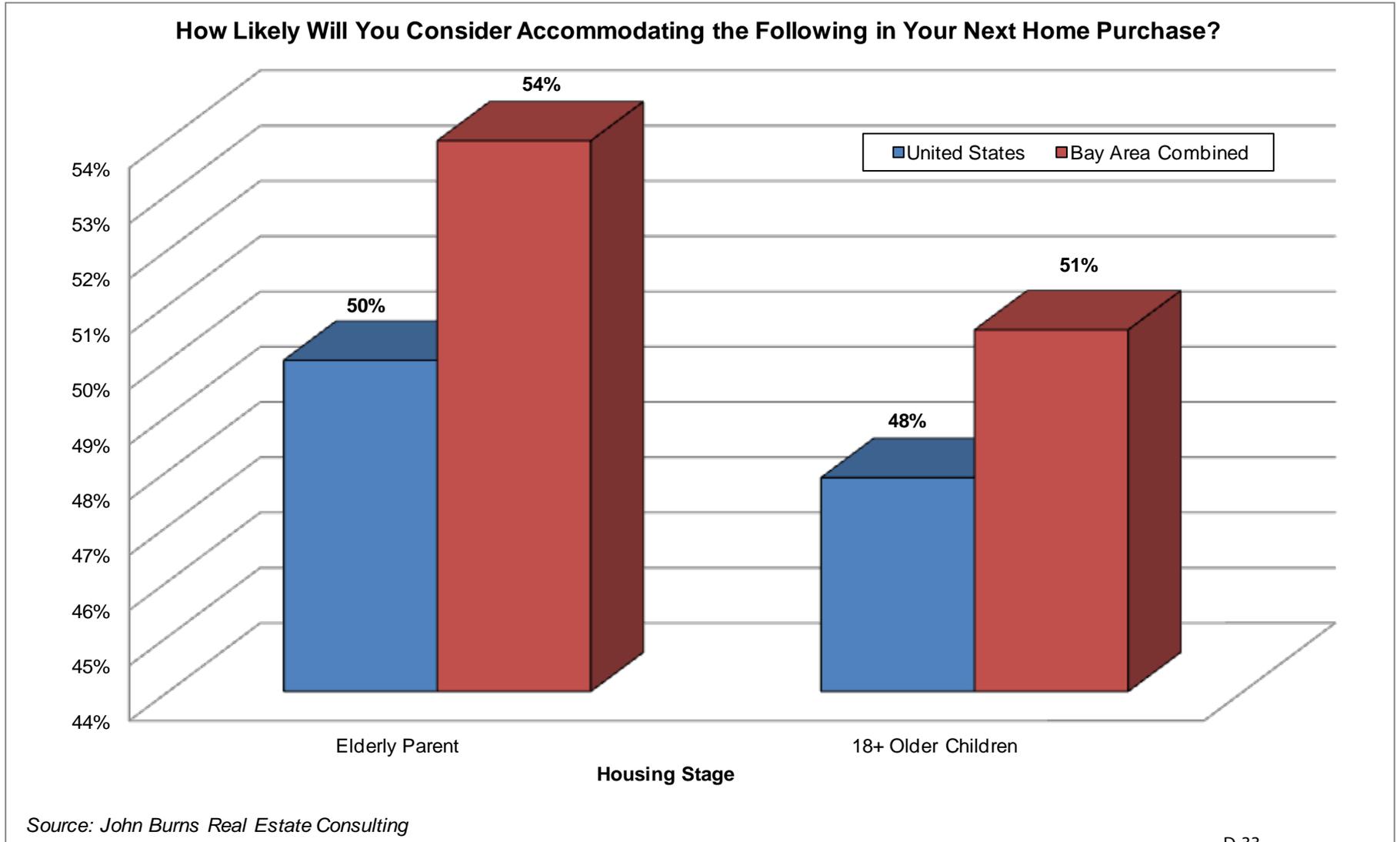
Bay Area respondents are more concentrated in the Young Couple segment, and less in the Mature Couple than the US average. Those two categories still dominate, however, with about one-quarter of the total family in the form of households. See above for more detailed demand analysis by life stage, where the skew toward family buyers is more pronounced when based on demographic-based housing *demand* estimates. Remember also that many young couples are essentially “pre-families” who will soon move onto that lifestage demographic.



The Bay Area has a greater preference for staying in the existing home, or “aging in place”, than the US average. This will limit potential retiree “down-sizers,” many of whom are prophesied to prefer higher density options.



The Bay Area has a greater preference for multi-generational living than the US average, indicating a greater need for more bedrooms and more square footage, goals that are often difficult to provide in higher density housing.





BUILDER COSTS AND URBAN PRODUCT

Our survey of homebuilder and developer representatives with experience in the Bay Area indicate that high-density/condominium construction costs are significantly higher than single family home and townhome construction costs, and higher density product represents cost and marketability challenges. Therefore, very few developers are pursuing or even showing current interest in high-density product in anything less than “A” locations that command very high sales prices. This latter point is critical since it means that high-density urban housing will consistently translate into high prices – meaning either it will be built generally for above moderate income buyers in top locations or, more likely, will not be built at all regardless of any planning emphasis. This also means that this housing type will require major government subsidies when pursued as part of an affordable housing policy.

Questions	Builder / Developer Representatives				
	Smaller Private Regional Developer	Major National Home Builder	Major Regional Developer	Major National Home Builder	Major Regional Private Home Builder
1. What is your estimate of "hard" construction costs (per SF) for a typical single family home in the Bay Area?	\$50 - \$55 per SF	\$60 - \$65 per SF	\$60 - \$70 per SF	\$55 - \$60 per SF	\$55 - \$65 per SF
2. What is your estimate of "hard" construction costs (per SF) for a typical townhome or low-rise condominium in the Bay Area?	\$65 per SF	\$90 per SF	\$90 - \$95 per SF	\$80 - 85 per SF \$90/SF garden style apt.	\$75 - \$90 per SF Up to \$140/SF garden style apts, \$180/SF for wrap style
3. What is your estimate of "hard" construction costs (per SF) for podium condominiums (4-6 stories) in the Bay Area?	No Comment	No Comment (but see additional comments below)	\$200 per SF or more	\$200 - \$225 per SF	\$210 per SF

Note that apartment construction costs in the Bay Area also fairly high, but, of course, have different expectations of returns. Conventional two-story walk-up product with on-grade parking at 20-25/acre costs about \$115-135/SF. Podium product would range from about \$200+ to \$225/SF or more, though wrap product can be slightly cheaper (+/- \$190/SF). As with for-sale product, mid-rise and high-rise rental product will cost over \$300/SF to far higher.

Questions	Builder / Developer Representatives				
	Smaller Private Regional Developer	Major National Home Builder	Major Regional Developer	Major National Home Builder	Major Regional Private Home Builder
4. What is your estimate of "hard" construction costs (per SF) for mid-rise to high-rise condominiums in the Bay Area?	No Comment	No Comment (but see additional comments below)	\$300/SF minimum and potentially far more	\$300 - 325 per SF (and often more)	No Comment
5. Are you aware of any builders or developers currently pursuing high density development in the Bay Area?	Not aware of any.	Not aware of any. Has heard that San Francisco interest is "heating up."	Very rare, but some small private ventures are looking into new high density in San Francisco.	Mainly apartment developers interest in very high density urban product, and even then not high-rise. Some limited for-sale (e.g., a new condo building in San Francisco recently received funding).	Very few, basically only in city of San Francisco (e.g., BOSA), though developers will consider very high density apartments in "A" locations.
6. Additional comments	High density developments do not make sense in most areas, both from cost and lifestyle standpoint. A transit focus in the suburbs, for instance, forces suburban dwellers to live in the kinds of high density product they went to the suburbs to avoid.	This builder no longer considers very high density developments due to high associated costs (in terms of construction, land, and often mitigation).	Typically cost of ownership (insurance, HOA) substantially higher in high density. FHA sales restrictions (must sell half of units for buyers to qualify for FHA backing) are more problematic in single-building high density developments.	Six stories and above usually means steel construction and they would not consider that (but have done in past). See very high density as only viable in limited, core Bay Area luxury areas that can support consequent high sales prices.	**Hard to believe it will ever make economic sense to build very high density outside of high-end submarkets at luxury pricing. Doubts most people want to live in that kind of product outside of few urban cores, and even then only when young.

Note: Podium assumes wood framing over podium. Mid-rise and high-rise product assumes steel and concrete construction.



RESEARCH CRITIQUES

As previously noted, the Draft Plan's land use pattern represents the policy analysis and assumptions contained in the Jobs-Housing Connection Strategy (JHCS) adopted by the regional agencies in 2012. Below we briefly point out several potential flaws in the logic or conclusions of this document, before turning to a more lengthy criticism of a recent analysis by Arthur Nelson, a demographic researcher whose work provides the key rationale that fuels the Draft Plan policy bent. Page number references for the "Jobs-Housing" document are from the version dated May 16 (there was an earlier March 7, 2012 version that was distributed as well). For purposes of shorthand we will refer to this paper simply as the "JHCS."

- **Array of Housing.** The JHCS claims that it "seeks to provide an array of housing types ... and envisions a pattern of growth and investment tailored to each of these communities... (page 3)" In fact, the "array" of housing product demanded is extraordinarily restricted both in type and placement and would overwhelmingly push residential development toward higher density urban transit housing types, not remotely the kind of housing breadth historically found in the region. Because the JHCS and Draft Plan are ultimately restricted by the prescriptive requirements set by the regional agencies in defining the type, location, and density necessary to qualify as a PDA, the JHCS and Plan Bay Area represent much more of a top-down, "very few sizes fit all" solution than is advertised.
- **Economic Growth.** In noting that the state and region have seen their rates of job creation slow in recent years, the JHCS seems to acknowledge that "[g]eographic constraints and policy protections for resource lands also limit future greenfield development and spatial expansion in the region, which has fueled part of the economic growth in California in the last century (pages 9-10)." The Draft Plan will severely restrict such economic development going forward, and hence job growth. This appears to be a conscious policy choice made MTC and ABAG: "[Downward] Adjustments to the job forecast are needed to account for the region's expected level of housing production given historic trends *and the constraints of an infill growth development pattern.*" (Draft Plan, page 21) (emphasis added)
- **Job Decentralization.** Similarly, it is acknowledged that the decentralization of development led to a similar pattern in job growth (JHCS, page 10) and, presumably, was a key part of the above average regional job growth previously cited. The Draft Plan policy would not merely slow down this trend, but would very much lead to a recentralizing trend in job growth. Is this recentralization a reasonable expectation going forward? Is it possible or even likely that a policy focused on recentralization in the face of the recent historical trend could actually result in slower job growth?
- **Affordable Housing.** "The housing boom of the mid-2000s expanded the supply of affordable housing significantly (JHCS, page 10)." The Draft Plan, with its emphasis on housing products that are expensive to build, would hamper a return of a housing market able to expand affordability.

- **In-Commuting.** In estimating region-wide housing and job growth totals (see page 14), the JHCS “assumes that the rate of net in-commuting will remain at 2010 levels, greatly reducing the region’s reliance on surrounding areas to house our workforce.” The policies surrounding SB 375 are intended to decrease in-commuting, not maintain current levels. More importantly, limiting housing choices in most of the Bay Area will push lower density options into outlying communities since the “allowed” product types are not desirable or amenable to so many households. In this way the Draft Plan could actually result in greater in-commuting to house the Bay Area’s workforce and even longer commutes, increasing greenhouse gas emissions as compared to a more market responsive alternative.
- **Jobs and Housing.** The JHCS notes (page 14) that “total job growth is constrained by our ability to produce housing, which is ambitiously estimated at 660,000 new units by 2040.” Elsewhere in the document the lack of future single family demand is noted. This housing-based constraint on job growth logically implies that all types of housing are needed going forward, with a variety of types and locations, not the very restricted development focus inherent in the Draft Plan. It is easy to see that allowing very limited new single family housing, for instance, will constrain certain types of higher paying job growth, regardless of how many single family homes already exist. For instance, this stock might be too old, too out-dated, in the wrong locations for new job growth, etc. for those who would fill these jobs.
- **Middle-Income Housing and Jobs.** Similarly, the JHCS cites a need to create “more middle-income jobs and improving opportunities for advancement among Bay Area workers (page 20).” We would argue that the extreme emphasis on high-density, urban, transit-oriented housing types will not at all achieve this goal, both in terms of preferences and affordability. Inadequate housing choices will more likely limit options for middle-income households and drive many of these households to outlying areas, other regions, or even other states.
- **Single Family Dominance.** The Draft Plan ignores or upends long-term housing preferences in making its core argument, but also seems to misunderstand how preferences lead to outcomes. Noting the predominance of single family homes in the region (and therefore the lack of a need for new SFD), the JHCS notes that “this is in part because single family homes have been the predominant form of housing produced in the region for decades.” Of course, this is because single family housing has been the most preferred form of housing for decades. This contradicts the expectation that preferences will shift so strongly toward higher densities going forward. In the same paragraph (page 28), the JHCS argues that “townhouses, apartment buildings, condos, and other multifamily housing options are currently comparatively limited.” While this argument is rightfully qualified, few people from outside the region would agree with this. The Bay Area is typically viewed as a comparatively high density housing market, particularly in core areas where most new development would be focused – and, incidentally, where the vast bulk of recent and current development is already at higher densities (townhomes and denser).

- **Single Family Demand.** The JHCS estimates of future housing demand argue for a net oversupply of single family units of nearly 170,000 (page 29). This oversupply would result in lessened demand for other types of housing by this same number “as households that would otherwise choose multifamily units instead opt for single family homes made more affordable due to excess supply.” The argument that people will want multifamily but it will be too expensive relative to single family is the precise opposite of the current reality and highly unlikely to ever be true. This also again denies a clear and ongoing preference for single family housing.
- **Building Costs and Market Pricing.** Above we argued that high-density building types are very expensive to build. The JHCS notes that the ability of high-density housing to deliver more units to the acre results in lower unit per acre costs than lower density housing (page 30). While certainly this factor can mitigate the high building cost argument we detailed above, the Draft Plan’s emphasis on high-density urban product will not necessarily result in more affordable housing for buyers or renters. High density housing in core areas of the region will usually be priced toward the upper end of the market because that is what the market will demand. Developers will not build such product if it is not cost-effective (the argument inherent in our building costs argument above) or they will demand high-end for-sale and rental pricing because it is the overall market dynamic that dictates price, not costs alone.

Ultimately, **the Draft Plan envisions a fundamental shift of the Bay Area toward a more rental-oriented region and less toward a for-sale market.** High-density housing is expensive to build on a per unit basis meaning, as argued above, it will only be pursued in “luxury” for-sale markets where sale prices can support these building types. Rental development is an on-going commercial endeavor with different economic demands, and thus is more likely to be pursued in the urban locations earmarked by the PDAs. Luxury rental markets will mean luxury rental pricing, but, in general, rental developments are more likely to go forward at less than top of the market pricing than for-sale developments when building costs are a key consideration. Already we see that new rental activity in core areas is focused on achieving high densities given high land costs. Further, from a preferences standpoint, renters are more likely to desire high-density urban locations / product. This ability of rental product to be more accommodative of the costs, prices, and preferences of the building types demanded by the Draft Plan would thus logically lead to a greater emphasis on rental development in this vision of a future Bay Area.

We now turn specifically to the “single family glut” argument. Is there an oversupply of single family homes in the Bay Area that will only get worse over the next 20+ years as demographic trends shift demand to higher density housing? Should this coming wave of high-density urban demand induce planners to virtually swear off single family development in favor of high-density product, and preferably in urban locations, and even more so urban locations surrounding transit nodes?

The assumption is one of the key motivations for the Draft Plan plan’s skew toward higher density urban development. We will critique this assumption from an examination of current inventory trends and from a recap of housing preferences. The former shows that, at least for the nearer-term, there is not likely to be a mass of oversupply in the Bay Area, while the latter shows the enduring preferences for relatively less dense housing that has already been detailed above. We then challenge the assumption of this coming wave of urban demand that will make new SFD obsolete via a critique of the work that provides its intellectual underpinnings.

- **Inventory:** While there is no question that the housing bust has left a mass of distressed homes in its wake and higher vacancy levels, inventory trends specific to the Bay Area paint a comparatively more benign picture. This is true from a variety of measures. Home listings are stabilizing to decreasing, foreclosures have steadily diminished, and shadow inventory levels (distressed homes not yet on the market but likely to be in the near future) are relatively far more favorable in the Bay Area than anywhere else in the nation. Specific to high-density supply, there is also already a great deal of higher density units under construction or planned that indicates any oversupply would be more varied across housing product than might be thought. Further, it is a crucial mistake simply to assume that foreclosed homes in the Bay Area are actually vacant.
- **Preferences:** Housing preferences were detailed above, but these clearly indicate that most households prefer relatively conventional, lower density and suburban options on the whole. Combined with the life stage demand data also examined above, this strongly indicates that any single family supply overhang would be temporary. Young millennials who allegedly thirst for high-density urban product will grow older and most will shift their preferences toward more conventional options and locations. Life stage and housing attitudes essentially define product and location preferences, and these show an enduring and basic predilection toward lower density and suburban product and locations.
- **Wave of Urban Demand:** Though the two key demographic trends that will define the next couple of decades are in favor of the young and the old, the argument that this will lead to the need for an almost universal focus on high-density housing is extreme. It is based on one-sided demand and preference assumptions, assumptions that fly in the face of long-term preferences and patterns. While it is likely true that demographics will shift demand in the coming years, the degree of this shift and its endurance is very much open to question.

While there are unquestionably many single family homes in distressed conditions that will need to be absorbed by organic buyers over the next several years, there is also a potential abundance of high-density housing already in the “pipeline.” Though housing activity trends in recent years indicate an eventual pent-up demand that makes any oversupply in the Bay Area unlikely (see housing trends below), approved and recently constructed high-density units will also need to be absorbed over the immediate future. Most of this is “pipeline” product that has yet to be constructed, but there are at least 1,800+ units in urban locations in the core of the Bay Area in either “re-positioned” condos now renting or condominium units currently under construction. There are another 6,000 apartment units under construction currently (see table below). Beyond this there are literally tens of thousands more condo and apartment units already approved. That is, at least for the near- to mid-term, there is sufficient product already in or near the market to absorb the high-density urban demand wave that some believe is coming.

Product Type	Silicon Valley	San Francisco	Oakland- Emeryville	Total
Repositioned Condos	800	259	208	1,267
Condos under construction	395	167	0	562
Condos Approved	10,713	17,723	8,433	36,869
Apartments under construction	3,897	2,350	0	6,247
Apartments Approved	9,475	5,306	476	15,257
Total	25,280	25,805	9,117	60,202

Source: Polaris. Silicon Valley includes San Mateo County and greater San Jose.

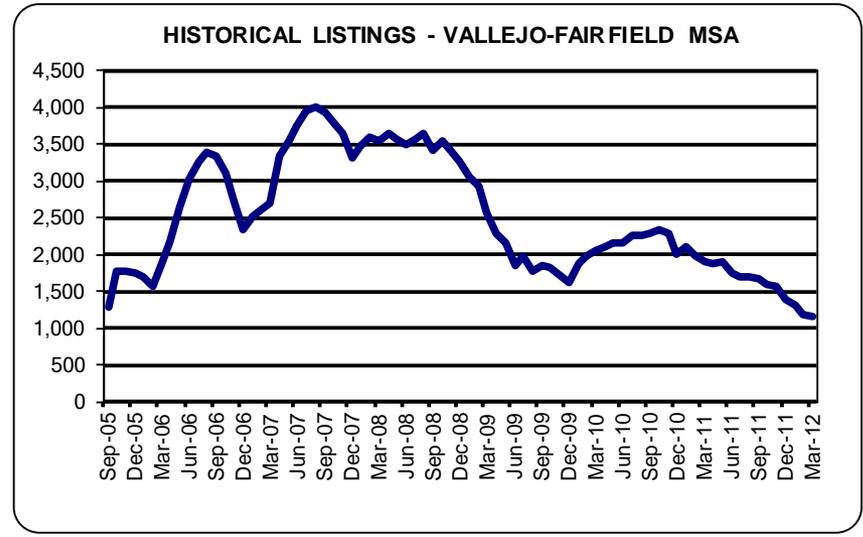
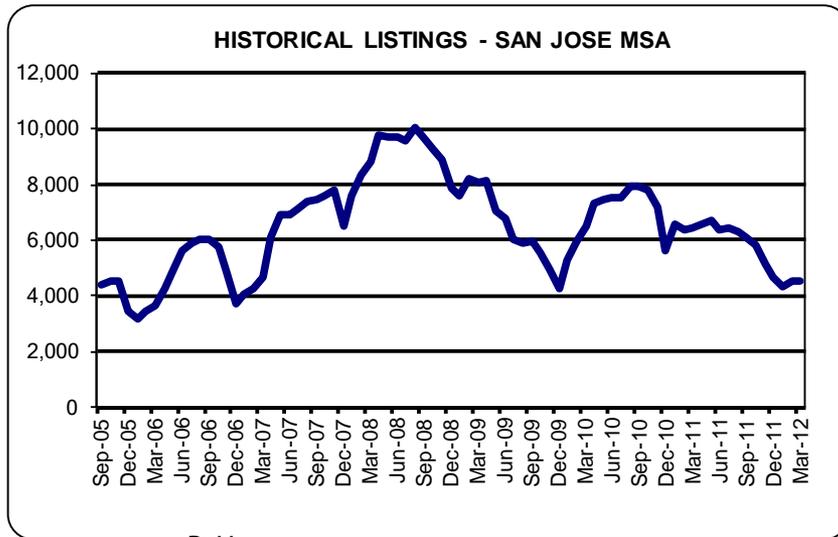
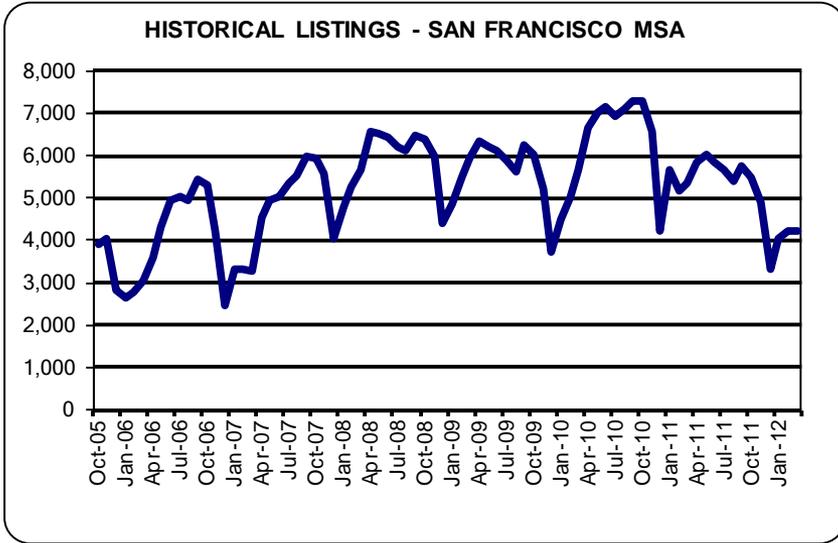
Distressed inventory – homes either short sold or reclaimed by the lender and sold – dampens the housing market both in terms of price pressures and excess inventory. Rising foreclosures led to rapidly increasing home listing levels and, in turn, were a major contributor to massive dips in home pricing. Thus to the degree home listings and distressed inventory levels are beginning to diminish this implies that the market is steadily correcting the oversupply wrought by the housing bust. While diminished current and near-future inventory levels do not entirely negate the argument for an incipient demographic wave that will lead to future single family supply excess, these trends do lessen the likelihood of this presumed oversupply since there will be less inventory to absorb as this demographic wave begins.

And **foreclosures and listings are steadily diminishing in the Bay Area**. What follows is a series of charts showing the undeniable stabilizing to downward trend for first home listings (per MLS Boards) and then foreclosures by county (per Foreclosure Radar.com). Though foreclosure levels are still elevated, these trends seem clear and indicate excess inventory may be less of an issue, at least in the Bay Area, than is often assumed.

Two other factors worth noting will help stabilize the housing market in relation to supply:

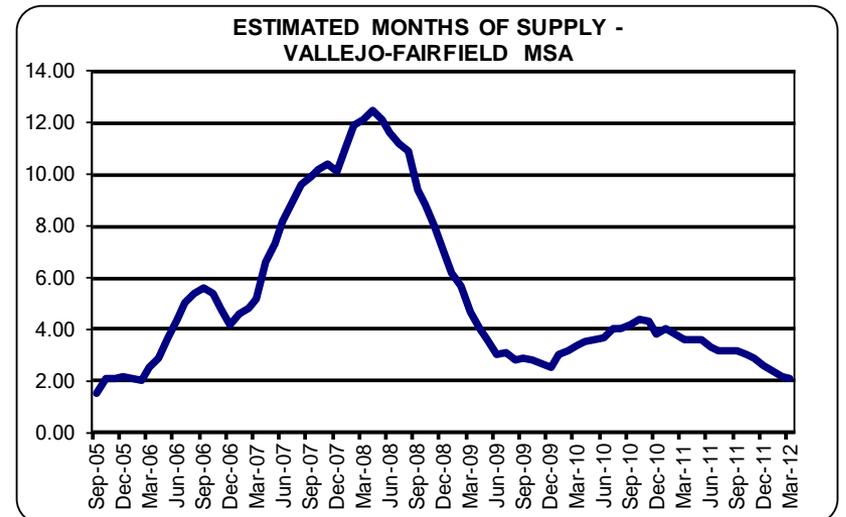
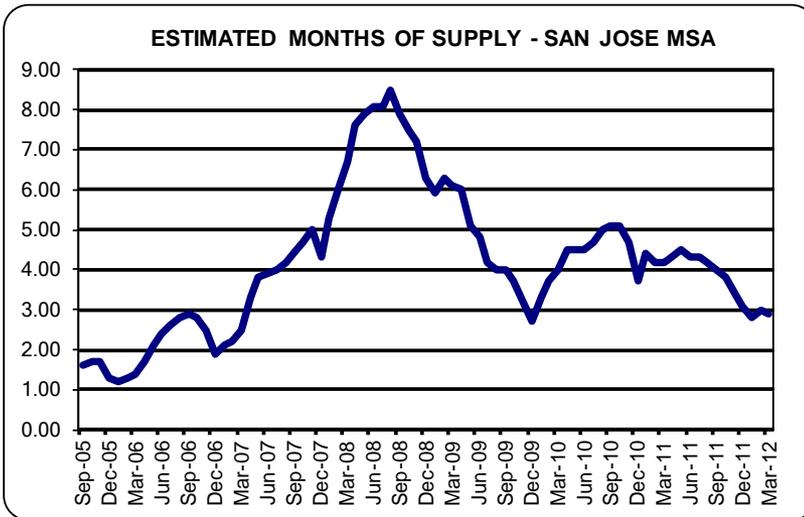
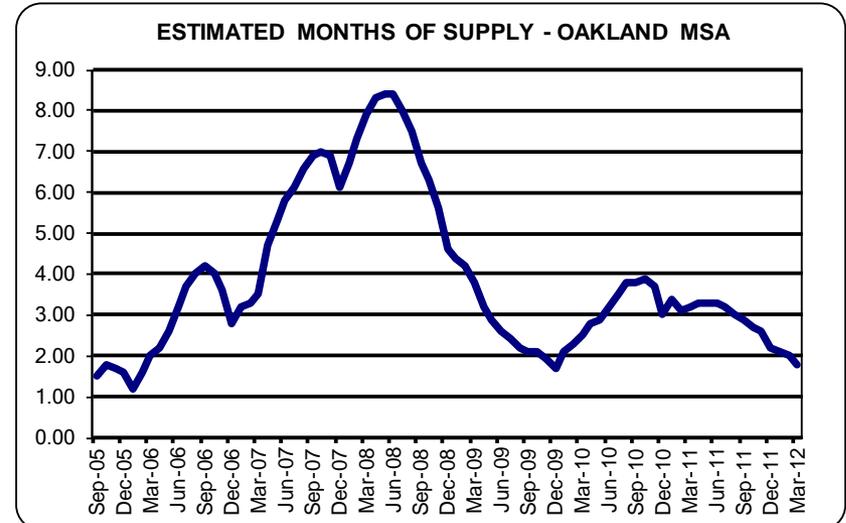
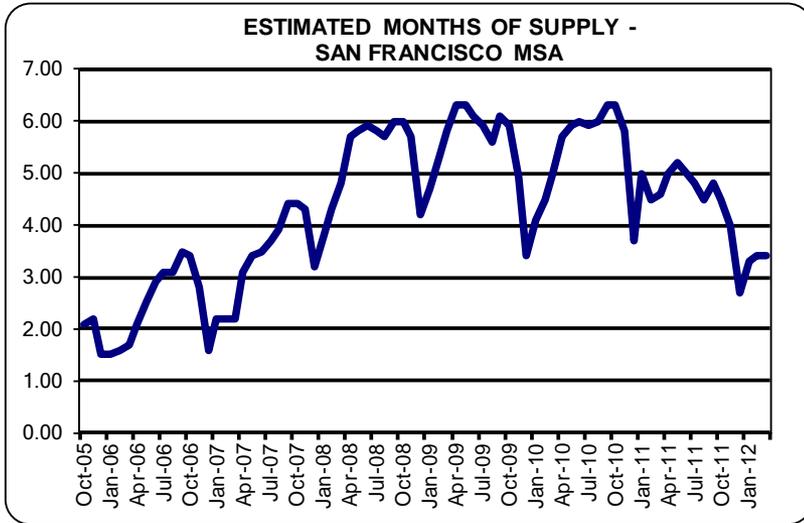
- single family households in foreclosure situations typically move to another single family home as renters since that is the product they require (typically families in newly developed suburbs given foreclosure patterns). This essentially shifts that household from one distressed unit to another. This helps stabilize overall occupancy levels and negates demand from a higher density apartment unit that a foreclosed family might be “forced” to occupy.
- Additionally, our experience indicates that an increasing amount of excess inventory will be purchased by banks and investor pools who will rent these units, often for long periods. There is growing interest in this strategy and thus there is the potential for a substantial amount of inventory to be absorbed in this fashion. A 2012 research note by CoreLogic found that the single-family rental market is characterized by “increases in demand, tightening inventory and rising rents.” (Market Pulse, Nov. 13, 2012, page 3). This will essentially provide the inventory for the foreclosed families just noted, and will have the same effect of stabilizing the market while shrinking apartment demand, at least in areas with high foreclosure rates.

Listings in the resale market are less than half of their peak since 2005 for all Bay Area MSAs. Listings are relatively flat very recently in San Francisco and San Jose, but are trending downward in Oakland and Vallejo.

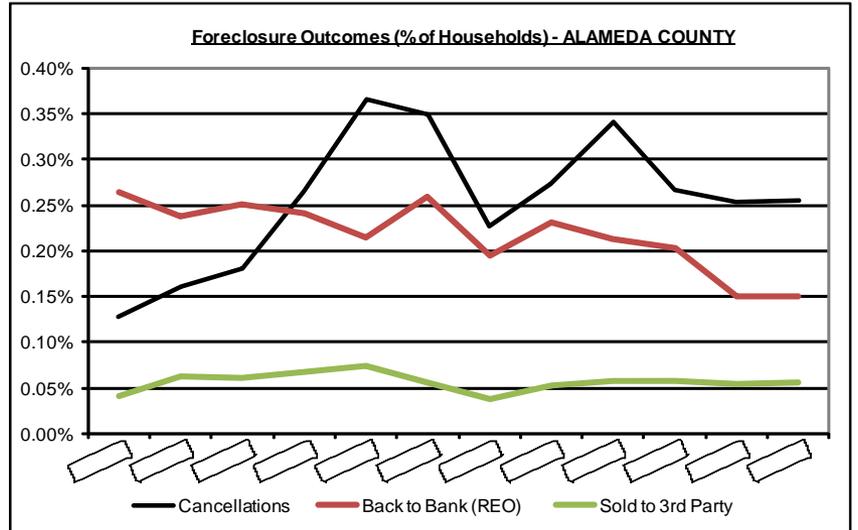
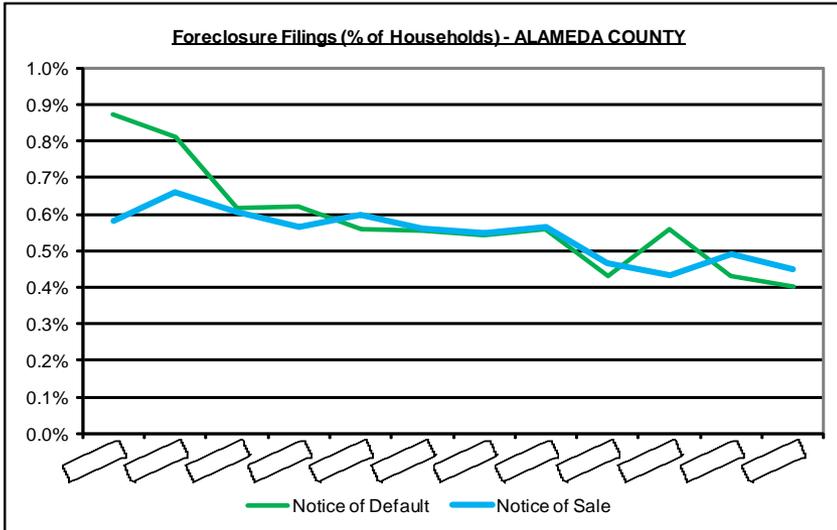
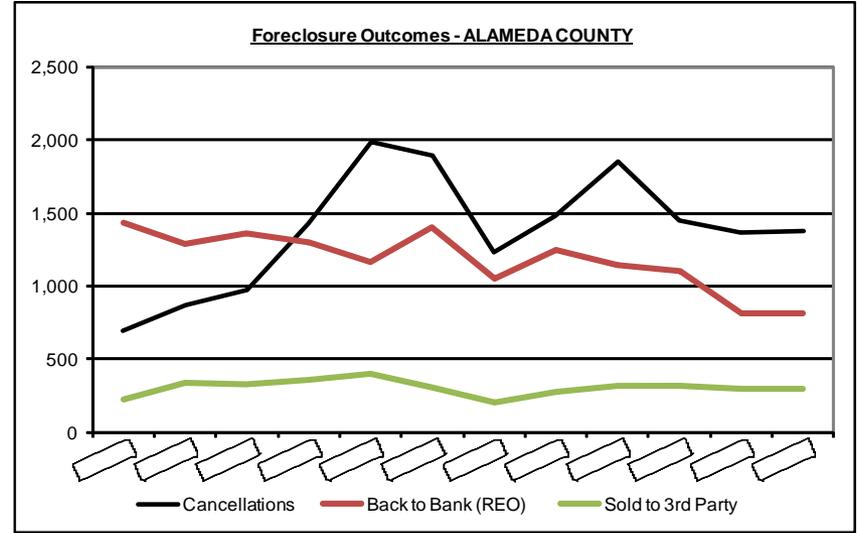
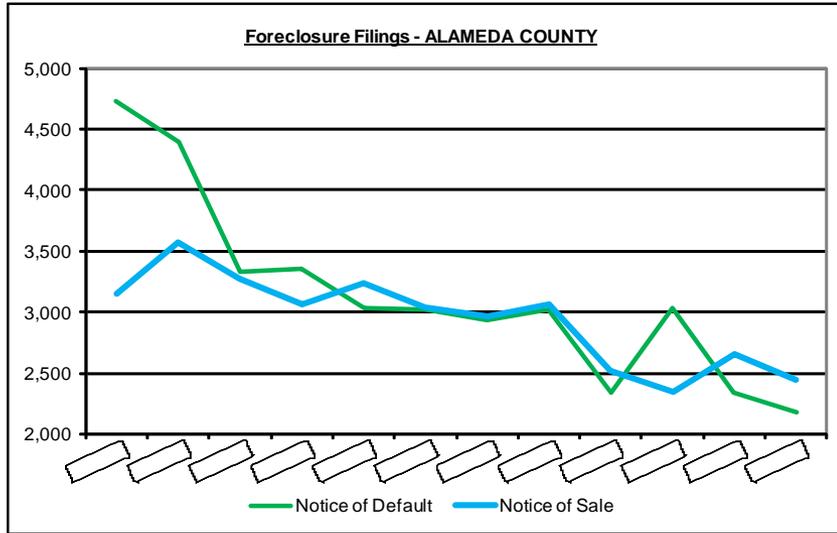


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Months of supply in the resale market are near historical lows (since 2005) in Oakland and Vallejo-Fairfield. San Francisco and San Jose's months of supply have declined in recent months to levels that are lower than 2010 and 2011.



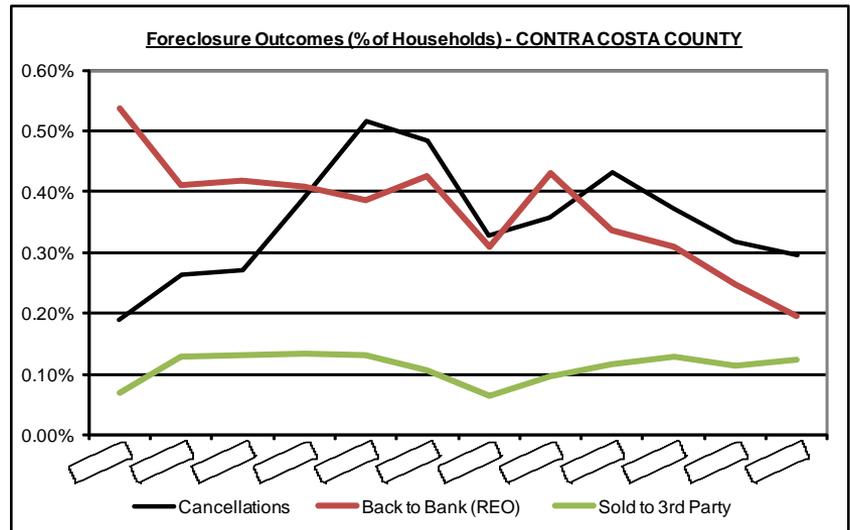
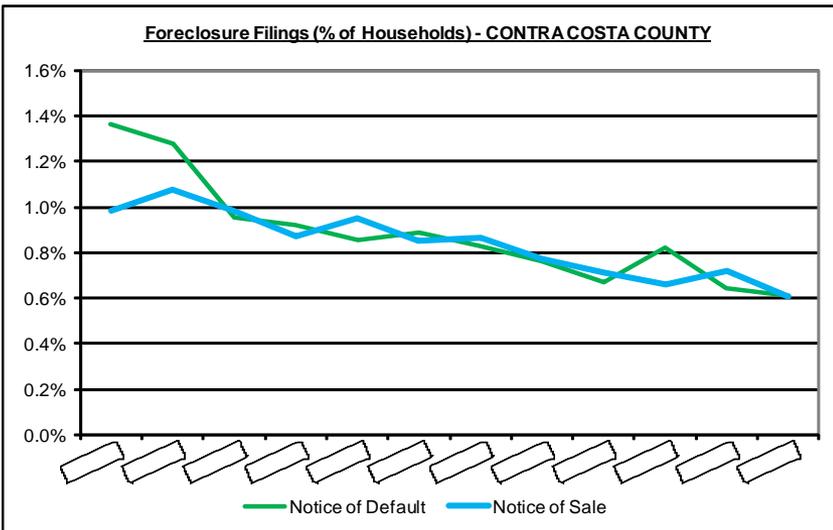
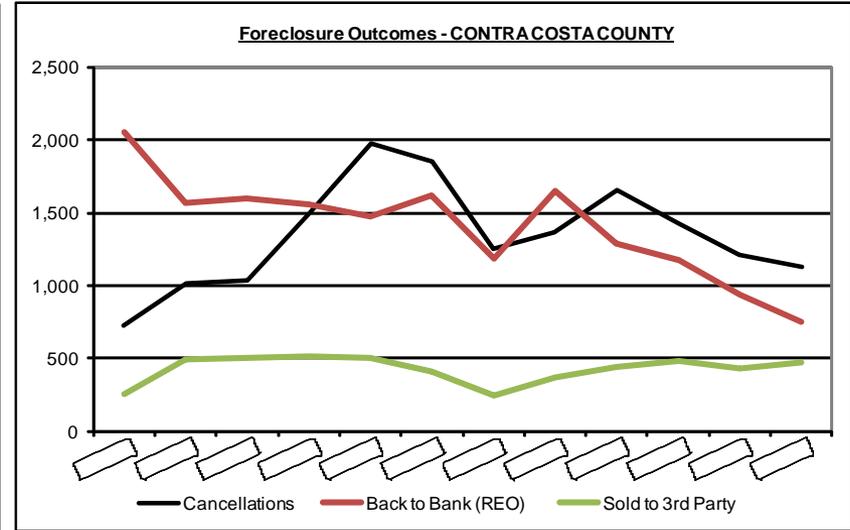
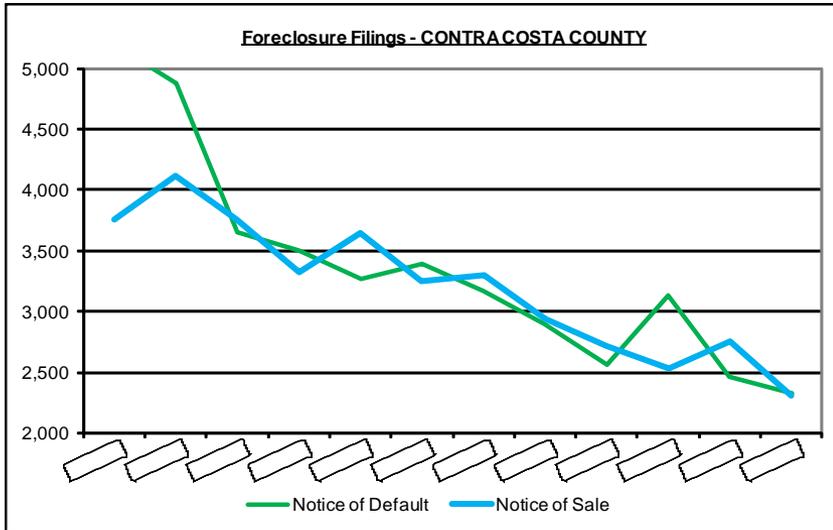
Pre-foreclosure notices continue to decline from high levels in Alameda County, and Back to Bank (REOs) are declining as well. The percentage of notices and REOs as compared to total households is low, at less than 0.5%.



Source: John Burns Real Estate Consulting, Foreclosure Radar

Note: % of Households calculation based on 2010 Households

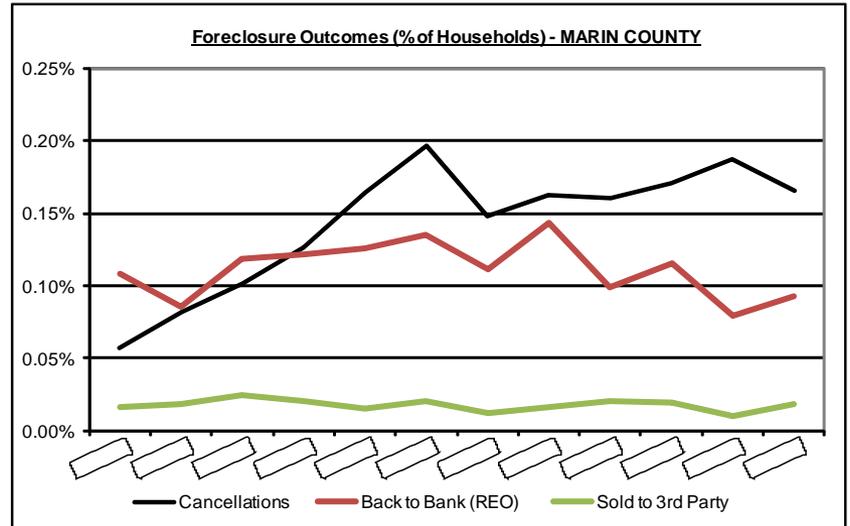
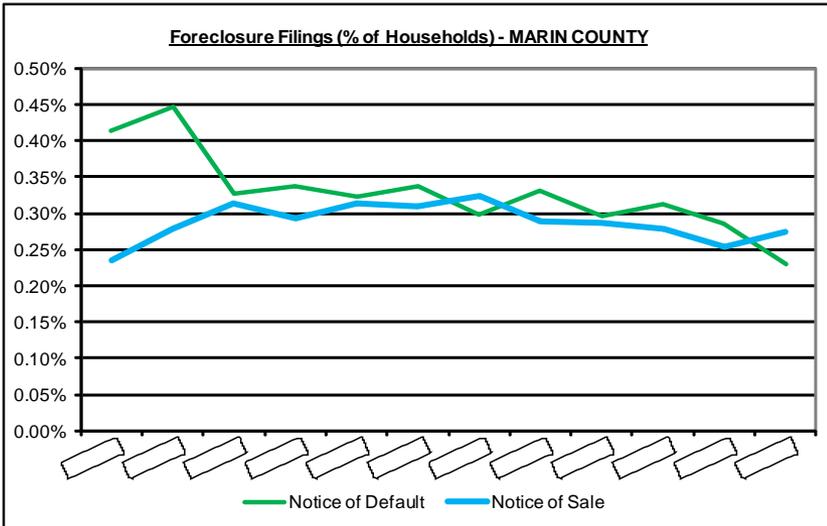
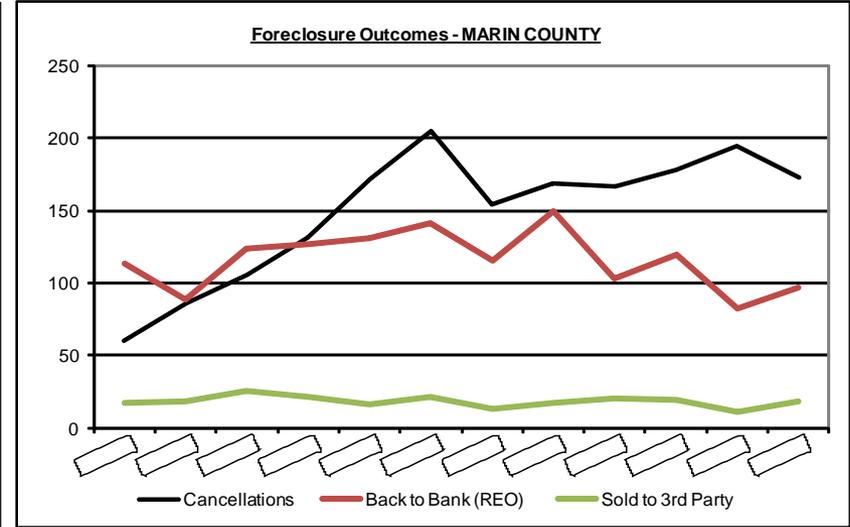
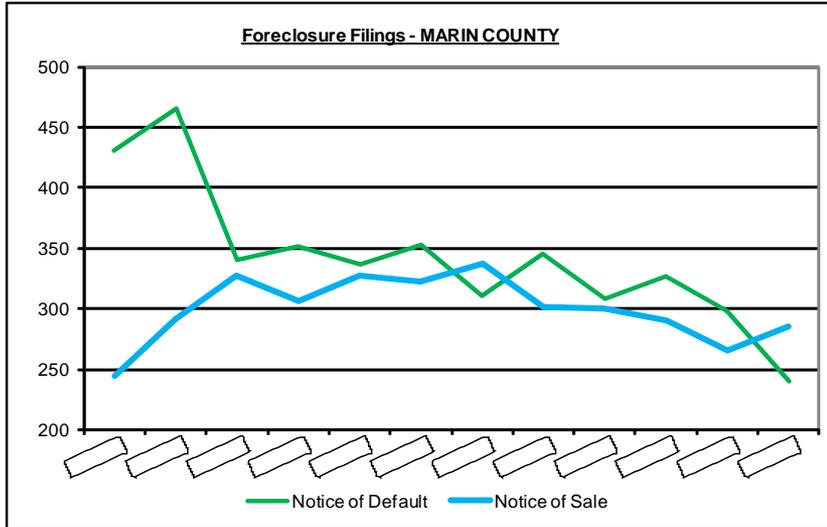
Pre-foreclosure notices continue to decline from high levels in Contra Costa County, and Back to Bank (REOs) are also declining. The percentage of notices and REOs as compared to total households is about 0.6%.



Source: John Burns Real Estate Consulting, Foreclosure Radar

Note: % of Households calculation based on 2010 Households

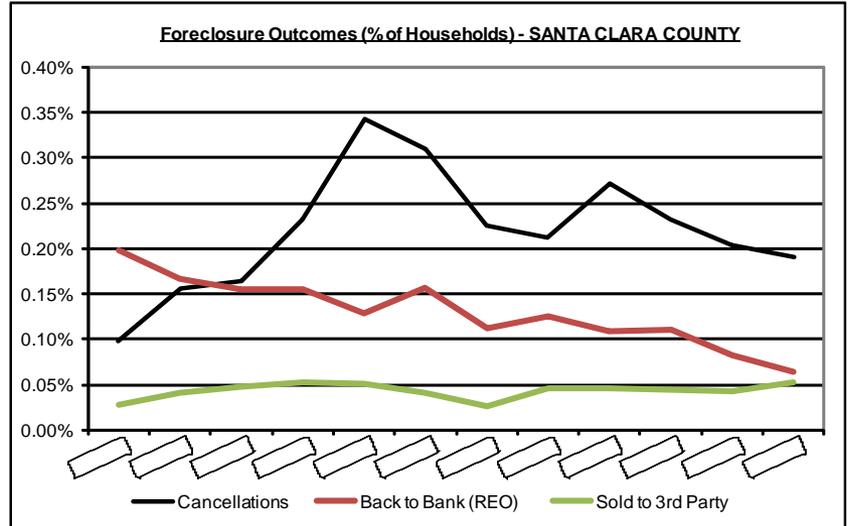
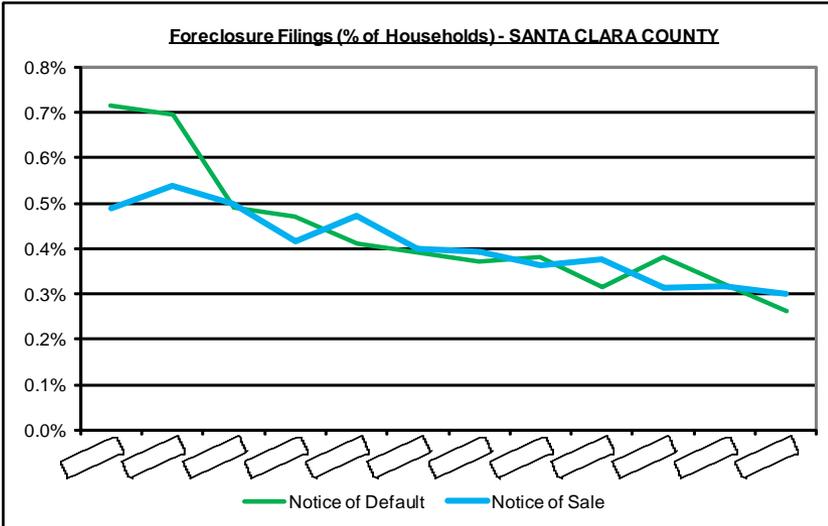
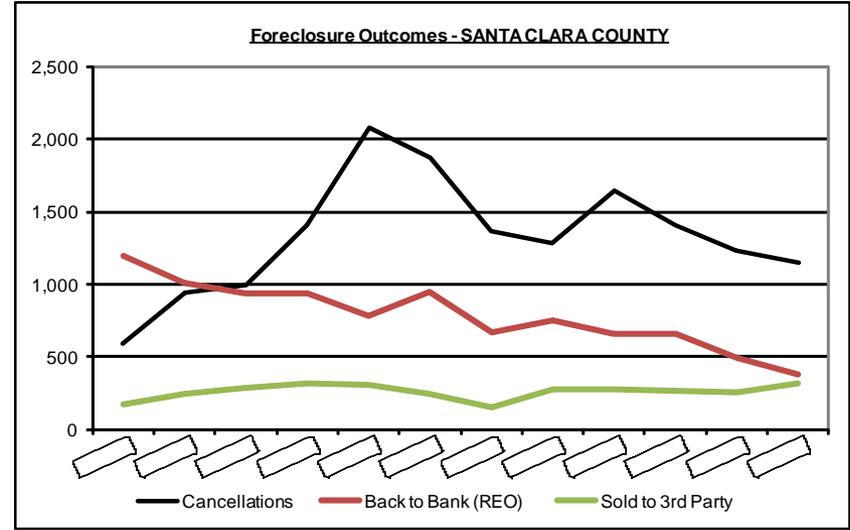
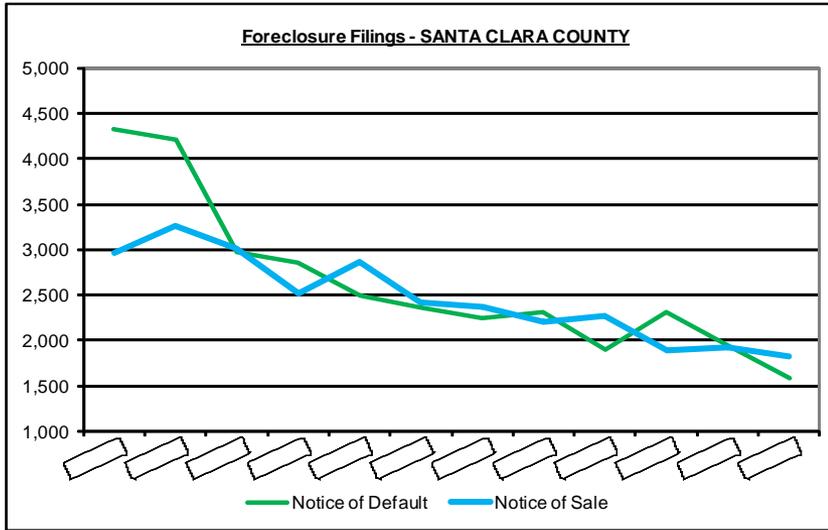
Pre-foreclosure notices are relatively flat in Marin County, and Back to Bank (REOs) are as well. The percentage of notices and REOs as compared to total households is very low at less than 0.3%.



Source: John Burns Real Estate Consulting, Foreclosure Radar

Note: % of Households calculation based on 2010 Households

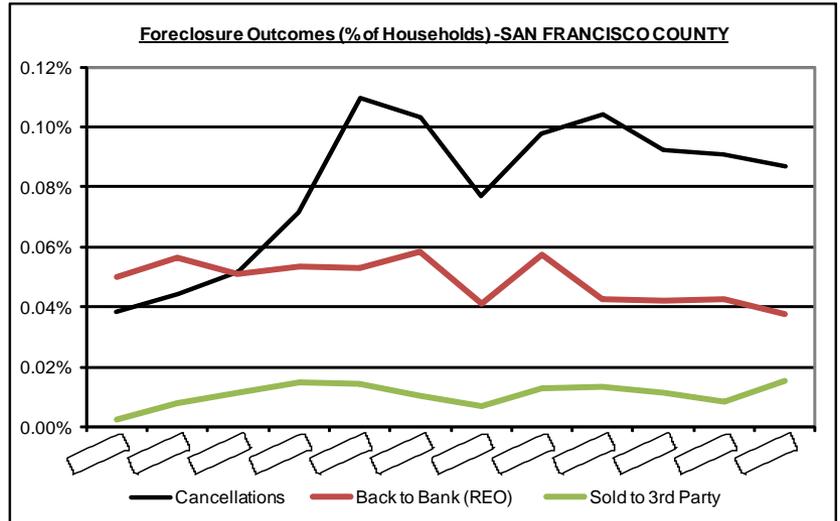
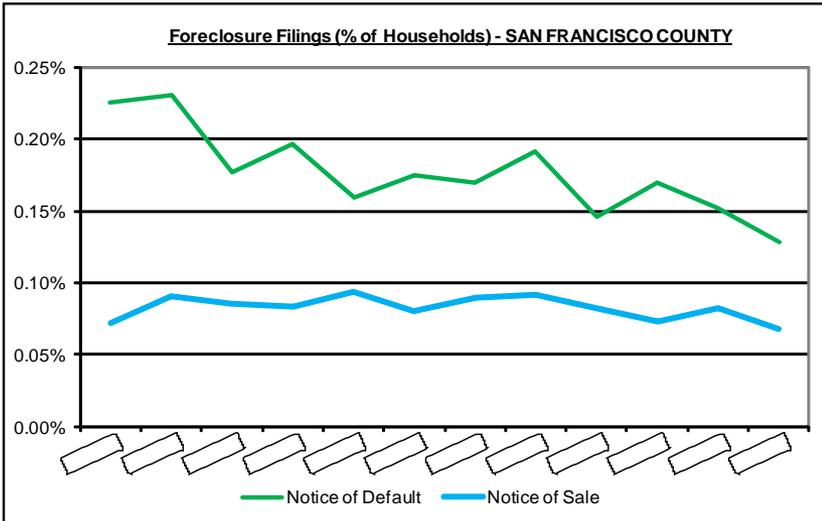
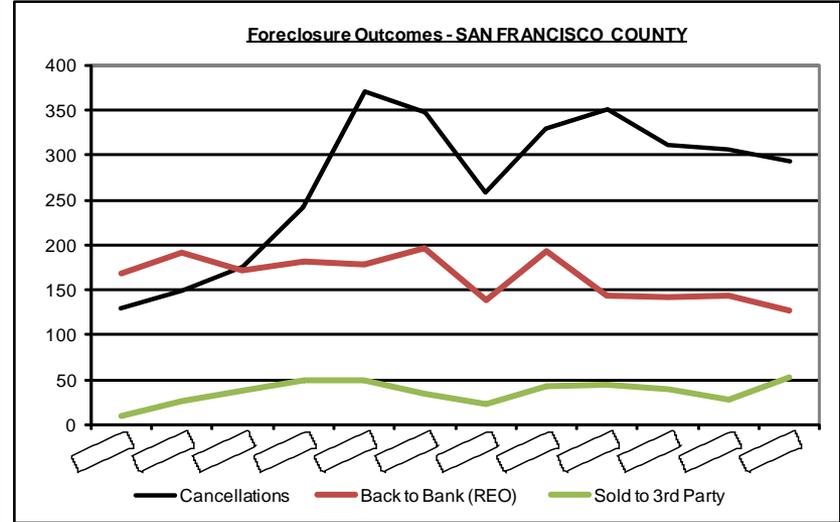
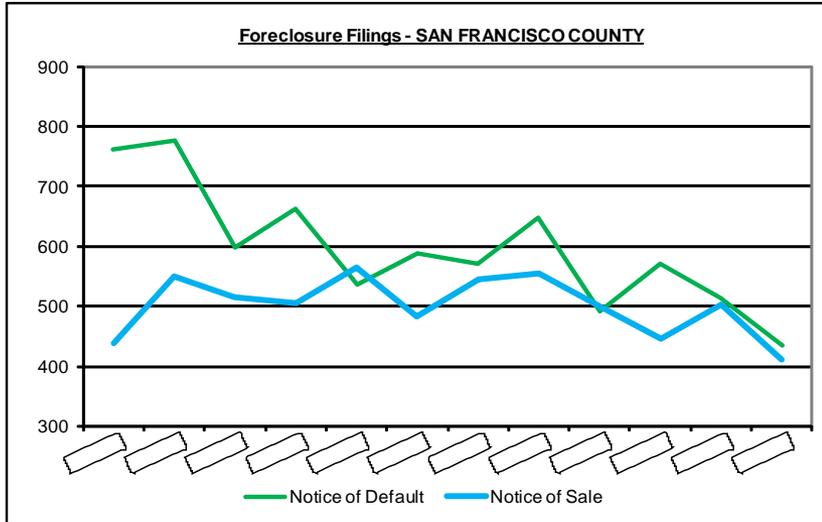
Pre-foreclosure notices continue to decline from high levels in Santa Clara County, and Back to Bank (REOs) are diminishing. The percentage of notices and REOs as compared to total households is about 0.3%.



Source: John Burns Real Estate Consulting, Foreclosure Radar

Note: % of Households calculation based on 2010 Households

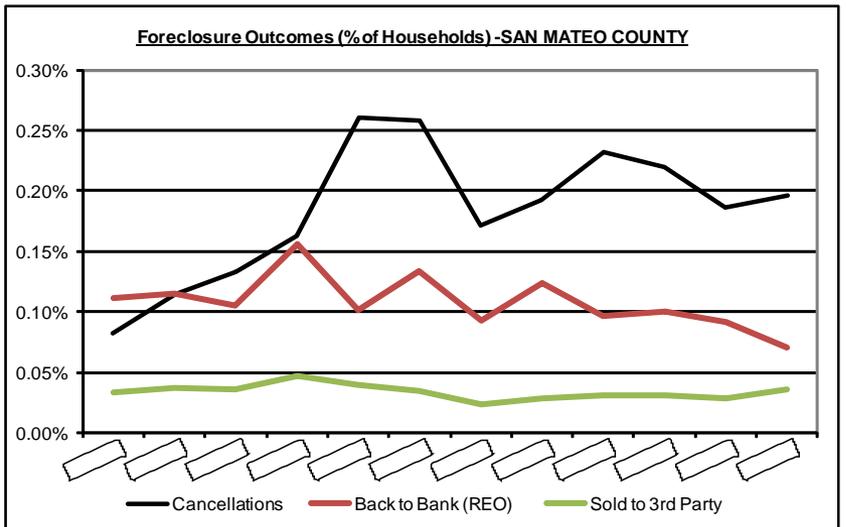
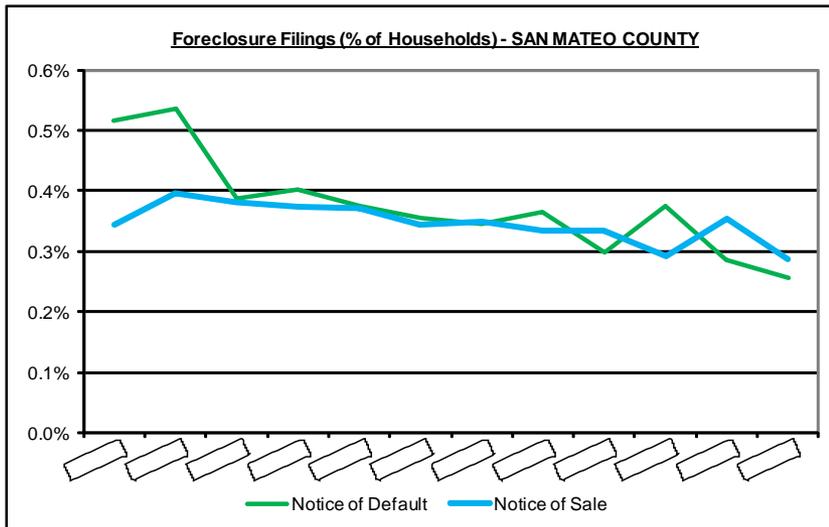
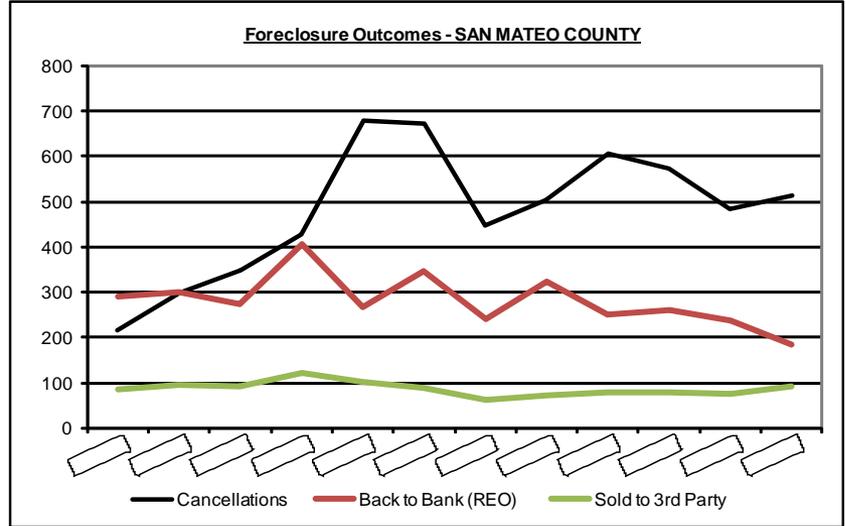
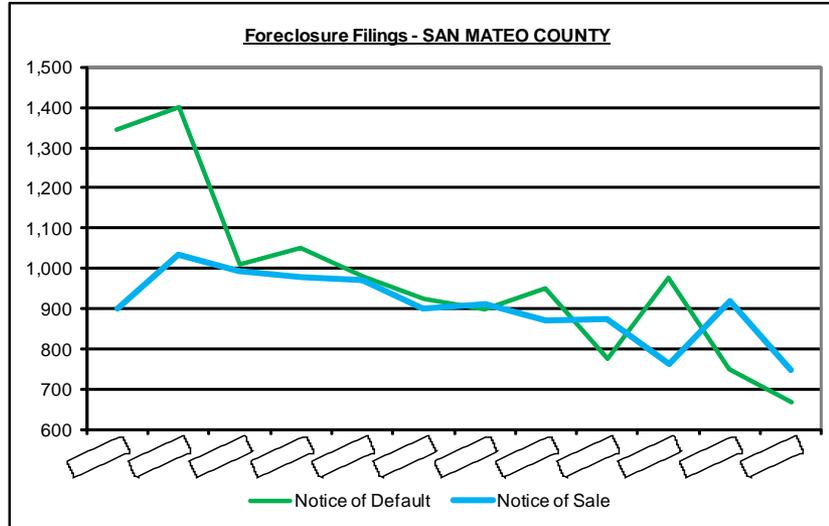
Pre-foreclosure notices are relatively flat in San Francisco County, and Back to Bank (REOs) are flat as well. The percentage of notices and REOs as compared to total households is less than 0.2%.



Source: John Burns Real Estate Consulting, Foreclosure Radar
D-50

Note: % of Households calculation based on 2010 Households

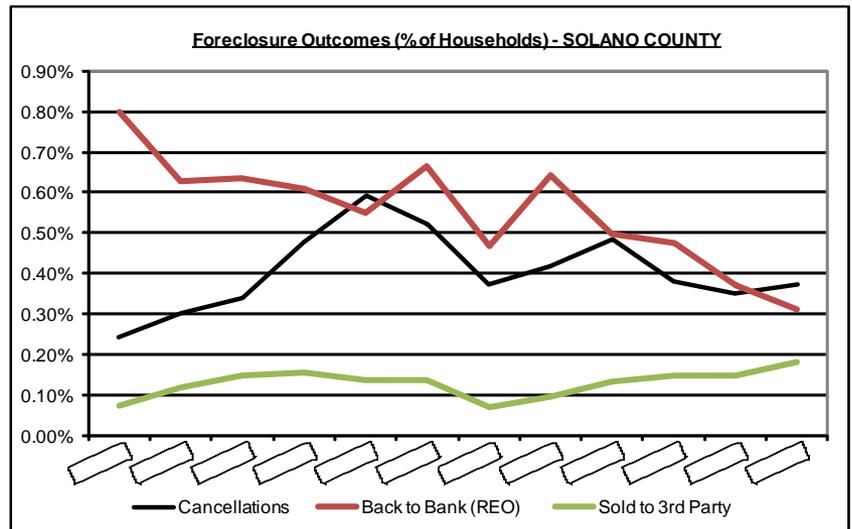
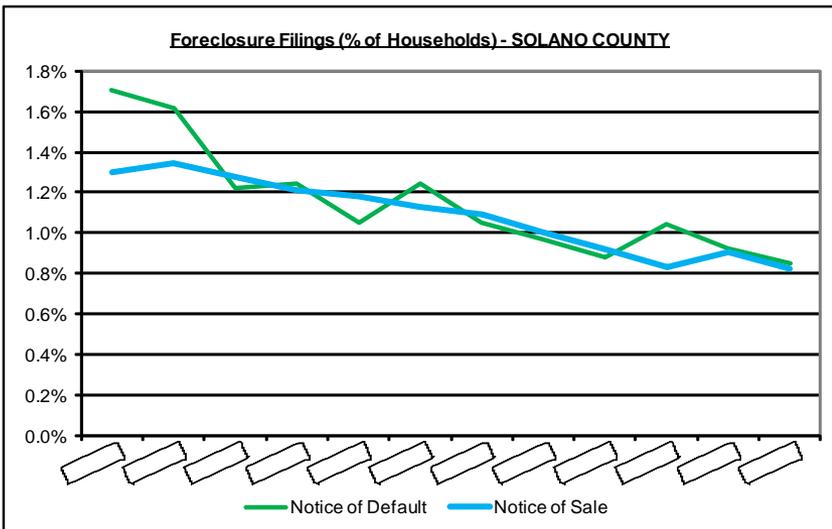
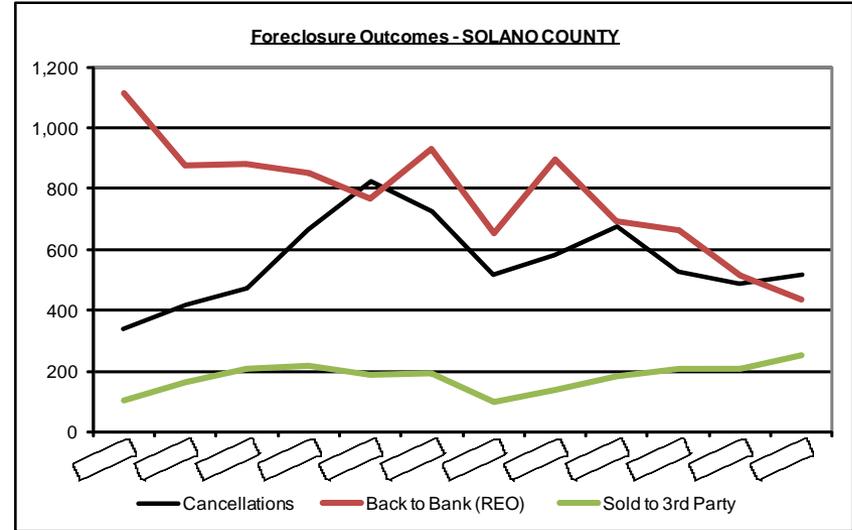
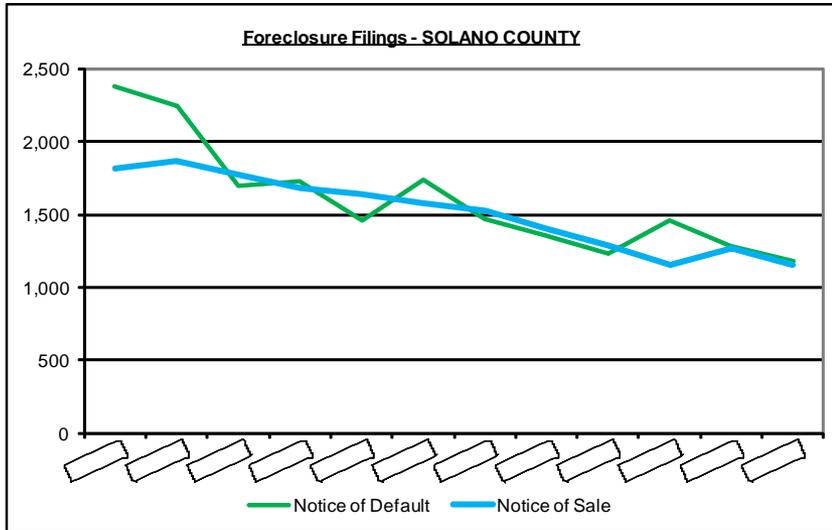
Pre-foreclosure notices continue to decline in San Mateo County, and Back to Bank (REOs) are declining as well. The percentage of notices and REOs as compared to total households is about 0.3%.



Source: John Burns Real Estate Consulting, Foreclosure Radar

Note: % of Households calculation based on 2010 Households
D-51

Pre-foreclosure notices continue to decline in Solano County, and Back to Bank (REOs) are declining as well. The percentage of notices and REOs as compared to total households is under 1.0%, though this is the highest in the region.



Source: John Burns Real Estate Consulting, Foreclosure Radar

Note: % of Households calculation based on 2010 Households

Bay Area markets (shown in green) rank favorably in terms of low numbers of shadow inventory homes and months of supply. San Francisco has the least shadow inventory months of supply, and three of the four core Bay Area MSAs are in the top 10.

Metros in Order of Least Shadow Months of Supply						
Metro	Shadow Months of Supply	Shadow Inventory (base case) ^{3,6}	Resale Sales (10-yr Avg)	Estimated Metro Delinquency % ²	Current Median Price	JBREC Affordability Index™
1 San Francisco, CA (MDiv)	6.8	10,365	18,212	5.2%	\$575,000	0.7
2 Denver, CO	7.4	28,802	46,485	7.6%	\$208,000	2.3
3 San Jose, CA	7.7	15,171	23,690	7.1%	\$450,000	0.6
4 San Diego, CA	9.0	30,141	40,015	8.9%	\$339,000	1.5
5 Orange County, CA (MDiv)	9.1	28,596	37,799	8.1%	\$450,000	3.0
6 Phoenix, AZ	9.2	70,960	92,735	12.7%	\$125,100	0.2
7 Portland, OR-WA	9.2	26,828	34,981	8.6%	\$196,600	0.9
8 Oakland, CA (MDiv)	10.7	34,124	38,153	10.3%	\$280,000	0.6
9 Las Vegas, NV	11.2	41,355	44,416	19.5%	\$115,000	0.0
10 Riverside-San Bernardino, CA	11.4	68,983	72,839	14.9%	\$170,000	0.4
11 Austin, TX	11.5	21,355	22,296	10.9%	\$176,000	0.0
12 Los Angeles, CA (MDiv)	11.6	92,258	95,817	10.2%	\$300,000	0.0
13 Sacramento, CA	12.0	36,034	36,102	12.4%	\$175,000	0.0
14 Fort Myers, FL	12.3	19,842	19,362	31.9%	\$105,950	1.2
15 Bakersfield, CA	12.3	12,231	11,916	14.1%	\$117,750	0.1
16 Vallejo-Fairfield, CA	12.8	8,067	7,550	14.5%	\$180,500	0.0
17 Seattle, WA (MDiv)	13.5	44,280	39,237	11.4%	\$298,500	0.5
18 West Palm Beach, FL (MDiv)	14.0	34,797	29,786	23.0%	\$170,000	0.0
19 Stockton, CA	14.1	12,113	10,301	15.7%	\$150,000	0.1
20 San Antonio, TX	14.6	23,786	19,608	11.0%	\$139,300	0.6
21 Port St. Lucie, FL	14.6	11,691	9,629	21.4%	\$107,000	0.1
22 Fresno, CA	14.9	12,997	10,499	14.4%	\$128,750	0.0
23 Dallas, TX (MDiv)	14.9	62,671	50,561	13.1%	\$151,200	0.0
24 North Port-Bradenton-Sarasota, FL	15.0	21,539	17,251	24.6%	\$140,000	0.5
25 Baltimore, MD	15.1	53,802	42,624	14.0%	\$229,000	2.9
26 Tacoma, WA (MDiv)	15.6	15,031	11,579	14.1%	\$165,000	0.0
27 Charleston, SC	15.9	11,982	9,043	16.1%	\$187,000	1.3
28 Melbourne, FL	16.2	14,179	10,520	17.5%	\$98,000	0.0
29 Houston, TX	16.2	85,855	63,579	14.3%	\$137,500	0.0
30 Raleigh-Cary, NC*	16.2	18,627	13,793	11.8%	\$195,000	0.8
31 Charlotte, NC-SC*	16.2	28,421	21,033	11.8%	\$170,215	1.4
32 Fort Worth, TX (MDiv)	16.7	30,484	21,897	12.1%	\$129,380	0.0
33 Fort Lauderdale, FL (MDiv)	16.9	57,570	40,978	23.6%	\$155,000	0.2
34 Tampa, FL	17.9	82,321	55,299	22.2%	\$105,000	0.1
35 Daytona Beach, FL	18.7	15,270	9,788	23.1%	\$87,000	0.1
36 Lakeland, FL	19.7	14,624	8,923	20.7%	\$94,000	0.3
37 Jacksonville, FL	21.4	36,070	20,259	19.6%	\$130,000	0.0
38 Orlando, FL	21.7	65,662	36,393	23.1%	\$120,000	0.0
39 Chicago, IL (MDiv)	23.5	198,353	101,355	18.8%	\$155,000	0.0
40 Miami, FL (MDiv)	24.2	79,210	39,331	31.0%	\$160,000	0.0
41 Ocala, FL	24.7	10,443	5,069	24.4%	\$82,500	0.0
42 Cleveland, OH	25.9	53,680	24,885	18.7%	\$114,751	0.6

These data show that the Bay Area is in comparatively good shape when it comes to shadow inventory, that is, distressed homes not yet on the market but likely to eventually be. Further, **shadow inventory levels have improved markedly** since the nadir of the downturn. The table below shows this clearly (fourth quarter of each year):

Shadow Inventory Months of Supply

MSA	2009	2010	2011
San Francisco	8.4	8.6	6.8
San Jose	11.7	8.7	7.7
Oakland	15.6	13.6	10.7
Vallejo	18.8	16.1	12.8

This decreasing shadow inventory trend means there will be less excess inventory on the market requiring absorption since most of this inventory tends to be single family units.

There are approximately 6.8 months of supply of “shadow” inventory in the San Francisco MSA, or homes not currently on the market and in one form of distress that we believe will be eventually liquidated/sold. This is the lowest level of any major MSA.

Category	Estimated # of Delinquent Loans in Metro ⁴	Shadow Inventory ⁶ (based on liquidation probabilities above)		
		Upside Scenario ³	Base Case ³	Downside Scenario ³
In Foreclosure	4,399	3,519	3,959	4,399
90+ Days	4,603	3,452	3,913	4,557
60 Days	1,428	1,000	1,142	1,357
30 Days	3,188	1,594	1,913	2,232
Total	13,618	9,565	10,927	12,545
Less: Distressed Units already listed on MLS ⁷		(562)	(562)	(562)
Shadow Inventory⁶		9,003	10,365	11,983
Plus: Current MLS Listings		4,220	4,220	4,220
Total Supply		13,223	14,585	16,203
Months of Supply - Shadow		5.9	6.8	7.9
Months of Supply - MLS		2.8	2.8	2.8
Total Months of Supply		8.7	9.6	10.7

Total Metro Mortgages ⁵ :	261,015
10-yr Avg Annual Metro Resale Sales:	18,212

1 - Based on metro's ratio of pre-foreclosure notices to total mortgages relative to state average

2 - State delinquency % X Metro Adjustment (see methodology)

3 - Liquidation probability scenarios were based on a study of probabilities used by leading credit analysts and analysis of county records data

4 - Total Metro Mortgages X Estimated Metro Delinquency %

5 - Estimate of total mortgages, adjusted from the 2008-2010 American Community Survey (Census)

6 - # of currently distressed properties that will ultimately become supply

7 - Assumed that U.S. distressed listings as % of total listings was 32% (same as % distressed sales, then

adjusted that % based on differential between metro total mortgage delinquency and U.S. total mortgage delinquency

There are approximately 7.7 months of supply of “shadow” inventory in the San Jose MSA, or homes not currently on the market and in one form of distress that we believe will be eventually liquidated/sold. This is the third lowest in the nation.

Category	Estimated # of Delinquent Loans in Metro ⁴	Shadow Inventory ⁶ (based on liquidation probabilities above)		
		Upside Scenario ³	Base Case ³	Downside Scenario ³
In Foreclosure	6,436	5,149	5,792	6,436
90+ Days	6,734	5,051	5,724	6,667
60 Days	2,089	1,462	1,671	1,985
30 Days	4,663	2,332	2,798	3,264
Total	19,922	13,994	15,985	18,352
Less: Distressed Units already listed on MLS ⁷		(814)	(814)	(814)
Shadow Inventory⁶		13,180	15,171	17,538
Plus: Current MLS Listings		4,515	4,515	4,515
Total Supply		17,695	19,686	22,053
Months of Supply - Shadow		6.7	7.7	8.9
Months of Supply - MLS		2.3	2.3	2.3
Total Months of Supply		9.0	10.0	11.2

Total Metro Mortgages ⁵ :	282,122
10-yr Avg Annual Metro Resale Sales:	23,690

1 - Based on metro's ratio of pre-foreclosure notices to total mortgages relative to state average

2 - State delinquency % X Metro Adjustment (see methodology)

3 - Liquidation probability scenarios were based on a study of probabilities used by leading credit analysts and analysis of county records data

4 - Total Metro Mortgages X Estimated Metro Delinquency %

5 - Estimate of total mortgages, adjusted from the 2008-2010 American Community Survey (Census)

6 - # of currently distressed properties that will ultimately become supply

7 - Assumed that U.S. distressed listings as % of total listings was 32% (same as % distressed sales, then adjusted that % based on differential between metro total mortgage delinquency and U.S. total mortgage delinquency)

There are approximately 10.7 months of supply of “shadow” inventory in the Oakland MSA, or homes not currently on the market and in one form of distress that we believe will be eventually liquidated/sold.

Category	Estimated # of Delinquent Loans in Metro ⁴	Shadow Inventory ⁶ (based on liquidation probabilities above)		
		Upside Scenario ³	Base Case ³	Downside Scenario ³
In Foreclosure	14,284	11,427	12,856	14,284
90+ Days	14,947	11,210	12,705	14,798
60 Days	4,637	3,246	3,710	4,405
30 Days	10,351	5,176	6,211	7,246
Total	44,219	31,059	35,482	40,733
Less: Distressed Units already listed on MLS ⁷		(1,357)	(1,357)	(1,357)
Shadow Inventory⁶		29,702	34,125	39,376
Plus: Current MLS Listings		5,170	5,170	5,170
Total Supply		34,872	39,295	44,546
Months of Supply - Shadow		9.3	10.7	12.4
Months of Supply - MLS		1.6	1.6	1.6
Total Months of Supply		11.0	12.4	14.0

Total Metro Mortgages ⁵ :	430,298
10-yr Avg Annual Metro Resale Sales:	38,153

1 - Based on metro's ratio of pre-foreclosure notices to total mortgages relative to state average

2 - State delinquency % X Metro Adjustment (see methodology)

3 - Liquidation probability scenarios were based on a study of probabilities used by leading credit analysts and analysis of county records data

4 - Total Metro Mortgages X Estimated Metro Delinquency %

5 - Estimate of total mortgages, adjusted from the 2008-2010 American Community Survey (Census)

6 - # of currently distressed properties that will ultimately become supply

7 - Assumed that U.S. distressed listings as % of total listings was 32% (same as % distressed sales, then

adjusted that % based on differential between metro total mortgage delinquency and U.S. total mortgage delinquency

There are approximately 12.8 months of supply of “shadow” inventory in the Vallejo-Fairfield MSA, or homes not currently on the market and in one form of distress that we believe will be eventually liquidated/sold.

Category	Estimated # of Delinquent Loans in Metro ⁴	Shadow Inventory ⁶ (based on liquidation probabilities above)		
		Upside Scenario ³	Base Case ³	Downside Scenario ³
In Foreclosure	3,425	2,740	3,083	3,425
90+ Days	3,583	2,687	3,046	3,547
60 Days	1,112	778	890	1,056
30 Days	2,482	1,241	1,489	1,737
Total	10,601	7,446	8,508	9,765
Less: Distressed Units already listed on MLS ⁷		(440)	(440)	(440)
Shadow Inventory⁶		7,006	8,068	9,325
Plus: Current MLS Listings		1,193	1,193	1,193
Total Supply		8,199	9,261	10,518
Months of Supply - Shadow		11.1	12.8	14.8
Months of Supply - MLS		1.9	1.9	1.9
Total Months of Supply		13.0	14.7	16.7

Total Metro Mortgages ⁵ :	73,355
10-yr Avg Annual Metro Resale Sales:	7,550

1 - Based on metro's ratio of pre-foreclosure notices to total mortgages relative to state average

2 - State delinquency % X Metro Adjustment (see methodology)

3 - Liquidation probability scenarios were based on a study of probabilities used by leading credit analysts and analysis of county records data

4 - Total Metro Mortgages X Estimated Metro Delinquency %

5 - Estimate of total mortgages, adjusted from the 2008-2010 American Community Survey (Census)

6 - # of currently distressed properties that will ultimately become supply

7 - Assumed that U.S. distressed listings as % of total listings was 32% (same as % distressed sales, then adjusted that % based on differential between metro total mortgage delinquency and U.S. total mortgage delinquency)

Recapping the findings from the consumer preference survey detailed above indicate the following:

- Bay Area home shoppers are diverse
- They generally prefer lower density conventional housing in suburban locations
- They want larger homes with more rooms with yard and storage spaces
- And their preferences are not dramatically different from people across the country.

These conclusions are backed up by a recent survey that the National Association of Realtors conducted on housing preferences nationwide. The results may be summarized succinctly as follows: **people continue to favor suburbs and relatively low density housing, they just prefer this within a vibrant, mixed-use environment.** Respondents also showed generally favorable attitudes towards “smart growth,” it should be added, and were willing to trade off some home space and lower density if it meant a shorter commute and/or an ideal community type. Essentially, this underlines the contention that diversity in housing and community types is critical. If a vibrant, mixed-use, relatively close-in community with relatively low densities is the ideal, approximating this in a variety of places – here sacrificing density for community, there sacrificing home preferences for walkability and commutability – is the best possible solution. This is confirmed by MTC’s own survey showing that Bay Area home-seekers prefer such suburban features as safe neighborhoods, clean neighborhoods, indoor space, parks, and quiet streets in addition to such urban amenities as short commutes and neighborhoods where there are places to spend time (see “Choosing Where We Live: Attracting Residents to Transit-Oriented Neighborhoods in the San Francisco Bay Area,” May 2010). As part of the MTC research, respondents were given attitudinal statements ranking 35 statements regarding housing preferences, and within the top 15 none are related to access to transit or vertical urban living. In fact, car related needs/wants rank higher than any of the transit access statements.

Moreover, even should there be a gradual skew toward younger households and urban preferences, these **younger households will inevitably age.** Life stage evolution will work its way and push these households toward more conventional housing. Diverse housing preferences, a long-term skew toward lower densities as the ideal, and the inevitable effects of life stage factors all mean that any oversupply in single family housing is likely to be short-lived. An overwhelming push toward high-density urban product, then, would likely simply result in an oversupply of that kind of product as the Millennials age and change.

Tapping into shifting demand to house more people near transit hubs that helps to achieve the goals of SB 375 is well worth working toward, but housing preferences are diverse and will remain so forever. While availability, pricing, etc. will always affect housing outcomes in a place like the Bay Area, preferences ultimately drive the market and, it could be argued, should drive planning to the greatest extent possible.

Arthur Nelson, a demographer at the University of Southern California, recently released a study called “New California Dream: How Demographic and Economic Trends May Shape the Housing Market.” This paper has provided a demand-based underpinning of the idea that the Bay Area will need a great deal of new high-density housing over the next two decades and beyond. Nelson’s argument effectively posits the following:

- The young cohort of Millennials is on the rise
- Millennials like high-density and urban housing
- The aging cohort is also on the rise and will be leaving single family homes (SFD)
- Family households are shrinking, meaning fewer natural SFD buyers as a share of the total housing profile
- There are already lots of SFD units and it may be more difficult to buy them in the near future
- Fewer families buying SFD, old people moving out of SFD, and young people favoring high-density combines with the current stock of SFD to mean there will be a glut of SFD housing that will grow over the next two to three decades. That is, **the projected supply of SFD outstrips projected demand for SFD going forward, meaning builders and developers and planners should concentrate on high-density housing, preferably in urban areas.**
- These demographic trends coincide with the goals of SB 375 and, in turn, with the Draft Plan that would apply SB 375 to the Bay Area region.

That the Gen Y and Millennial wave is upon us is beyond doubt. The share of younger households will increase and many will likely prefer higher density urban spaces. In the Bay Area specifically, this will often mean trading space and privacy for being close to the their job. We already see this happening in the South Bay and now in San Francisco with the surge in tech sector jobs there. But that these households will nearly monolithically favor high-density urban environments, that they will continue to as they age, and that new SFD demand will be extremely limited despite decades of precedent and preferences is all very much open to question.

This is not a detailed criticism of the Nelson argument. Below we simply **summarize several critiques and counter-arguments that are worthy of consideration, and have the effect of questioning the core conclusions of the Nelson paper.**

- **Home Ownership.** Nelson’s assumption appear overly pessimistic in terms of projecting future home ownership levels. This is important since it is one of the key reasons for the shrinkage seen for SFD demand going forward. Nelson’s modeling pushes ownership rates down to ahistorically low levels over the next decade or so. John Burns Real Estate Consulting has also estimated home ownership and its modeling posits a decrease in rates over the near-term, but above the levels presumed by Nelson and gradually rising after that, though not to the levels seen during the height of the recent housing boom. Here even small differences have big cumulative effects. Here also political policy has long favored ownership, and so it is likely that future policies (mortgage underwriting, tax policies, etc.) would be design to boost ownership rates if this should be seen as a significant issue. An ownership trend above Nelson’s assumption “solves” much of the problem of the SFD glut by itself.
- **Ownership Attitudes.** Survey results cited in the paper show a great deal of pessimism among respondents that they will ever own their own home, which feeds into the low ownership argument and hence the coming SFD glut. The key surveyed cited, however, was conducted in 2009 at the bottom of the housing bust. These attitudes, then, likely reflect as much panic as they do preference. Surveying – even that cited by Nelson – has consistently shown that people still *want* to own a home and that is a critical goal for most Americans.
- **Equity.** Again using 2009 data, Nelson paints a dismal picture of home equity in the U.S. The equity level cited from these data represents by far the lowest level in the post-war era. It is another ahistorical data point that is not likely to hold indefinitely. While Americans have “lost” billions in equity with rapid price decreases over the last few years, prices are already on the rise in many Bay Area locations and will undoubtedly rise over the mid- to long-term. This will push equity levels higher and feed the home buying cycle that is so important to single family inventory. Nelson’s assumptions about home ownership are consistently from a “worst case” perspective and are not likely to prove entirely accurate.
- **Minority Ownership.** Demographics in California favor minority households in coming years, households with lower than average ownership rates. Simply applying this historical trend in this case, however, can be misleading. Typically, ethnic groups in America have assimilated over time and taken on more of the characteristics of the dominant society. This is precedent, then, that minority households – in California, most importantly Latino households – will gradually experience a rise in home ownership as their incomes improve and mortgage vehicles become more available to them.

- **Smaller Homes.** The claimed survey-based desire for smaller homes is likely at least partly a function of high and rising home prices (these surveys were conducted from 2001-04) as much as a desire to “go small.” The consumer data detailed above shows this, and buyer desires for conventional suburban housing are enduring. It is undoubtedly true that many people will seek a trade-off if they get something in return – smaller house for being closer to work or in better community – but in general most people prefer a good-sized home with private space.
- **Urban Environment.** Any perceived preferences for high-density urban housing derived from abstract questions will, ultimately, have to be tested against urban realities. That is, preferences for smaller homes are based on a trade off for an idealized urban space that is often far from accurate in real life. Small urban homes even in places with walkable retail, good transit connections, etc. will be weighed against the larger nature of that urban area. Very often, these supposed urban preferences will be trumped by other considerations such as schools, crime, price, congestion, etc.
- **Price and Density.** It is possible that some of the preferences for higher density cited by Nelson are due to respondent knowledge that lower density may be beyond their reach or from their current (higher density) reality. Many of these respondents were apartment dwellers. That is, these responses may have been colored by the current situation of the respondent and a somewhat pessimistic personal housing outlook. This would be most true, naturally, for surveys done at the height of the market when SFD prices were high and rising. This is ironic, however, since, as the builder cost discussion above shows, most new very high-density product will have to necessarily be priced high to make them financially feasible.
- **PDA Densities.** Regardless of the realism and relevance of the high-density preferences cataloged by Nelson, even these attitudes are at odds with the very high densities that would be the norm under the PDAs as outlined above. A major portion of the high-density demand estimated by Nelson is in the form of small lot detached and townhome/plex housing product. The PDAs as constructed by ABAG and MTC require densities generally higher than these, with a great number of units earmarked for densities that could only be fulfilled in very dense mid-rise and high-rise developments.
- **Transit Preference.** The survey work cited to establish a preference for high-density, transit-oriented housing by Nelson is far from persuasive. Even these data indicate nuanced and more diverse opinions than portrayed, and one key survey that finds a 71% generational preference for urban transit-oriented housing among Californians seems unlikely and is far above the national level. It is very possible this is a statistical quirk, and at the least may reflect more an ideal than a strong desire that will actually drive decisions. Another reason for skepticism is that the results are inconsistent with MTC’s own more recent Bay Area research, which found that respondents attached more importance to convenient auto access and “plenty of indoor space” than any of the transit access preference statements. (http://www.mtc.ca.gov/planning/smart_growth/tod/5-10/Attitudinal_Statements.pdf)

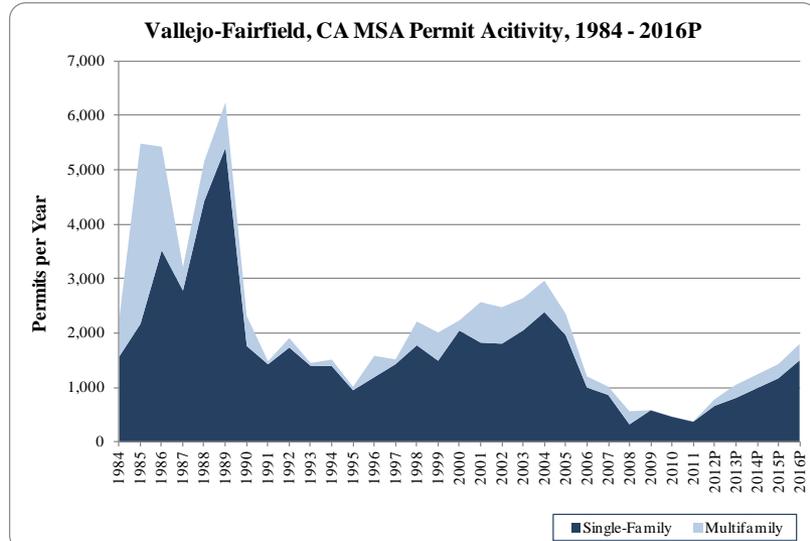
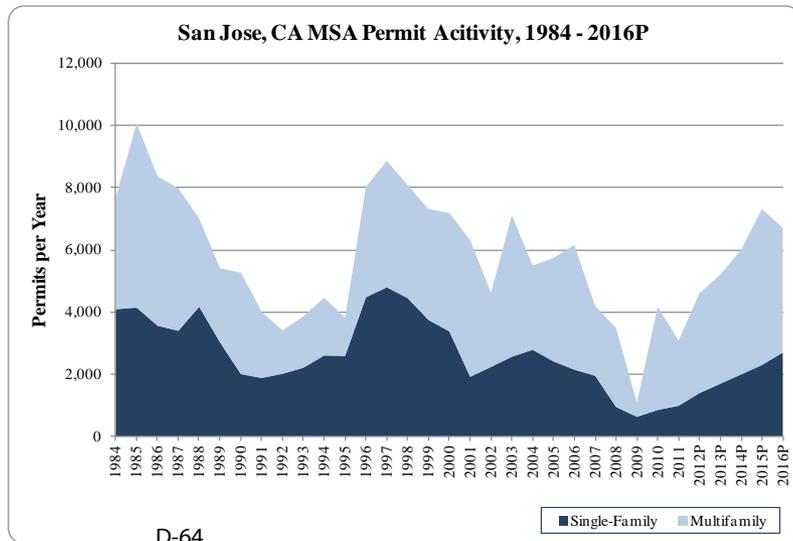
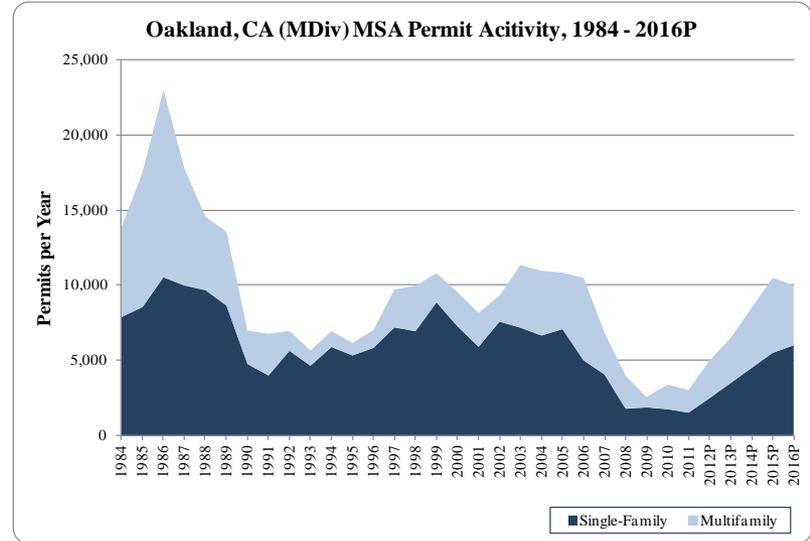
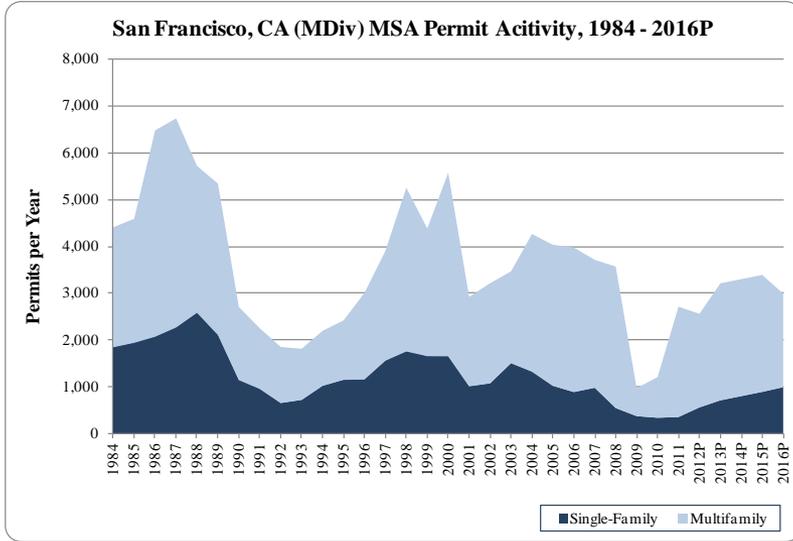
- **Growing Up and Out.** Some degree (and likely quite a lot) of the seeming preference among Gen Y and Millennials for high-density and urban housing will dissipate as they age, and likely very quickly. When 20-somethings become 30-somethings and get married, have kids, etc., their needs for space, schools, and security begin to outweigh their desire for a walkable landscape with cool places to eat nearby.
- **High-density and Urban Locales.** The surveys Nelson uses indicate that high-density is really only favored if very close to transportation and shopping, etc. That is, it typically only works in urban cores with these amenities. While transit-oriented urban locales are the focus of the Draft Plan, these high-density preferences clearly negate the need for this kind of housing outside of relatively few attractive close-in urban locations. As noted, the PDA guidelines allow for little else but very high-density housing, regardless of the surrounding environment.
- **Overarching Preferences.** At the risk of belaboring the point, the preference findings discussed above from our own consumer survey and others indicate that diverse housing types will always be needed and desired. This is true even for Millennials. Polling by Frank Magid and the New Politics Institute indicate that Millennials generally prefer suburbs and want to own their own home. (See “The Politics of the Millennial Generation,” March 2006.) They don’t want to be high-density renters their whole lives. And, as more inclusive polling and the life stage argument shows, even when young people do favor a high-density urban housing environment this attitude is transitory and eventually gives way to more conventional desires.

As noted above, this critique is not a point by point refutation of Nelson’s argument, which has some merit and correctly indicates the need for new transit-oriented urban housing. But we have raised significant questions that cumulatively challenge at least the degree of Nelson’s conclusions. Going forward, the Bay Area will require housing diversity as it always has and there is no reason in this argument to believe this long-term reality is suddenly false.



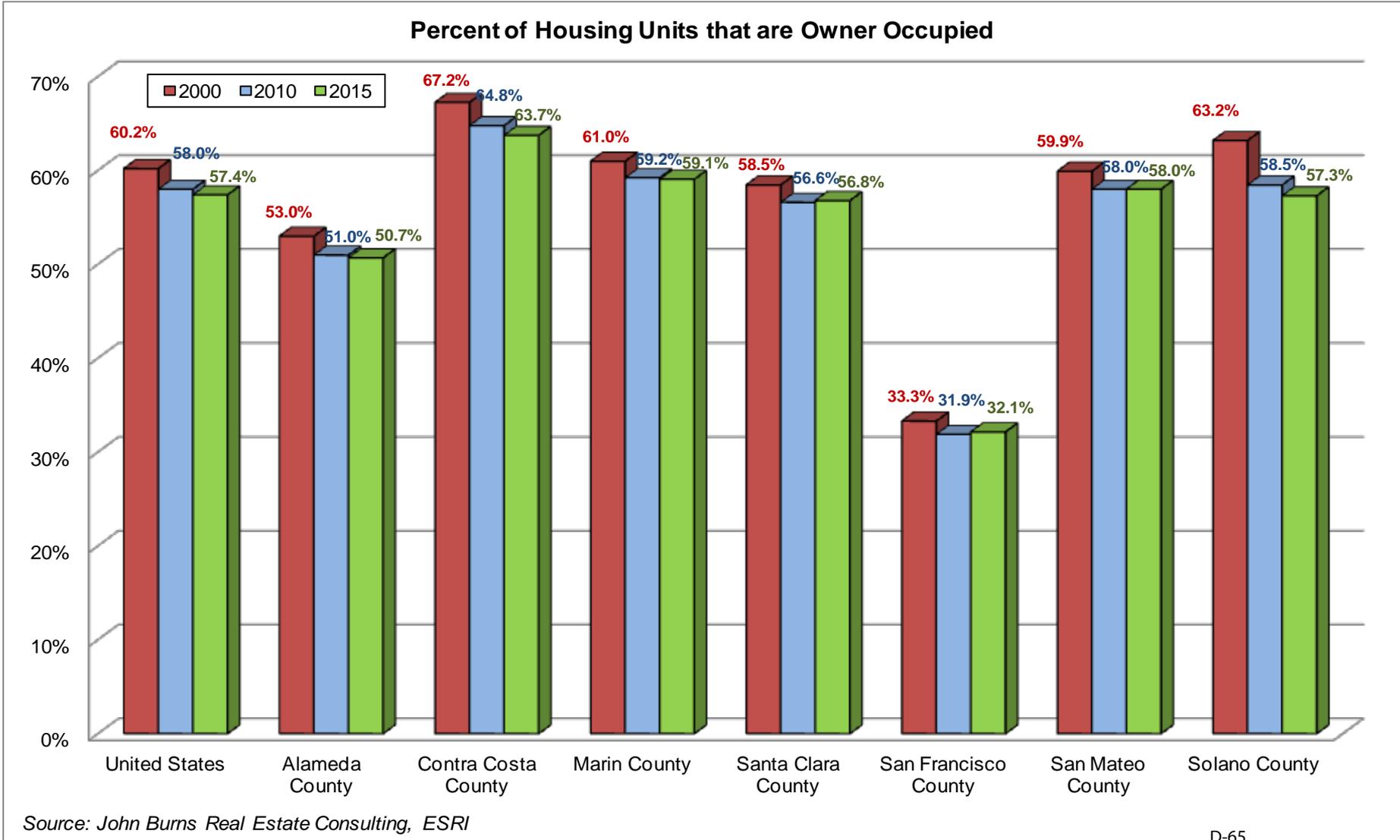
MACRO HOUSING TRENDS

Single family and multifamily permits are projected to increase gradually throughout the region, but the housing bust depressed housing activity to aberrant lows. The resulting pent-up demand will eventually help absorb the increased development activity in the coming years.



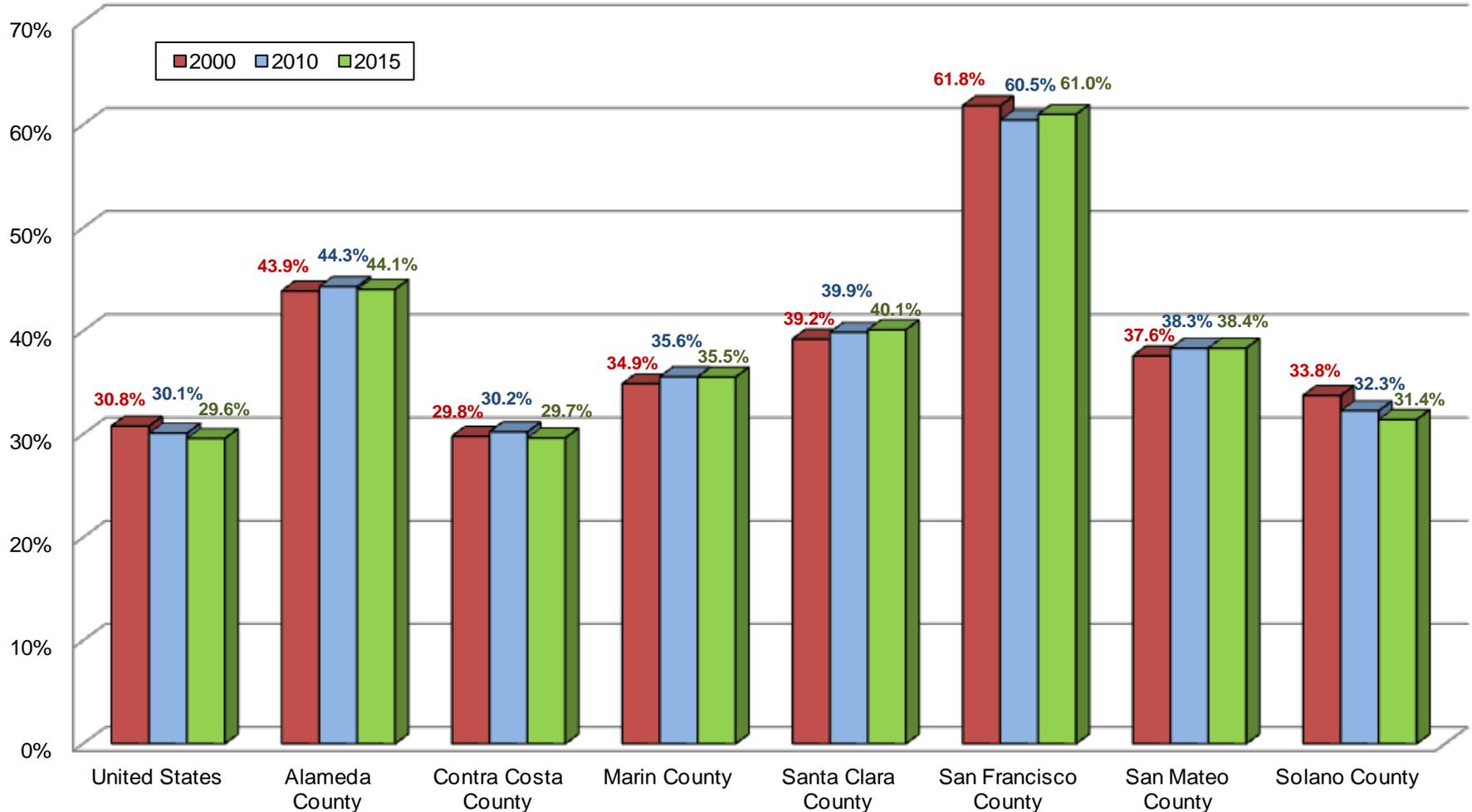
D-64

The percentage of owner occupied units is trending downward or is flat in all counties in the region, except San Francisco. Though comparatively more renter-oriented, the Bay Area is still dominated by home owners living in diverse product. It is critical to note that this trend has been a function of financing, not preference.



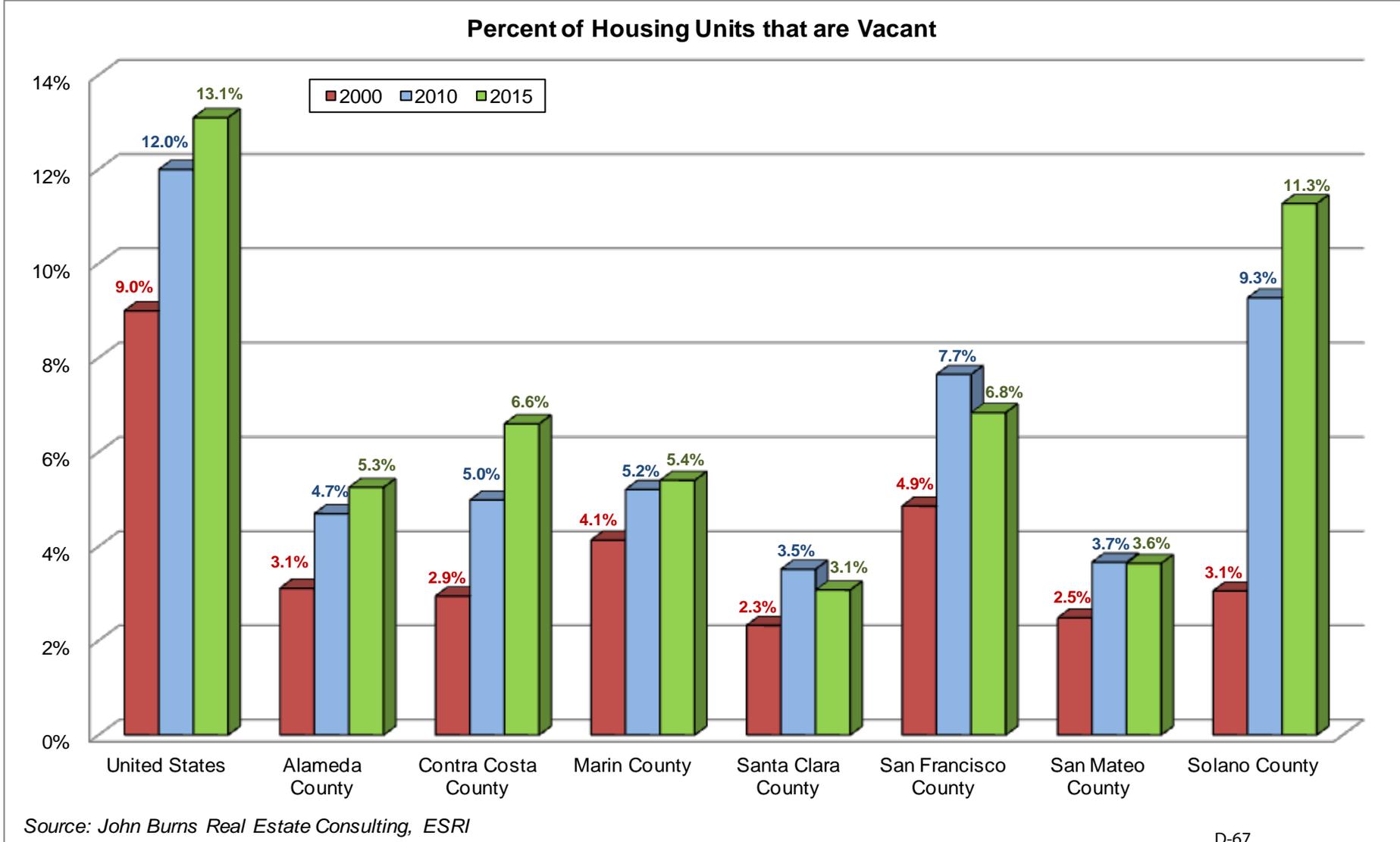
The percentage of renter occupied units has been generally flat throughout the region as the loss in owner-occupied rates is reflected mainly in lower occupancies (see next page). Rental housing is generally more associated with higher densities, but not typically with the extreme densities embodied in the PDAs except in narrow core urban locations.

Percent of Housing Units that are Renter Occupied

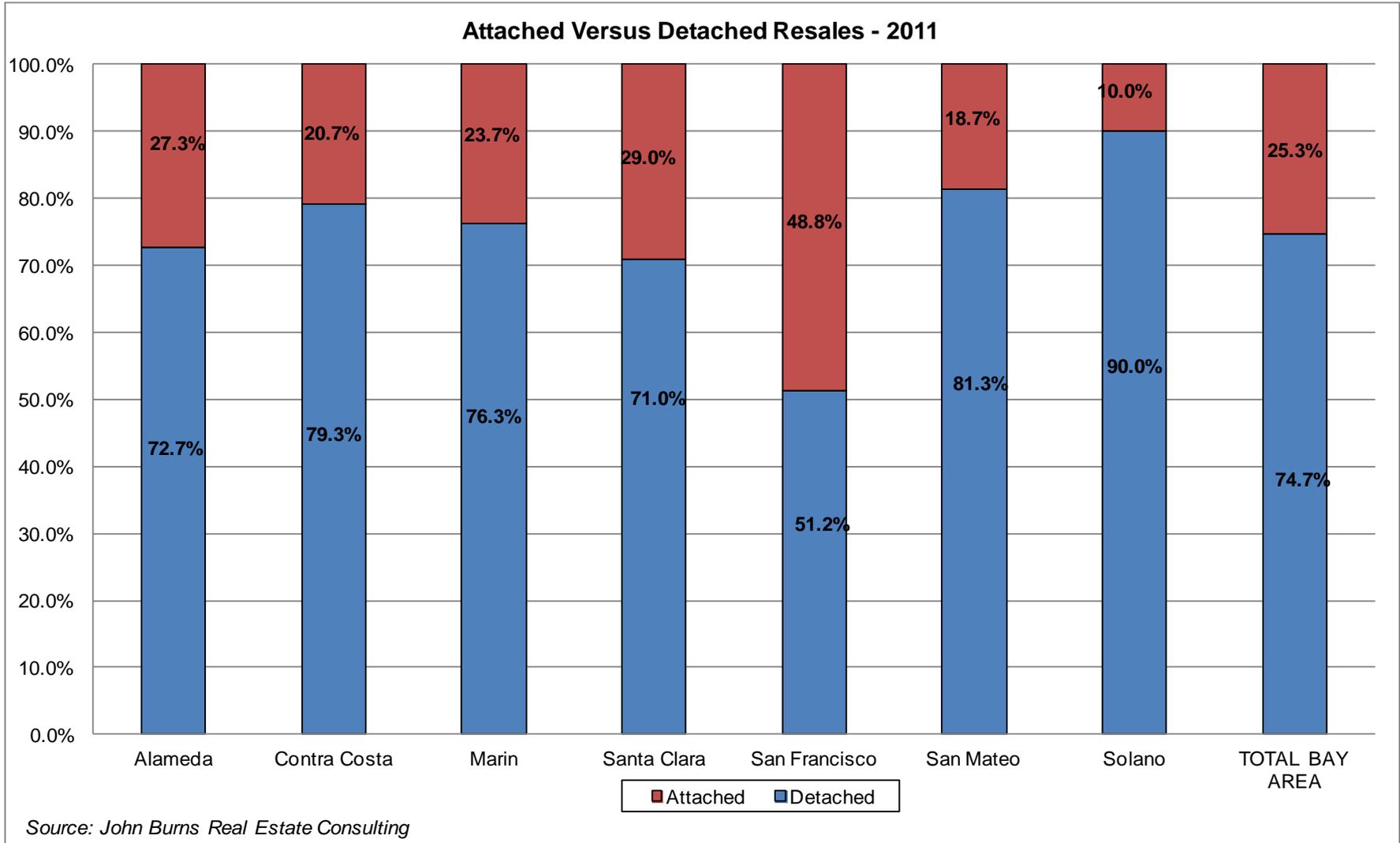


Source: John Burns Real Estate Consulting, ESRI

Though the proportion of vacant households rose over the last decade due to the housing bust, only in relatively outlying Solano County was this change dramatic. Further, these proportions are projected to roughly stabilize over the near-term (green bars in chart below), again with the less dramatic exception of Solano County.



The majority of home sales in the resale market are for detached units at about a 75% / 25% split of detached over attached in the Bay Area overall. San Francisco County is the only market with a more even mix of attached and detached resale product. This is effectively the market indicating the preferences seen in the attitudinal data discussed above.





PSYCHOGRAPHIC PROFILES

Below are descriptions of the dominant life stage groups for the San Francisco MSA. Data cited is based on US medians.



08: Laptops and Lattes

- No homeownership or children, enjoying single life in the big city.
- Median household income of \$93,899, median net worth of \$285,718. Professional and management jobs.
- Highly educated, 70% have a bachelors degree and 90% attended some college.
- Home ownership is at 39 percent, and the median home value is \$634,295.
- **The majority live in apartments or multiunit buildings, in older urban neighborhoods.**



11: Pacific Heights

- Families of upscale neighborhoods in Pacific coastal cities. Household size of 3.61 on average.
- Median household income of \$79,148, median net worth of \$207,148.
- 60% attended some college.
- Home ownership is at 68 percent, and the median home value is \$471,676.
- **Prefer single family or townhomes, live in densely populated urban centers near their jobs.**



09: Urban Chic

- Professionals who live a sophisticated, urban lifestyle. Half are married households, less than half have kids.
- Median household income of \$87,202, median net worth of \$314,496. Professional and management jobs.
- Educated, 50% have a bachelors degree and 80% attended some college.
- Home ownership is at 66 percent, and the median home value is \$536,367.
- **63 percent of the housing is single family, 27 percent is apartments in multiunit buildings.**



23: Trendsetters

- On the cutting edge of urban style, young diverse, mobile. Singles who live alone or rent.
- Median household income of \$61,498, median net worth of \$35,210.
- 46% have a bachelors degree and 70% attended some college.
- **68% live in upscale apartments or multiunit buildings, in older urban neighborhoods.**



03: Connoisseurs

- The top segment for conspicuous consumption. Older population, median of 47 years, and 70% married.
- Median household income of \$121,368, median net worth of \$708,781. Professional and management jobs.
- Well educated, 64% have a bachelors degree.
- Home ownership is at 87 percent, and the median home value is \$601,492.
- **The majority live in single family homes in slow growing, established, affluent areas.**

Below are descriptions of the dominant life stage groups for the Oakland MSA. Data cited is based on US medians.



10: Pleasant-Ville

- Prosperous domesticity. Well settled families and middle aged married couples.
- Median household income of \$77,930, median net worth of \$248,861. Employed in a variety of industries.
- Home ownership is at 82 percent, and the median home value is \$291,084.
- **The majority live in single family homes and are settled-in. Two-thirds live in the same house since 1995.**



23: Trendsetters

- On the cutting edge of urban style, young diverse, mobile. Singles who live alone or rent.
- Median household income of \$61,498, median net worth of \$35,210.
- 46% have a bachelors degree and 70% attended some college.
- **68% live in upscale apartments or multiunit buildings, in older urban neighborhoods.**



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11: Pacific Heights

- Families of upscale neighborhoods in Pacific coastal cities. Household size of 3.61 on average.
- Median household income of \$79,148, median net worth of \$207,148.
- 60% attended some college.
- Home ownership is at 68 percent, and the median home value is \$471,676.
- **Prefer single family or townhomes, live in densely populated urban centers near their jobs.**



35: International Marketplace

- Urban neighborhoods with a blend of cultures and household types. More than half are Hispanic; 11.6% are Asian.
- Young population, median 30.4 years. 70% are families.
- Median household income of \$40,076, median net worth of \$17,878. Some Security income or public assistance.
- Manufacturing, Retail, Health Care, Other service industries.
- Home ownership is at 32 percent, and the median home value is \$261,438.
- **The majority live in apartments or multiunit buildings, in older urban neighborhoods.**

Below are descriptions of the dominant life stage groups for the San Jose MSA. Data cited is based on US medians.



11: Pacific Heights

- Families of upscale neighborhoods in Pacific coastal cities. Household size of 3.61 on average.
- Median household income of \$79,148, median net worth of \$207,148.
- 60% attended some college.
- Home ownership is at 68 percent, and the median home value is \$471,676.
- **Prefer single family or townhomes, live in densely populated urban centers near their jobs.**



23: Trendsetters

- On the cutting edge of urban style, young diverse, mobile. Singles who live alone or rent.
- Median household income of \$61,498, median net worth of \$35,210.
- 46% have a bachelors degree and 70% attended some college.
- **68% live in upscale apartments or multiunit buildings, in older urban neighborhoods.**



09: Urban Chic

- Professionals who live a sophisticated, urban lifestyle. Half are married households, less than half have kids.
- Median household income of \$87,202, median net worth of \$314,496. Professional and management jobs.
- Educated, 50% have a bachelors degree and 80% attended some college.
- Home ownership is at 66 percent, and the median home value is \$536,367.
- **63 percent of the housing is single family, 27 percent is apartments in multiunit buildings.**



01: Top Rung

- Mature, married, highly educated, wealthy.
- Median household income of \$182,041, median net worth of \$1,120,886. Wealth is from investments.
- Well educated, 70% have a bachelors degree.
- Home ownership is at 66 percent, and the median home value is \$536,367.
- **Own at least one single family home, with a median value of \$864,923.**



35: International Marketplace

- Urban neighborhoods with a blend of cultures and household types. More than half are Hispanic; 11.6% are Asian.
- Young population, median 30.4 years. 70% are families.
- Median household income of \$40,076, median net worth of \$17,878. Some Security income or public assistance.
- Manufacturing, Retail, Health Care, Other service industries.
- Home ownership is at 32 percent, and the median home value is \$261,438.
- **The majority live in apartments or multiunit buildings, in older urban neighborhoods.**

Source: ESRI D-72

Below are descriptions of the dominant life stage groups for the Vallejo-Fairfield MSA. Data cited is based on US medians.



24: Main Street, USA

- A mix of household types, similar to the US distribution. A mix of married couples, singles and families.
- Median household income of \$57,196, median net worth of \$84,763.
- Home ownership is at 63 percent, and the median home value is \$174,970.
- **A mix of single family homes and multiunit buildings.**



06: Sophisticated Squires

- Cultured country lifestyle on the urban fringe.
- Median household income of \$85,144, median net worth of \$287,727. Employed in a variety of industries.
- The median home value is \$230,333.
- **Approximately 90% live in single family homes.**



12: Up and Coming Families

- Household growth rate of 4.56% annually, second highest of any segment. Gen X and Baby Boomers.
- Median household income of \$76,135, median net worth of \$175,142.
- Home ownership is at 83 percent, and the median home value is \$175,637.
- **The majority live in in single family homes and are settled-in, two-thirds live in the same house since 1995.**



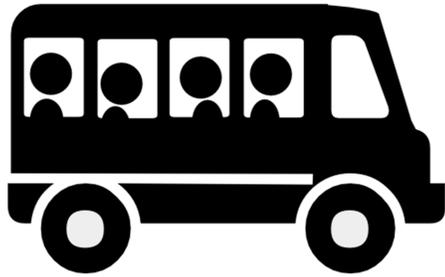
28: Aspiring Young Families

- Prosperous domesticity. Well settled families and middle aged married couples.
- Median household income of \$77,930, median net worth of \$248,861. Employed in a variety of industries.
- Home ownership is at 82 percent, and the median home value is \$291,084.
- **The majority live in newer single family housing, built in the past 10 years, in the suburban outskirts of mid-sized metro areas.**



10: Pleasant-Ville

- Prosperous domesticity. Well settled families and middle aged married couples.
- Median household income of \$77,930, median net worth of \$248,861. Employed in a variety of industries.
- Home ownership is at 82 percent, and the median home value is \$291,084.
- **The majority live in single family homes and are settled-in. Two-thirds live in the same house since 1995.**



MOVING PEOPLE, NOT JUST CARS

Ensuring Choice, Equity & Innovation
in MTC's Express Lane Network

WHITEPAPER

BY JEFF HOBSON & CLARRISSA CABANSAGAN

MAY 2013

TRANSFORM



Formerly TALC, the Transportation and Land Use Coalition

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EXECUTIVE SUMMARY

Express lanes, also known as high-occupancy toll lanes or “HOT lanes,” could provide a regional highway network where transit and high-occupancy vehicle lanes work together to seamlessly provide convenient and swift transit connections through the Bay Area. Planned as a transit system that sells excess system capacity to non-carpool vehicles, this network could move more people and reduce greenhouse gas pollution by providing new transportation choices.

But MTC’s proposed Express Lane Network is out of balance. The Express Lane Network is the 2nd-largest project in Plan Bay Area, the region’s comprehensive transportation and land use plan that is supposed to reduce greenhouse gas pollution. MTC plans to collect \$6.5 billion in tolls from drivers and spend most of the money to build – or pay financing costs for – hundreds of miles of new highway lanes. There is no funding to expand transportation choices to support long-term congestion reduction. Nor is there funding for programs to ensure low-income families receive equitable benefits from this new transportation system.

Once billed as an innovative way to help manage traffic and provide a wide array of new transportation choices, MTC’s Express Lane Network has now primarily become a highway-building program whose main beneficiaries will be solo drivers who can afford to buy their way into new lanes.

Other regions have recognized the potentially inequitable impacts of HOT lanes, as higher-income drivers use them much more frequently and are the main beneficiaries of the travel-time savings. In Seattle, over 50% of HOT lane users had household incomes over \$100,000, while only 15% had incomes under \$50,000. These concerns have prompted other regions to incorporate expanded transportation choices – transit, vanpools, carpools, and other alternatives to solo driving – when they design their HOT network.

The Bay Area can do better. Some positive elements of MTC’s current network point the way. MTC plans to convert 173 miles of existing carpool lanes to HOT, mostly by 2015. These conversions are cost-effective: if done alone, they would produce net revenues that could be invested in a broad range of transportation improvements.

But MTC plans another 170 miles of new highway lanes, costing \$2.8 billion (plus financing costs). This new construction would use up the revenues generated by the rest of the system and leave nothing left for more transportation choices or mitigations for low-income families.

Instead, the Bay Area could pursue what we call an “optimize-a-lane” approach. This approach could move more people at lower cost, with less pollution, and a more equitable distribution of benefits and costs. “Optimize-a-lane” would convert one existing general purpose lane to HOT, save \$10+ million per mile, and use revenues to dramatically increase transportation options along the same corridor.

Properly managed, this HOT lane would flow freely, potentially carrying even more vehicles per hour than the previously-congested general purpose lane. With higher average vehicle occupancy from transportation choices paid for by HOT revenues, optimized HOT lanes would move more people, not just cars.

By contrast, MTC’s plans to build new highway lanes with no new transportation choices will sink the vast majority of drivers’ tolls into another fruitless attempt to build our way out of congestion. If we don’t change course, we will spend 20+ years paying off construction bonds with driver tolls that could have been used to provide more people with more choices.

Moving People, Not Just Cars is a detailed analysis of MTC’s network and how it compares to practices in regions around the country, and shows how MTC can prioritize choice, equity, and innovation to move more people for less money, make connections sooner, and invest in public transit and other long-term solutions. Key recommendations include:

RECOMMENDATIONS FOR CHOICE

- MTC should dedicate at least 50% of HOT revenues to provide new transportation choices – transit, vanpools, carpools, and other alternatives to solo driving – along HOT corridors and to mitigate the network’s impacts on low-income families.
- MTC should create a transportation choices expansion plan as part of the express lane network and include a commitment that with the opening of every new HOT lane, there will be a simultaneous improvement in transportation choices along the same corridor, over and above existing service.

RECOMMENDATIONS FOR EQUITY

- MTC should design and implement mitigations to ensure low-income families receive an equitable share of the benefits and do not bear a disproportionate burden of the HOT network. Mitigations may include access to the network itself, as well as transit investments.
- MTC should expand its environmental justice analysis of the HOT lane network to include a primary research question on the distribution of benefits across different income and ethnic groups, considering differences in expected frequency of use of the HOT lanes.

RECOMMENDATIONS FOR INNOVATION

- Along with the relevant CMA and Caltrans, MTC should study the “optimize-a-lane” approach (defined above) before pursuing new-construction projects in MTC’s Phase II (after 2015) or beyond, and for any congested corridor with at least 8 mixed flow lanes and no HOV lanes.
- MTC and a CMA should seek approval from Caltrans, the state legislature, and if necessary federal authorities to try the “optimize-a-lane” approach in at least two Bay Area locations.

WHAT'S WRONG WITH MTC'S HOT NETWORK

THE BAY AREA'S PLANNED HOT NETWORK

The Metropolitan Transportation Commission (MTC) is planning to create a network of express lanes, or high occupancy toll (“HOT”) lanes, in the San Francisco Bay Area. Express lanes are meant to make use of excess capacity in high occupancy vehicle (HOV) lanes by allowing solo drivers the option to pay entry into the lane, while HOVs retain free use of the lane. The Bay Area now plans for a 570-mile network of these lanes, through a series of projects that are expected to take twenty years and \$7-8 billion to complete.¹ Drivers will be able to access the lanes with a FasTrak® toll tag for a fee of \$3-7.50 per average one-way trip.² The lanes will be managed through variable tolls in order to keep the HOT lane flowing smoothly—low enough to attract drivers out of congestion for a fee, but high enough so that not all cars buy their way into the lane. MTC states that the network aims to improve the reliability of travel, to create efficiencies in highway usage, and to generate revenues that can enhance the connectivity of the region.³

This paper focuses on the network that MTC described in its September 2011 application to the California Transportation Commission (CTC), consisting of lanes in Alameda, Contra Costa, and Solano Counties. The network includes 91 miles of “Legacy Programs,” lanes previously authorized in Alameda County on I-580 and I-680, and 285 miles of newly authorized lanes on I-80, I-880, I-680, and connections to the San Mateo and Dumbarton bridges.

MTC's application to the CTC shows that the region would spend \$225 million to convert 173 miles of existing HOV lanes, but spend \$2,755 million on new construction: 170 new miles of highway lanes.⁴ The new lanes cost \$16 million per mile, more than 12 times as much on a per-mile basis as the conversions! (See Figure 1.) The remainder of the network's costs are largely for operations and maintenance and debt servicing.⁵

¹ MTC Memorandum from Lisa Klein to Policy Advisory Council dated March 27, 2012: *Regional Express Lane Network*. p13. http://apps.mtc.ca.gov/meeting_packet_documents/agenda_1842/4_Express_Lane_Network.pdf

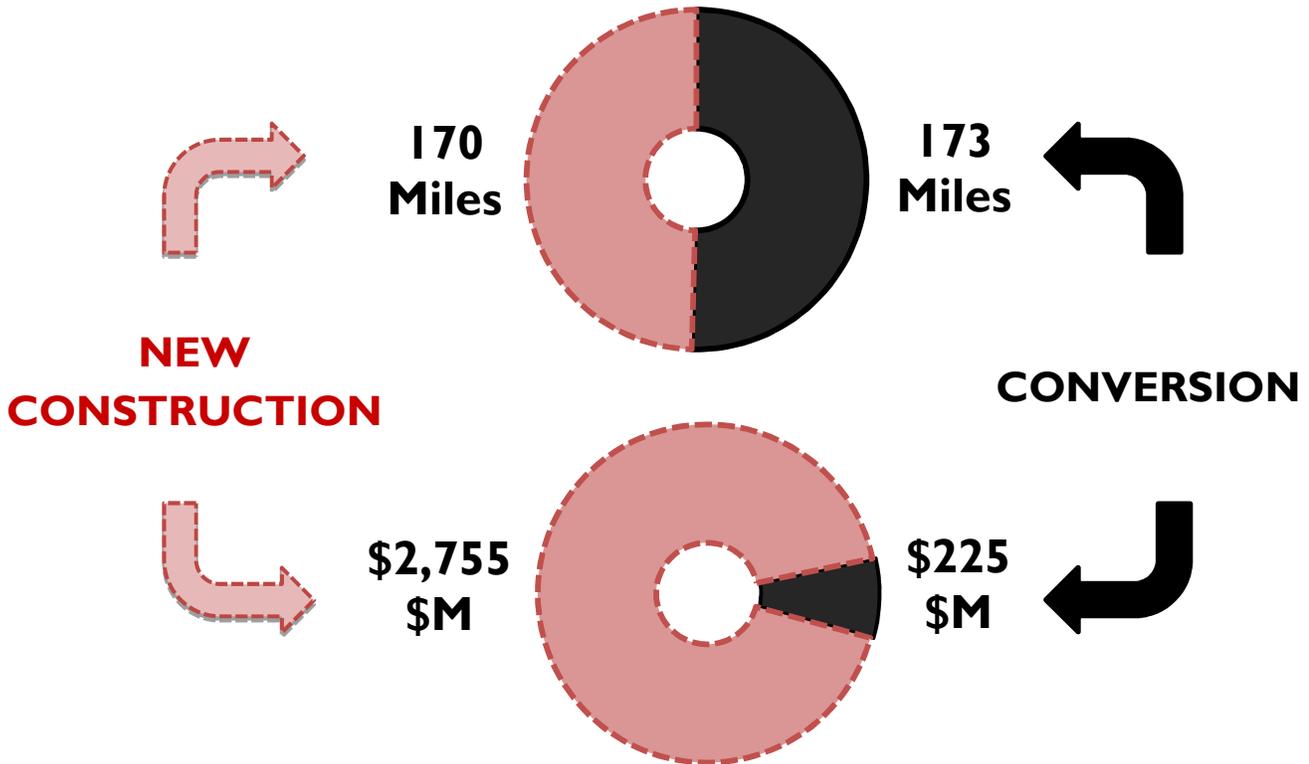
² MTC Application to the California Transportation Commission (CTC) dated September 28, 2011: *Bay Area Express Lanes: Public Partnership Application for High Occupancy Toll Lanes*. p44. http://www.mtc.ca.gov/planning/hov/FINAL_CTC_Application_092811b.pdf

³ MTC Application to the CTC, 2011. Ibid, p1.

⁴ MTC Application to the CTC, 2011. Ibid, pp2-4.

⁵ MTC Memorandum, March 27, 2012. p13.

Figure I. Cost and Lane Miles: New Construction Versus HOV Lane Conversion



The rest of the Bay Area’s network includes 180 miles in Santa Clara County controlled by the Valley Transportation Authority.⁶ The planned network has HOT lanes in Solano, Contra Costa, Alameda, and Santa Clara County (with a short connection to the southern edge of San Mateo County), and includes approaches to five of the seven state-owned bridges in the region. While MTC’s original plans for the network included the North Bay, there are currently no plans for HOT lanes in San Francisco, Marin, Sonoma, or Napa Counties. A feasibility study is underway in San Mateo to create new HOV lane segments through the conversion of mixed flow lanes.

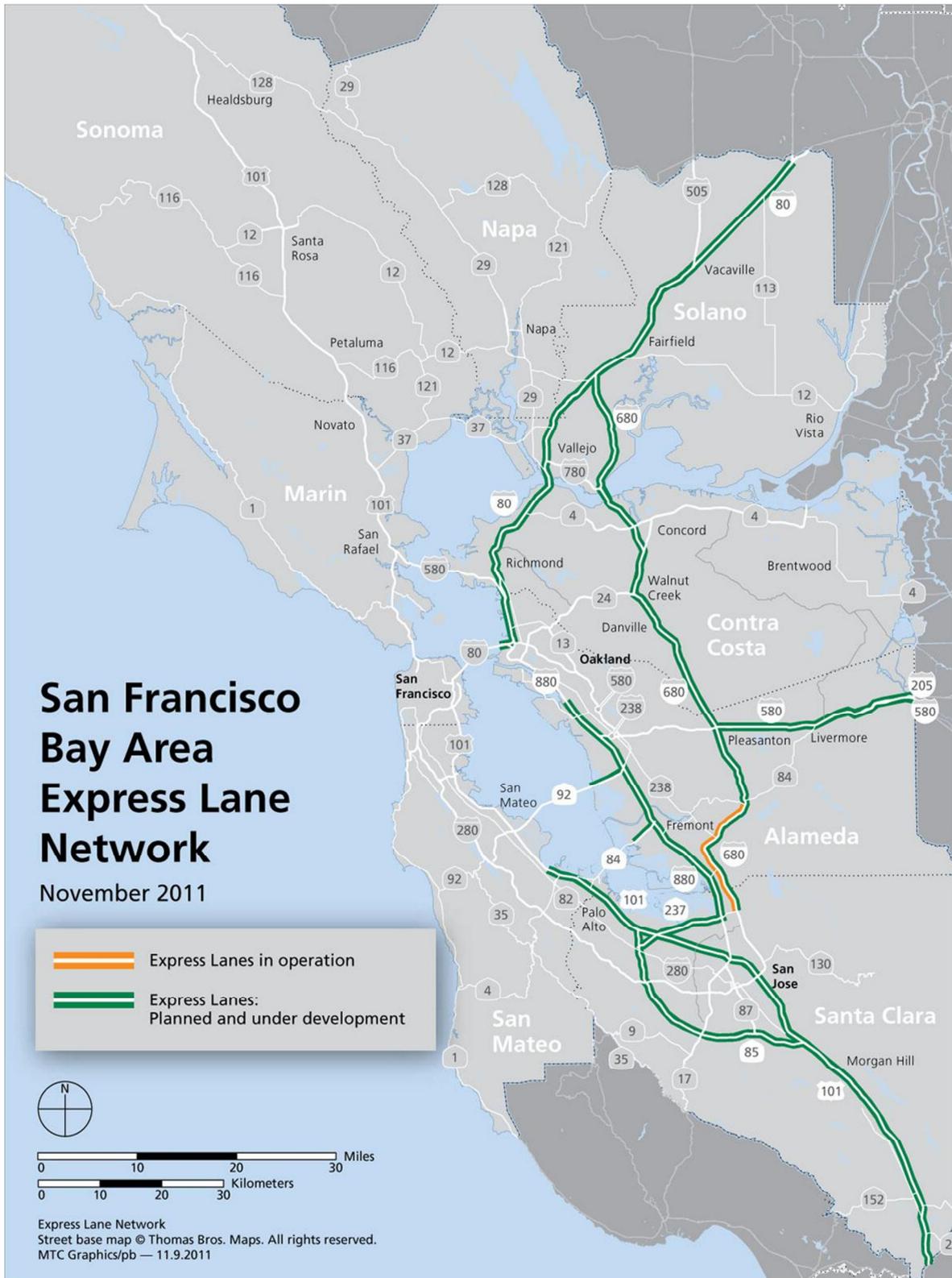
The project is one of the most expensive transportation projects of our generation. With a total projected cost of \$6.7 billion, the Bay Area’s Express Lane Network is the largest highway investment in Plan Bay Area. This is the region’s Sustainable Communities Strategy (SCS), a comprehensive transportation and land use plan that is supposed to reduce greenhouse gas pollution in accordance with SB 375. The Express Lane Network is the second-largest project in the whole plan.⁷

It needs more scrutiny.

⁶ Santa Clara Valley Transportation Authority (VTA) Webpages: *Silicon Valley Express Lanes*. Retrieved March 6 2013. <http://www.vta.org/expresslanes/>

⁷ MTC & ABAG Draft Plan Bay Area dated March 2013. "Top 10" *Plan Bay Area Investments, by Project*. p13.

Figure 2. MTC's proposed Express Lane Network⁸



⁸ MTC Webpages: *Express Lane Network*. Retrieved March 4, 2013. http://www.mtc.ca.gov/images/Express_Lane_Network-big

(STILL) TRYING TO BUILD OUR WAY OUT OF CONGESTION

Unfortunately, MTC's Express Lane Network is failing to innovate. The network fails to challenge Caltrans' 1970s thinking that we can't convert an existing general purpose lane to a high-occupancy lane. The vast majority of the money MTC expects to spend on the Express Lane Network is slated for building new highway lanes.

MTC's Express Lane Network, once billed as an innovative way to help manage traffic and raise new revenues for transit,⁹ has now primarily become a highway-building program.

MTC starts off the network right: Phase I of the Bay Area Express Lane network, expected to be complete by 2015 consists almost entirely of converting existing HOV lanes to HOT lanes: 89% of the projected Phase I costs are for lane conversions. But Phase II, expected to be complete by 2020, is the opposite. Of the 5 projects in Phase II, projected for \$1,543 million in construction costs, fully 95% of the costs are devoted to building new lanes. Phases III and IV, planned for completion in 2025 and 2030, consist entirely of new lanes and will cost \$1,282 million.¹⁰

Through this phasing, MTC is planning to use all of the revenues from the entire network just to build new highway lanes in the other parts of the network. MTC's primary objective appears to be maximizing the number of lane-miles in the network.

This focus on building new lanes is a big reason that MTC's network includes no plans to add transportation choices (transit, vanpools, carpools and other alternatives to solo driving) with the implementation of the network. There is no expected funding for transportation choices before 2035 and there are no stipulations to guide revenues towards transit after 2035.¹¹ It appears that the Bay Area is not heeding a warning from the US Government Accountability Office: "meeting revenue targets [with HOT lanes] can be at odds with policies to increase throughput on highways and bridges by encouraging more people to use carpools and express bus service."¹²

MTC's plans stand in contrast to other planned HOT networks around the country. There are currently 14 HOT projects in operation around the United States, two of which are expanding, and 10 more in construction.¹³ Several of these other regions include extensive networks; Los Angeles, San Diego, Dallas-Ft Worth, Atlanta, Minneapolis-St Paul, and Seattle all have HOT networks in development or in their long-range plans. As described in more detail in the section below titled

⁹ "High-Occupancy Toll (HOT) Network Implementation Principles", Attachment B to Resolution 3868, Metropolitan Transportation Commission. http://www.mtc.ca.gov/planning/hov/Res3868_Att_B-HOT_Network_Principles.pdf. These principles list five objectives, one of which is "Toll revenue collected from the HOT network will be used to operate the HOT network; to maintain HOT system equipment and software; to provide transit services and improvements in the corridors; to finance and construct the HOT network; and to provide other corridor improvements."

¹⁰ CTC Memorandum to Chair and Commissioners from Bimla G. Rhinehart, Executive Director dated October 26-27, 2011. CTC Meeting. Attachment A, *Phasing Assumptions in the Financial Analysis*, pp2-4.

http://www.catc.ca.gov/programs/HOTLanes/MTC_HOT_lanes_analysis.pdf

¹¹ MTC Application to the CTC, 2011. p3.

¹² GAO Report, 2012. pp25-26.

¹³ United States Government Accountability Office (GAO) Report: *Traffic Congestion: Road Pricing Can Help Reduce Congestion, but Equity Concerns May Grow*. January 2012. p4. <http://www.gao.gov/assets/590/587833.pdf>

“Choice: Invest in Transportation Choices”, many other regions have added transportation choices with the implementation of their new HOT lanes.

Further, MTC has not yet made any plans to mitigate the impacts on low-income drivers. There is good reason to be concerned about what impact the HOT network will have on all Bay Area drivers, especially low-income and minority commuters.

INCOMPLETE EQUITY ANALYSIS

Low-income families in the Bay Area currently spend 72%¹⁴ of their income on housing and transportation—among the highest combined costs in the entire country. The Bay Area’s leaders recognized this problem and set a target that the region’s SCS cut this number by 10% (target 7).¹⁵ Unfortunately, MTC’s latest analyses predict that the SCS moves the region in the opposite direction, increasing the burden on low-income families to 74%.¹⁶ As a region we simply cannot accept this result. We must reassess major initiatives that may contribute to this problem and make sure we are doing all we can to combat it.

The economic literature on travel behavior says that equity should be analyzed in terms of the distribution of both costs and benefits across different income and ethnic groups. The US Government Accountability Office did an extensive review of equity impacts in HOT and congestion pricing projects around the country. The study concluded that equity concerns are particularly acute in situations like the Bay Area’s, where agencies are using pricing to raise revenue to build new projects.

MTC is in the process of conducting an Environmental Justice Analysis of the Express Lane Network. This analysis focuses on the question of whether low-income and minority populations will face barriers to using express lanes, either because of the toll tag requirement or the cost of tolls. Below are the key questions guiding MTC’s Environmental Justice Analysis:

- Is the toll tag requirement a barrier for low-income and minority persons, who may be more likely to lack access to a credit card or bank account?
- Are low-income populations likely to be able to afford and willing to pay the tolls?¹⁷

These are important questions. But they are far from sufficient. MTC’s analysis of the environmental justice impacts of the Express Lane Network is incomplete.

¹⁴ Joint MTC Planning/ABAG Administrative Committees Presentation dated May 11, 2012: *Plan Bay Area, Preferred Land Use and Transportation Investment Strategy*. Slide 39.

<http://www.abag.ca.gov/jointpolicy/pdfs/Preferred%20LU%20and%20Transp%20Investment%20Strategy.pdf>

¹⁵ One Bay Area Webpage: *Performance Targets for the Sustainable Communities Strategy*. Retrieved April 25, 2013.

<http://onebayarea.org/pdf/PerfTargetsSCS-RTP.pdf>

¹⁶ MTC & ABAG Draft Plan Bay Area, 2013. p117.

¹⁷ MTC Presentation to MTC Policy Advisory Council dated July 11, 2012: *Bay Area Regional Express Lane Network - Environmental Justice Analysis: Setting the Context*. Slide 8.

http://apps.mtc.ca.gov/meeting_packet_documents/agenda_1899/7_DRAFT_Express_Lanes_Network_EJ_Analysis.pdf

A more complete analysis would also ask:

- Do some Bay Area residents benefit more than others from the HOT lane network?
- In particular, do low-income residents or people of color gain fewer benefits than higher income or white residents?

“Individuals with higher incomes receive more direct benefits from the lane than those with lower incomes.”

Evidence from other regions suggests that the answer is likely to be yes. In a 2012 review of actual HOT lanes in operation around the country, the Federal Highway Administration concluded, “Those who have higher incomes will tend to use congestion-priced facilities more often.”¹⁸ This was supported by evidence of actual HOT lane use in San Diego, Orange County, Minneapolis, and Seattle. In Minneapolis, researchers similarly concluded, “Individuals with higher incomes receive more direct benefits from the lane than those with lower incomes.”¹⁹

This is not surprising. The principal beneficiaries of the HOT lanes themselves are solo drivers who are willing to pay a toll to go faster at peak times. Those drivers are more likely to be higher income. In the case of the Bay Area’s network, where there is added road capacity but no proposed added public transportation capacity, secondary beneficiaries may include riders of existing express bus service if those buses travel on new HOT lanes that move faster than existing traffic. But these secondary beneficiaries will receive much less benefit than the solo drivers who get new travel options.

This evidence stands in contrast to statements in MTC’s application to the CTC, which argued that equity concerns “are not supported by the actual performance of those lanes in operation around the country. Travelers using and benefiting from express lane facilities are shown to represent all socio-economic backgrounds.”²⁰ MTC’s project application did not acknowledge the considerable evidence showing that while all drivers use the lanes, they do so at very different frequencies. The frequency pattern is what actually determines the distribution of benefits. The chart in Figure 3²¹ depicts the disproportionate use of Seattle’s SR-167 toll lanes by income: those with annual household incomes under \$50,000 constitute less than 15% of HOT users, and over half of all users have incomes over \$100,000.

¹⁸ U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) Primer. *Income-Based Equity Impacts of Congestion Pricing, A Primer*. December 2008. p19. <http://ops.fhwa.dot.gov/publications/fhwahop08040/fhwahop08040.pdf>.

¹⁹ Patterson, T. M., & Levinson, D. *Lexus Lanes or Corolla Lanes? Spatial Use and Equity Patterns on the I-394 MnPASS lanes*. Unpublished manuscript, Department of Civil Engineering, University of Minnesota, March 2008. <http://nexus.umn.edu/Papers/MnPASSEquity.pdf> (cited in USDOT & FHWA Primer, 2008, p11).

²⁰ MTC Application to the CTC, 2011. p61.

²¹ Washington State Department of Transportation Study: *SR 167 HOT Lanes Pilot Project, Fourth Annual Performance Study May 2008-April 2012*. 2012. p11. http://www.wsdot.wa.gov/NR/rdonlyres/2DA072CA-7D4A-4876-A58B-64DBE152D48D/0/SR167_AnnualPerformanceSummary_080812_web.pdf

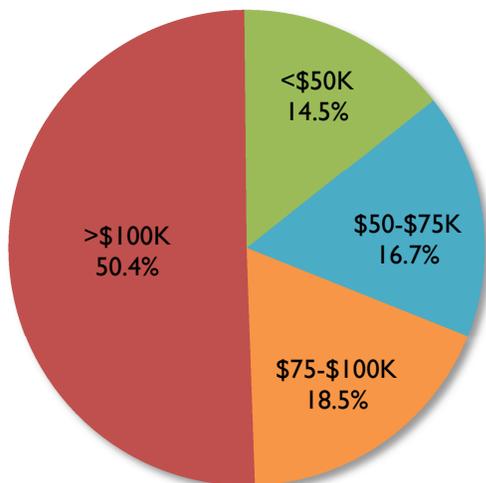


Figure 3. Income Distribution of Seattle's SR-167 HOT Lane Drivers, 2012

With MTC's current HOT network, higher income drivers have more opportunity to experience these new options and receive the travel time benefits of unrestricted travel, while lower-income drivers will be less able to receive the same travel time benefits.

MTC plans to spend all HOT revenues on expanding the network, so the primary beneficiaries will be solo drivers who get new transportation options. Those solo drivers will be more likely to be high-income. There will be equity impacts, and MTC is not making adequate efforts to understand and respond to them.

Another nuance to the disproportionate impacts and benefits of HOT lanes is the reality that an individual's propensity to carpool is also directly linked to income.

Professor Deb Niemeier, with the UC Davis Department of Civil and Environmental Engineering, conducted an independent analysis of MTC's Express Lane Network. Her analysis finds that the current plan will result in more stringent HOV thresholds (requiring 3+ occupants to qualify for carpool) to maintain the flow of vehicles in HOT lanes. "Those who ride in 2+ carpools but cannot pay tolls will eventually experience increased delays...[and only] some carpools (those who are 2+ in the short term and 3+ in the long term) will benefit from travel time reductions when new HOT lanes are built."²² Carpoolers that are unable to conform to more stringent HOV requirements may be pushed out of the fast lane. Compared to more affluent travelers, lower-income commuters are more likely to carpool than drive alone and more likely to be impacted by this change. The current HOT network plans for the Bay Area enable solo driving and do very little to incentivize other transportation choices. It is likely, given the track record of other HOT projects, that most benefits of the HOT network will accrue to those who can afford tolls, who are expected to be higher income drivers.

HOT projects in LA, San Diego, Minneapolis, Miami and Atlanta foresaw equity challenges and designed mitigations into their initial project funding. In LA, "SB 1422 requires Metro to study the impact of the demonstration program on low income commuters and develop ways to provide low income commuters the same opportunity to use toll lanes as any other commuter."²³

²² University of California, Davis (UC Davis) Memorandum from Dr. Deb Niemeier, et al. to TransForm dated September 28, 2011: Re: Bay Area Public Partnership Application for High Occupancy Toll Lanes. p3.

http://apps.mtc.ca.gov/meeting_packet_documents/agenda_1745/8_Staff_Liaison_Report.pdf

²³ Los Angeles Metropolitan Transportation Authority (LA Metro) Factsheet dated July 2012: Metro Express Lanes, Equity Program Factsheet. Retrieved November 13, 2012.

http://www.metro.net/projects_studies/expresslanes/images/ExpressLanes_Factsheet_Toll_Credit_Program.pdf

By contrast, MTC denies the equity challenge and proposes no mitigations, putting the issue off until later: “If it is later determined that there is a negative impact on low-income persons, special provisions, such as discounts for low-income travelers, may be considered at a future time.”²⁴

MTC’s “wait-and-see” approach is unacceptable. MTC must understand the equity impacts of the currently planned HOT lane network before the network is launched.

ENVIRONMENTAL IMPACTS

MTC’s current HOT network plans also harm Bay Area efforts to meet regional goals for reducing pollution from greenhouse gas emissions (GHGs), the region’s first target and a statutory requirement of California’s landmark greenhouse gas reduction bills, AB 32 and SB 375. The state has set a goal that the Bay Area’s plans would lead to a 15% per capita reduction of GHGs by 2035.²⁵

MTC claims that HOT lanes can reduce GHGs by allowing drivers to get out of gridlock.

But this claim is contradicted Professor Niemeier’s study that identified several weaknesses in MTC’s method for evaluating the HOT lane network, stating “we find MTC’s evaluation to be an overly optimistic portrayal of project benefits that ignores climate and equity impacts.”²⁶ The analysis shows that the HOT lane network is likely to have a negative climate impact in the long run unless the project is revised to have a focus on promoting public transportation and other alternatives, rather than lane expansions. In fact, the HOT lanes are likely to increase greenhouse gases by enticing more motorists to drive. “The cyclical effects of building new lane-miles to mitigate congestion are well documented in the academic literature: increased roadway supply brings increased demand, or vehicle miles traveled.”²⁷ Called “induced demand,” this effect has not been adequately recognized in MTC’s analyses of the HOT network plans. MTC has to recognize these induced demand impacts.

²⁴ MTC CTC Application, 2011. p25.

²⁵ MTC & ABAG One Bay Area Performance Targets: *Performance Targets for the Sustainable Communities Strategy / Regional Transport Plan*, Retrieved November 21 2012. <http://onebayarea.org/pdf/PerfTargetsSCS-RTP.pdf>

²⁶ UC Davis Memorandum, 2011. p1.

²⁷ UC Davis Memorandum, 2011. Ibid.

HOW TO IMPROVE THE BAY AREA'S NETWORK

If, as we expect, a complete equity analysis of the Bay Area's planned HOT network shows that it would provide more choice and benefits to higher income residents than lower-income residents, or cause other unequal distribution of benefits, then we must change our plans.

We must design the HOT network so that it helps the Bay Area meet one of our regional goals: a 10% reduction in the share of income spent on transportation and housing by low-income families. Given the magnitude of this investment in the SCS, the HOT network must reduce the share of income spent on transportation by low-income families. At the very least, we must be able to tell that the HOT network will not *increase* the share of income spent on transportation by low-income families. The system as currently defined cannot do that.

We propose that the HOT network must have three policy responses to achieve these goals: equity, choice, and innovation. The following sections describe each of these responses.

EQUITY: MITIGATIONS FOR LOW-INCOME FAMILIES

The Federal Highway Administration has suggested numerous ways to ensure low-income residents receive equal benefit from HOT lanes. These generally fall into two categories: increasing choice and compensation. Increasing choice is addressed in the next section. Ways to provide compensation that the tolling authority may administer could include discounted per-mile tolls, credits towards toll payments, rebates, and toll exemptions. Other means of compensation, that would likely require involvement by the state, could include tax rebates, tax credits, or income supplements.²⁸

Other regions around the country have seen these needs and put mitigations in place. For example, Los Angeles (LA) offers a discount on FasTrak[®] toll tags for low-income drivers. The LA network is the first in California to include an "Equity Program" to offset the unequal benefits that HOT lanes otherwise provide to high-income drivers. The program offers a \$25 credit to low-income drivers for the deposit on toll tags, and even waives monthly account maintenance fees.²⁹ MTC's ongoing Environmental Justice analysis that considers impacts on access to toll tags and financial institutions may also play a useful role in helping to identify good mitigations.

Low-income mitigations that make it cheaper to drive on the network need to be designed carefully. If we make access to solo drivers too cheap for some drivers, it would threaten to undermine the lanes' ability to provide smooth and fast service to transit vehicles and carpools. In designing ways to provide equivalent benefits to low-income residents, the region needs to strike a balance between providing access into HOT lanes for low-income drivers and providing mobility for low-income residents via increased transportation choices.

²⁸ USDOT & FHWA Primer, 2008. p19.

²⁹ LA Metro Factsheet, 2012. p2.

RECOMMENDATIONS FOR EQUITY

- MTC should design and implement mitigations to ensure low-income families receive an equitable share of the benefits and do not bear a disproportionate burden of the HOT network. Mitigations may include access to the network itself, as well as transit investments.
- MTC should expand its Environmental Justice Analysis of the HOT lane network to include a primary research question concerning the distribution of benefits across different income and ethnic groups, based on differences in expected frequency of use of the HOT lanes.
- MTC should further expand its analysis to understand how low-income carpoolers may be affected by the switch from 2+ to 3+ occupancy requirements.

CHOICE: INVEST IN TRANSPORTATION CHOICES

The HOT network needs to move more people so it can reduce greenhouse gas pollution, distribute benefits equitably, and reduce congestion. Decades of experience have shown us that building more and more highway lanes has not worked to build our way out of congestion. We need to increase the average number of people travelling in each vehicle. Transportation planners call this “average vehicle occupancy.” And we’ll only do that if we invest in expanding transportation choices: transit, vanpools, carpools, and other alternatives to solo driving.

This is not only good planning, it is good politics. For example, Seattle found that public support “grew substantially if a portion of the toll revenue was dedicated to transit.”³⁰ In the Bay Area, public acceptance of the HOT network will be more likely if drivers know that the tolls they pay on the HOT lanes will provide transportation choices that will either give them an option in the future, or that will provide other commuters with options that reduce the number of cars on the road.

Expanding transportation choices is also the best way to address the significant potential inequitable impacts of pricing described above. The Federal Highway Administration’s (FHWA) report on equity in HOT lanes states that “Low-income transit riders can benefit significantly from toll-financed transit improvements, which are generally included in any pricing package.”³¹

But the Bay Area’s HOT network has no plans to invest toll revenues into public transportation improvements.

“Low-income transit riders can benefit significantly from toll-financed transit improvements, which are generally included in any pricing package.” -- FHWA
But the HOT network has no plans to invest toll revenues to expand public transportation.

³⁰ GAO report, p.27.

³¹ USDOT & FHWA Primer, 2008. p19.

Many other regions have recognized the potentially inequitable impacts of HOT lanes and have designed mitigations to ensure low-income residents share in the benefits. When transportation planners in other parts of the country design their HOT networks, they plan for simultaneous improvements in transportation choices. These other areas support public transit, vanpooling, and in some cases access to the HOT lanes themselves, to allow low-income and people of color residents access to the fast lane. MTC's plans do not.

The following table shows what other regions have done to expand transportation choices, compared to what the Bay Area is planning.

Table I. Transit Improvements Associated with HOT Projects

LOCATION	IMPROVEMENTS
ATLANTA	Providing 36 new 57-passenger coaches, several new express coach routes, and two new Park and Ride lots that will create 1,900 additional Park and Ride spaces. ³²
LOS ANGELES	Adding 59 more clean fuel buses to routes along HOT corridors and has also expanded and updated transit facilities, all using initial project funding. ³³
MIAMI	Purchased 23 new articulated buses, added peak hour transit service on HOT corridor, and introduced three new transit routes. The HOT network will be used as the backbone for a bus rapid transit system subsidized through HOT revenues. ³⁴
MINNESOTA	Purchased 27 new buses are currently in operation on the new and expanded bus service on HOT lanes. ³⁵
SAN DIEGO	About 25% of I-15 project revenue goes directly to subsidize transit service on the HOT corridor. Revenues to transit total \$1M/year, \$12M since project inception. ³⁶
BAY AREA	No plans for transit expansion funded by or linked to HOT network.

³² Georgia Department of Transportation Webpages: *I-85 Express Lanes*. Retrieved November 15, 2012.

<http://www.dot.ga.gov/travelingingeorgia/expresslanes/185expresslanes/Pages/default.aspx>

³³ LA Metro Webpages: *Metro ExpressLanes*. Retrieved March 12, 2013. <http://www.metro.net/projects/expresslanes/>

³⁴ USDOT Urban Partnership Agreement/Congestion Reduction Demonstration (UPA/CRD) Annual Report: Miami, FL I-95 Express Lanes. pp1-2. <http://www.upa.dot.gov/docs/fhwajpo11044/armiami1.pdf>

³⁵ USDOT UPA/CRD Annual Report: *Minnesota: Innovative Choices for Congestion Relief*. 2010. p2.

<http://www.upa.dot.gov/docs/fhwajpo11039/arminn1.pdf>

³⁶ Personal Communication with Helen Gao of San Diego Association of Governments (SANDAG) dated November 13, 2012.

San Diego’s system is an example of how other regions understand that transportation officials should increase transportation choices when introducing HOT lanes as an option for solo drivers. The Federal Highway Administration writes that “I-15 was the first project to demonstrate that implementing tolls as a demand management measure can play a major role in paying for transit and reducing the negative impact of this strategy on low-income individuals.”³⁷ Currently San Diego commuters can purchase a regional monthly transit pass for \$100/month for unlimited access to six express bus routes on I-15.³⁸ San Diego is now planning a massive expansion of transit and vanpooling, whose funding is tied to plans for an expanded HOT lane network.³⁹ The network plans to integrate Bus Rapid Transit through direct access at four transit stations along I-15.⁴⁰

Table 2. San Diego HOT Network Highlights

PRESENT	<ul style="list-style-type: none"> Revenues from San Diego’s HOT network provide \$1M per year in transit subsidies (about 25% of the I-15 Express Lane budget). To date these subsidies have totaled \$12M.⁴¹
	<ul style="list-style-type: none"> San Diego has 749 vanpools that carry 5,900 daily passengers, reducing vehicle-miles traveled by 575,000 each day.⁴²
	<ul style="list-style-type: none"> Very sharp growth in vanpool usage since introducing a subsidy of \$400 per van per month.
FUTURE	<ul style="list-style-type: none"> Add 130 miles of Managed Lanes (current HOT network is 28 miles).⁴³
	<ul style="list-style-type: none"> Add 13 new BRT lines that take advantage of Managed Lanes, by 2020.⁴⁴
	<ul style="list-style-type: none"> Increase the number of vanpools from 749 to 1,124 by 2020.⁴⁵
	<ul style="list-style-type: none"> Increase carpools by 5,300 new carpools per year.⁴⁶

³⁷ USDOT & FHWA Primer, 2008. p.11

³⁸ San Diego Metropolitan Transit System Webpages: *Dump the Pump!* Retrieved May 1, 2013. <http://www.sdmts.com/marketing/dumpthepump.asp>

³⁹ SANDAG 2050 Regional Transportation Plan (RTP) dated October 2011. *Chapter 8: Demand Management: Innovative Incentives for Taking the Path Less Traveled.* <http://www.sandag.org/uploads/2050RTP/F2050rtp8.pdf>

⁴⁰ 511 San Diego Webpages: *I-15 MTS Express Bus.* Retrieved May 1, 2013. <http://fastrak.511sd.com/i-15-mts-express-bus>

⁴¹ Personal Communication with Helen Gao of SANDAG dated November 11, 2012.

⁴² SANDAG 2050 RTP, 2011. *Chapter 8: Demand Management: Innovative Incentives for Taking the Path Less Traveled.* p8-6 <http://www.sandag.org/uploads/2050RTP/F2050rtp8.pdf>

⁴³ SANDAG 2050 RTP, 2011. *Chapter 6: Systems Development: Offering More Travel Choices.* p6-38, network image on p6-29. <http://www.sandag.org/uploads/2050RTP/F2050rtp6.pdf>

⁴⁴ SANDAG 2050 RTP, 2011. *Chapter 6: Systems Development: Offering More Travel Choices.* <http://www.sandag.org/uploads/2050RTP/F2050rtp6.pdf>

⁴⁵ Personal Communication with Antoinette Meier of SANDAG dated November 9th 2012.

⁴⁶ SANDAG 2050 RTP. 2011. *Chapter 8.* p8-7.

MTC is making important policy choices about how much of the system's revenues to use to *build* the network versus how much to use to help people *use* the network. Currently, these policy choices are out of balance: all of the system revenues are dedicated to building the network, with no funds committed to public transportation or other alternatives and not even a plan for those parallel transit expansions.

The Bay Area must change its HOT network from a highway-building program to one that supports transportation choices with HOT and other new revenues. These must be new revenues over and above those being used for existing services, and these new investments must support new service, on top of existing service.

RECOMMENDATIONS FOR CHOICE

- MTC should dedicate at least 50% of HOT revenues to provide new transportation choices – transit, vanpools, carpools, and other alternatives to solo driving – along HOT corridors and to mitigate the network's impacts on low-income families.
- MTC should create a transportation choices expansion plan as part of the express lane network. This plan should include a commitment that with the opening of every new HOT lane, there will be a simultaneous improvement in transportation choices along the same corridor, over and above existing service.

INNOVATION: OPTIMIZE EXISTING LANES, DON'T BUILD NEW ONES

The Bay Area is the home of innovation: high tech and biotech industries, world-class universities, and movements for social change that have reverberated across the United States and throughout the world. This makes it all the more disturbing that the Bay Area is not innovating when it comes to building this Express Lane Network. In addition to the flaws above, the proposed network accepts outdated policies that inflate network costs and limit the positive impacts it could have.

The description in the section above titled "What's Wrong with MTC's HOT Network" shows that MTC's proposed HOT lane network is prioritizing maximizing the number of highway miles in the system. Instead, MTC should change the HOT network to maximize the number of people who can travel. We need to move more people, not just more vehicles.

The network's shortcomings are most clear in its failure to provide solutions in some of most congested corridors in the region, such as US-101 in San Mateo County and I-880 in Oakland. This lack is due in large part to an unwillingness to consider innovative solutions.

Currently, most Bay Area studies of highway lanes only study a few options. Agencies will study adding a new HOV lane with new construction and, as with MTC’s network, adding an HOT lane with new construction. MTC and Santa Clara Valley Transportation Authority (VTA) networks both consider converting existing HOV lanes to HOT lanes. Very occasionally an agency will study converting an

“We’re stuck with 1970s thinking in a world that has changed so much in so many other ways.”

existing mixed flow lane into an HOV lane. But no agency, to our knowledge, has considered converting an existing mixed flow lane into an HOT lane *and* using the revenue to dramatically increase transit, vanpool, and other transportation demand management (TDM) measures along the same corridor. This is a failure of imagination and a failure of planning.

HOT lanes should attempt to make more cost-effective and efficient use of existing highways through by congestion pricing. But Caltrans’ orthodoxy holds that it is

not acceptable to convert an existing mixed flow lane to a high-occupancy lane. This is based on one bad experience in Southern California in the 1970s.⁴⁷ This practice, reinforced by state legislation,^{48, 49} severely limits the Bay Area’s ability to implement a more innovative and efficient HOT network that focuses on moving more people in the fast lane. The result is that the Bay Area and other places keep trying to build our way out of congestion. We’re stuck with 1970s thinking in a world that has changed so much in so many other ways. Caltrans and MTC must start considering converting existing lanes and using the revenue to dramatically improve public transportation, vanpools, and TDM.

There is some planning rationale for prohibiting conversions from mixed flow lanes to HOV. In places where there are too few HOV vehicles to fill the converted HOV lane, a conversion could result in a dramatic increase in congestion in the mixed flow lanes next to a significantly under-used HOV lane. This could cause the same kind of backlash Caltrans experienced in 1976 in Santa Monica.

But a properly-managed HOT lane should not have the same problem. If managed properly, a HOT lane (converted from a mixed flow lane) should be able to use dynamic pricing to ensure free flow of 45mph-plus. Free flow at 45 mph-plus should carry as many, if not more, vehicles as the previous

⁴⁷ Markham, Kelly. *District 7 Reaches HOV Milestone: 500 Lane Miles and Counting!* Inside 7 from Caltrans, July 2010. www.dot.ca.gov/dist07/Publications/Inside7/story.php?id=518 California’s first HOV lane opened in 1976 (the El Monte Busway, originally a bus-only facility, began allowing 3+ vehicle pools). Also in 1976, a mixed flow lane on the Santa Monica Freeway (I-10) was converted to a 3+ carpool lane. This resulted in extremely congested mixed flow lanes and an empty HOV lane. Public outcry over the conversion led to its reversal. Since then Caltrans policy has been to never establish an HOV lane by conversion. Since then, there has never been a California study to observe and evaluate the feasibility of mixed flow conversion to high occupancy.

⁴⁸ AB 798 was approved into California Government Code §64112b. It specifies that every “highway project for which tolls are imposed shall have nontolled alternative lanes available for public use in the same corridor as the proposed toll project. Nothing in this division shall allow the conversion of any existing nontolled or non-user-fee lanes into tolled or user-fee lanes, except for the conversion of high-occupancy vehicle lanes into high-occupancy toll lanes.”

⁴⁹ Gress, Jennifer. *Bill Analysis: AB 798 (Nava)*. June 24, 2009. Retrieved May 2, 2013. http://leginfo.public.ca.gov/pub/09-10/bill/asm/ab_0751-0800/ab_798_cfa_20090706_112725_sen_comm.html. This requirement for HOT facilities is based overwhelmingly on the criticism that toll roads act as a “double tax” on users, elaborating that drivers already pay fuel taxes to support transportation and that HOT users would be burdened by an additional fee, the burden tolls place on low-income households.

mixed flow lane. With higher average vehicle occupancy, the converted HOT lane will definitely carry more people. By saving millions per mile in reduced construction costs, the lane will have net revenues. Those net revenues can be used to provide more people with more transportation choices. The result is a win-win-win: more service and choices for current and potential transit riders, a quicker ride for carpoolers, and a new option (at a price) for solo drivers.

“This optimize-a-lane approach has the potential to move more people at lower cost, with less pollution, and a more equitable distribution of benefits and costs, than the alternatives.”

Anywhere there are at least four mixed flow lanes each direction in the existing highway, MTC, the relevant CMA, and Caltrans should consider more than just the “new HOT with no transit” option currently planned for MTC’s network. The agencies should also consider an “optimize-a-lane” approach: convert one lane into an HOT lane and use some of the revenue to support aggressive new public transportation, vanpool, carpool, and other alternatives to solo driving along the corridor. This optimize-a-lane approach has the potential to move more people at lower cost, with less pollution, and a more equitable distribution of benefits and costs, than the alternatives.

The other alternatives are not enough. Adding a fifth lane in each direction as HOV usually has high costs, increases pollution, and does not carry enough people. This is particularly true where freeways are physically constrained, such as along US-101 in San Mateo County and I-880 in Oakland. In these cases, adding a fifth lane in each direction generally would entail unacceptable takings of private property through eminent domain or the huge costs of putting new lanes overhead.

We have one agency in the region that is starting to innovate. The City/County Association of Governments of San Mateo County (C/CAG) is about to embark on a study to consider what they are calling a ‘Hybrid HOV’ lane along US-101.⁵⁰ It is a ‘hybrid’ because it combines conversion of existing auxiliary lanes⁵¹ and new construction at interchanges. The combination is planned to provide a fifth lane and allow an HOV lane plus four continuous mixed flow lanes. C/CAG is considering this because it found that the cost of an entirely new lane to be too prohibitive: over \$20 million per mile for new construction compared to \$11-17 million/mile for the ‘hybrid’ option. Of course, the conversion option is even cheaper, less than \$1 million/mile.⁵²

C/CAG’s ‘hybrid’ approach is a step forward, but the relevant agencies should take the next step and consider the optimize-a-lane approach along the same corridor. Doing so without construction at the interchanges could be done much sooner and more cheaply than the approach C/CAG is about to study. By using HOT revenues to make simultaneous investments in transportation choices along the

⁵⁰City/County Association of Governments of San Mateo County (C/CAG) Meeting Minutes dated October 11, 2012: *Meeting No. 250*. p3.

⁵¹ Auxiliary lanes are lanes that run between exits but are not fully continuous.

⁵² *San Mateo – 101 HOV Lane Feasibility Study*. Dowling/Kittleson & Associates, Inc., June 2012, unpublished.

same corridor, we could move more people along the corridor. This is especially true for the US-101 corridor, which has so much private transit in employee shuttle buses.⁵³

TransForm has engaged a former C/CAG planner to conduct a scenario analysis for this corridor and plans to work with C/CAG and other relevant agencies to encourage consideration of the optimize-a-lane approach. MTC and the CMAs should be considering the same approach along several other corridors.

Areas such as I-880 in Oakland, other stretches of US-101, and CA-24 are ripe for considering a package in which one existing lane is converted to an HOT lane and a majority of the resulting revenue is used to support aggressive new transportation choices. The optimize-a-lane may not work in every situation, but it must be considered at least in every situation where there are four or more mixed flow lanes in each direction, without an existing HOV lane.

We recognize that there will be political and legislative obstacles to the optimize-a-lane approach. It is not something that MTC, an individual CMA, or Caltrans can do unilaterally.

There will be drivers who object to having an existing mixed flow lane, built with taxpayer dollars, converted to a tolled facility. But there are also many who object to our highways' current conditions, choked with congestion and lacking sufficient choices to avoid it. Many drivers, carpoolers, and transit riders would benefit from this new approach. We believe the optimize-a-lane approach can move more people at less public cost than MTC's current plans, many of which amount to "new highway lanes with no new transit." There are compelling reasons to believe the optimize-a-lane approach would work. We should at least study it in several locations and try it in a few.

MTC proposes to widen highways to build new HOT lanes. Because of the high capital costs for those highway widenings, the network provides no money for transportation choices. If we don't at least try something new, MTC will be stuck with its current business-as-usual plan of building new lanes only to see them become congested before too long.

⁵³ Tweney, Dylan. *Corporate Busses Taking Over Silicon Valley*, Venturebeat, September 24, 2012. <http://venturebeat.com/2012/09/24/shuttle-buses-taking-over-silicon-valley-awesome-visualization-shows/>

RECOMMENDATIONS FOR INNOVATION

- Along with the relevant CMA and Caltrans, MTC should study the “optimize-a-lane” approach (defined above) before pursuing new-construction projects in MTC’s Phase II (after 2015) or beyond, and for any congested corridor with at least 8 mixed flow lanes and no HOV lanes.
- MTC and a CMA should seek approval from Caltrans, the state legislature, and if necessary federal authorities to try the “optimize-a-lane” approach in at least two Bay Area locations.
- MTC should ensure that all environmental analyses of the HOT network recognize the impacts of induced demand.
- MTC should ensure that the overall impact of the HOT network itself – through combined effects of the road network and transit improvements funded by HOT revenues – reduces GHGs, separate from the analysis of whether the overall SCS reduces GHGs.

CONCLUSION: MOVE MORE PEOPLE

The priority of the Bay Area’s HOT network should be to move more people. The gauge of success should be how many people are served per dollar of investment. The gauge of success should not be how extensive the network is, or how many miles of roadway are built. Incorporating mitigations for equity, choice, and innovation will create a more balanced plan.

MTC’s proposed HOT plans, which would build new highway lanes without new transportation choices, will sink the vast majority of drivers’ tolls into another fruitless attempt to build our way out of congestion. If we don’t change course, we will spend 20 plus years paying off construction bonds with driver tolls that could have been used to provide more people with more choices.

The Bay Area could have a regional highway network in which public transportation and high-occupancy vehicle lanes seamlessly connect residents to the region’s job centers, providing convenient and swift connections throughout the region. If planned as a system, one that sells excess system capacity to non-carpool vehicles, this could help the Bay Area meet our region’s goals—reducing greenhouse gas emissions and achieving other environmental, economic, equity, and health targets—while also providing new transportation choices that maximize the benefit for all residents.

GLOSSARY OF TERMS

C/CAG	City/County Association of Governments of San Mateo County
CMA	congestion management agency
CTC	California Transportation Commission
FHWA	Federal Highway Administration
GAO	Government Accountability Office
GHG	greenhouse gas
HOT	high occupancy toll
HOV	high occupancy vehicle
MTC	Metropolitan Transportation Commission
RTP	Regional Transportation Plan
SANDAG	San Diego Association of Governments
SCS	Sustainable Communities Strategy
TDM	transportation demand management
UPA/CRD	Urban Partnership Agreement/Congestion Reduction Demonstration
USDOT	United States Department of Transportation
VTA	Santa Clara Valley Transportation Authority

TransForm works to create world-class public transportation and walkable communities in the Bay Area and beyond. We build diverse coalitions, influence policy, and develop innovative programs to improve the lives of all people and protect the environment.

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Richard Marcantonio
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Dear Ms. Spelliscy and Mr. Marcantonio:

As requested, we have completed our review of the Draft Environmental Impact Report (DEIR) for *Plan Bay Area*. Attached please find: 1) curricula vitae for the SSR personnel involved in the review, and 2) a memorandum that addresses the technical questions related to the DEIR posed by Public Advocates, Inc.

Please contact me if you have any questions.

Sincerely,



Alex Karner, PhD
Principal
Sustainable Systems Research, LLC

Enclosures:

Curricula Vitae for Deb Niemeier, Alex Karner, and Melody Eldridge
Technical Memorandum: Review of the Draft Environmental Impact Report for *Plan Bay Area* (FINAL)

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Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin*, 2012

East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR*, 2012

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TransForm, *Looking Deeper: A detailed review of the project performance assessment being used to develop OneBayArea*, 2011-2012

Resources Legacy Foundation, *Complete Streets in California: Challenges and Opportunities*, 2011

City of Davis, *GHG Inventory*, 2010

Transportation Project Manager. T.Y. Lin International, Falmouth, Maine, 1991-1994

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SELECTED PUBLICATIONS

Heres Del Valle, D., Niemeier, D. (2011). CO₂ emissions: Are land-use changes enough for California to reduce VMT? Specification of a two-part model with instrumental variables. *Transportation Research, Part B*, 45(1):150-161.

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Save Our Creek, *Danville General Plan Review*, 2012

Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR*, 2012

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East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR*, 2012

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PUBLICATIONS

London, J., Karner, A., Sze, J., Rowan, D., Gambirazzio, G., Niemeier, D. Racing Climate Change: Collaboration and Conflict in California's Global Climate Change Policy Arena. In press. *Global Environmental Change*.

Karner, A., Multimodal Dreamin': California transportation planning, 1967-1977. In press. *Journal of Transport History*.

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- Rowan, D., Karner, A. (2011). Moving toward equity: The ongoing struggle for environmental justice in California. Session co-organizer and moderator. Interdisciplinary Graduate and Professional Symposium, UC Davis, Davis, CA. April 23, 2011.
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- Karner, A., Eisinger, D., Niemeier, D. (2010). Near-road air quality: Findings from real world data. Paper presented at the Air & Waste Management Association Symposium on Air Quality Measurement Methods and Technology. Los Angeles, CA, November 2-4, 2010.

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Save Our Creek, *Danville General Plan Review*, 2012

Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR*, 2012

Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin*, 2012

East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR*, 2012

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PUBLICATIONS

Rowan, D., Eldridge, M., Niemeier, D., (Submitted to *Energy Policy*, March 2012). Incorporating regional growth into forecasts of greenhouse gas emissions from project-level residential and commercial development.

Technical Memorandum:
Review of the Draft Environmental Impact
Report for *Plan Bay Area*

MAY 15, 2013

FINAL

**PREPARED FOR:
RESOURCES LEGACY FUND
PUBLIC ADVOCATES, INC.**

**PREPARED BY:
SUSTAINABLE SYSTEMS RESEARCH, LLC**

DISCLAIMER

The views expressed in this review are those of the authors. They do not represent the opinions of the University of California Davis, Resources Legacy Fund, Public Advocates, Inc., or any other organization with which the authors or recipients are affiliated. The analyses contained in this report are based on the documents available to its authors at the time it was prepared.

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1. OVERVIEW

In April, 2013, Sustainable Systems Research, LLC was commissioned by Resources Legacy Fund to provide technical assistance to Public Advocates, Inc. during their review of the Draft Environmental Impact Report conducted for *Plan Bay Area* (DEIR). *Plan Bay Area* is the 2013 regional transportation plan/sustainable communities strategy (RTP/SCS) prepared jointly by the Metropolitan Transportation Commission (MTC), the metropolitan planning organization (MPO) for the nine-county Bay Area, and the Association of Bay Area Governments (ABAG), the regional council of governments (COG). Our assistance focused on assessing the performance analyses, travel demand modeling, and land use modeling conducted to support the DEIR. In this report, we address the questions posed by Public Advocates, Inc. including:

1. To what extent are the travel demand and land use modeling methods employed in the preparation of the DEIR likely to affect the relative performance of the Proposed Plan and Equity, Environment, and Jobs (EEJ) Alternatives?
2. Are the modeling methods employed consistent with the RTP Guidelines promulgated by the California Transportation Commission?
3. Were the full capabilities of the land use model used to consider gentrification and displacement?
4. How much would additional funds dedicated to the maintenance of Local Streets and Roads in the EEJ Alternative contribute to improved pavement conditions in the region relative to the Proposed Plan Alternative?
5. How do transit service improvements differ by mode in the Proposed Plan and EEJ Alternatives?
6. Is BART operating at or near capacity during the peak period in the Proposed Plan or EEJ Alternative?
7. To what extent do reported performance measures differ in absolute terms between the Proposed Plan and EEJ Alternatives, and what is the significance of those differences?

To address this list, we examined the quantitative results presented in the DEIR and related documents, as well as travel demand modeling data provided by MTC.

2. AGENCY MATERIALS REVIEWED

The following documents related to the DEIR have been consulted to support our analysis, and are referenced using the abbreviations indicated. References not related to the project are cited in footnotes.

- **Plan:** Draft Plan Bay Area. Prepared by MTC and ABAG. March 2013.
- **DEIR:** Draft Plan Bay Area Environmental Impact Report. State Clearinghouse No. 2012062029. April 2013.

- **Summary of Predicted Land Use Responses:** Draft Plan Bay Area Draft Summary of Predicted Land Use Responses. Prepared by MTC and ABAG. April 2013.
- **Summary of Predicted Traveler Responses:** Draft Plan Bay Area Draft Summary of Predicted Traveler Responses. Prepared by MTC and ABAG. March 2013.
- **Performance Assessment Report:** Draft Plan Bay Area Draft Performance Assessment Report. Prepared by MTC and ABAG. March 2013.
- **Equity Analysis Report:** Draft Plan Bay Area Draft Equity Analysis Report. Prepared by MTC and ABAG. March 2013.
- **Appendices to Equity Analysis:** Draft Plan Bay Area Appendices to Draft Equity Analysis Report. Prepared by MTC and ABAG. March 2013.
- **Local Streets and Roads Appendix:** Draft Plan Bay Area Local Street and Road Needs and Revenue Assessment. Prepared by MTC and ABAG. March 2013.
- **Summary of Funding Shifts Table:** Funding Adjustments for EEJ Alternative Compared to Preferred Transportation Investment Strategy. Document received via email from Richard Marcantonio, May 13, 2013. The origin of the document is with MTC staff. Because it is not readily available it is included in Appendix A.
- **Transit Frequency Increases Table:** Bus/Light Rail Routes Slated for Frequency Improvements in Plan Bay Area EIR Alternative #5 (DRAFT). Document received via email from Richard Marcantonio, May 13, 2013. The origin of the document is with MTC staff and it is dated 8/27/2012. Because it is not readily available it is included in Appendix A.
- **MTC Model Inputs & Outputs:** MTC provided travel demand model inputs and outputs for the base year (2010) and forecast year scenarios for 2020 and 2040. These were obtained from MTC and are referenced in text as appropriate.

3. REVIEW OF MODELING METHODS

The predicted location of future housing units in the Bay Area directly affects the performance of alternative transportation and land use scenarios on greenhouse gas emissions, vehicle-miles traveled, and housing and transportation affordability, among other indicators. There are key differences in how the forecasted housing distributions were generated for the Proposed Plan and Equity, Environment, and Jobs (EEJ) Alternatives. These differences are likely to have affected their relative performance. Specifically, if the projected housing distribution had been spatially allocated using the same methods for both scenarios, EEJ would show improved performance relative to the Proposed Plan above what is currently demonstrated in the Draft Environmental Impact Report (DEIR) prepared for *Plan Bay Area*.

After a review of the technical documentation and a request for clarification from modeling staff at MTC and ABAG, the exact steps used to create the housing distribution in the Proposed Plan Alternative remain unclear. However, it is clear that the method used to distribute housing in the EEJ alternative and two other alternatives (the No Project and the Transit Priority Alternatives) was not the same method used in the Proposed Plan Alternative.

The UrbanSim model was used to allocate housing to varying degrees for all alternatives. UrbanSim is an agent-based land use model that predicts the locations of businesses and households based on a spatial representation of the housing and commercial development markets and the decisions of individual actors – families, businesses, and real estate developers [1]. UrbanSim takes current and allowable land uses and demographics at the parcel level as input. The model also requires the user to input estimates of future jobs and population (known as “control totals”) that are subsequently allocated spatially to parcels. Measures of transportation accessibility, which are outputted from a travel demand model, are also used as an input to UrbanSim. Including accessibility ensures that modeled agents are sensitive to the travel time changes engendered by transportation investments. UrbanSim outputs annual estimates of housing and business locations and the demographics of household residents.

UrbanSim is sensitive to both market dynamics and policy instruments. Policy instruments can include urban growth boundaries and developer subsidies¹ that incentivize the construction of housing types that would otherwise not appear profitable. Specifically, “UrbanSim simulates land use outcomes (i.e. buildings and their occupants) on individual parcels of land. As such, the native units describing the land use outcomes for the No Project, Transit Priority, and EEJ Alternatives are parcels. There are about 2 million parcels in the nine county Bay Area” (Summary of Predicted Land Use Responses, Appendix A, p. 10).

For the EEJ alternative and the two other alternatives, housing was distributed using UrbanSim to “simulate the impact of land use and transportation projects/policies on land use outcomes. It is the sole method used to determine the land use distribution for these three alternatives” (Summary of Predicted Land Use Responses, Appendix A, p. 8). In other words, “land use outcomes” – the number, type, location, and residents of housing and commercial developments at the parcel level – in the EEJ Alternative were generated using only the UrbanSim economic forecasting model. UrbanSim’s underlying methods allocate new housing developments only where it determines that such developments on specific parcels would be profitable to a simulated developer. In order to encourage housing in designated infill zones, subsidies can be entered into the developer’s financial (rate of return) equation for each parcel, and various types of housing tested, until profitable projects are found. Subsidies were a key policy tool used to encourage the development of affordable housing near jobs in UrbanSim’s modeling of the EEJ Alternative. Employing subsidies for infill in UrbanSim brings more of this type of housing into the “profitable” realm for simulated developers.

On the other hand, for the Proposed Plan Alternative, the use of UrbanSim was restricted to only filling “in land use details not available through the methodology developed for the

¹ Note that subsidies need not be conceptualized as direct outlays from the public to developers. They could represent policies that are not currently well-modeled by UrbanSim. Stated differently, the land use outcomes realized with a total amount of subsidy could be realized by alternative policy instruments not currently represented in the model including deed-restricted housing and inclusionary zoning.

Jobs/Housing Connection, including detailed land uses, densities, and intensities outside of PDAs” (Summary of Predicted Land Use Responses, Appendix A, p. 8). More specifically,

for the proposed Plan, the *Jobs/Housing Connection* provides land use outcomes, including jobs and population, for PDAs, where applicable, as well as travel analysis zones (TAZs, which are geographies used by the travel model and identical to Census tracts for most of the Bay Area). (emphasis added, Summary of Predicted Land Use Responses, Appendix A, p. 10).

In other words, in the Proposed Plan Alternative, the number of housing units was fixed in each PDA according to the housing distribution set forth in the *Jobs/Housing Connection*.² The *Jobs/Housing Connection* specified not only the number of housing units and households in each city in the region in 2040, but also the percentage of housing units located in PDAs in that year. Since TAZs and PDAs are much larger than parcels, an allocation method must be employed to distribute land use outcomes by parcel. The approach used by staff adjusted

UrbanSim ... via calibration techniques to simulate a future in which the outcomes, when measured across collections of PDAs or TAZs, adequately re-create the results of the Proposed Plan ... This process generated parcel-level results for the Proposed Plan ... which can then be used for detailed analyses. (Summary of Predicted Land Use Responses, Appendix A, p. 10).

The technical documentation does not explain the “calibration techniques” employed to obtain this result. However, it does give some hints, explaining that, in the Proposed Plan Alternative

For parcels within PDAs, the UrbanSim results are scaled up or down to match the PDA results from the *Jobs/Housing Connection* methods ... For parcels outside of PDAs, the UrbanSim results are scaled up or down to match the TAZ results from the *Jobs/Housing Connection* methods. (Summary of Predicted Land Use Responses, Appendix A, p. 13).

To be clear, staff are indicating that the approach used for the Proposed Alternative

explicitly assumes that the PDA- and TAZ-scale data from the *Jobs/Housing Connection* methods more accurately reflect the Proposed Plan Alternative than the UrbanSim results. Said another way: UrbanSim only informs the distribution of land use outcomes within TAZs or within PDAs. The *Jobs/Housing Connection* methods inform the distribution of land use outcomes across TAZs and across PDAs and the total amounts of population, jobs and housing within each PDA.” (emphasis added, Summary of Predicted Land Use Responses, Appendix A, p. 13).

² Although the DEIR does not say so explicitly, we assume this refers to the housing allocation data in the Appendix entitled “Jobs-Housing Connection Scenario (Draft, Revised: March 9, 2012),” available at http://www.onebayarea.org/pdf/SCS_PREFERRED_Scenario_Jobs_Housing_Connection_3-9-12.pdf.

It should also be noted that different types and magnitudes of subsidies appear to have been applied during the modeling of the Proposed Plan and EEJ Alternatives.³ Specifically, subsidies were employed only partially within UrbanSim to incentivize the desired number of housing units within PDAs in the Preferred Alternative. Additionally, the number of buildings and occupants were *scaled* (i.e. multiplied by a constant factor) to ensure that the sum of all parcels within PDAs and TAZs matched totals described in the *Jobs/Housing Connection*. Scaling in this manner circumvents the simulation of developer profitability since it simply asserts that more or less housing is constructed on a parcel.

The net result of the above discussion is that the land use outcomes under the Proposed Plan Alternative are forced to match targets defined in the *Jobs/Housing Connection* using unspecified “calibration techniques” which likely include a combination of a fixed amount of subsidy combined with scaling. In contrast, the Transit Priority and EEJ Alternatives are being modeled completely with UrbanSim, with subsidies being applied at the parcel level to incentivize the construction of housing units in specific zones. Rather than allocating housing to specific cities and PDAs, the EEJ Alternative must match only total jobs and housing at a regional level (control totals are listed in Summary of Predicted Land Use Responses, Appendix A, Table 1, p. 6).

The critical philosophical distinction between these two approaches is that the land use assumptions used to evaluate the Proposed Plan Alternative reflect regional land use planning *goals*, while the evaluation of the EEJ Alternative is based on the expected outcomes of policies that strive to achieve regional planning goals (i.e. the outcomes of a free market in which subsidies must be applied). This difference in assumptions means that arguments proffered in the DEIR regarding the relative subsidies required to realize each alternative are not meaningful (see, e.g., Summary of Predicted Land Use Responses, p. 27).⁴ A consistent land use modeling approach would have set zoning at the parcel level, applied land use policies (e.g., urban growth boundaries) to each alternative as appropriate, and executed UrbanSim for each. If subsidies were required to match regional goals, they should have been applied to the evaluation of each alternative, as required, rather than mixing the application of scaling and subsidization for one alternative but not another.

³ In a table summarizing the policy measures employed by each alternative, the DEIR indicates that “Subsidies for PDA/TPP Opportunity Areas” were employed in the EEJ alternative but “Subsidies for PDA Growth” were applied in the Proposed Plan Alternative (DEIR, Table 3.1-1, p. 3.1-9). Modeling for the Proposed Plan Alternative employed “a subsidy similar in magnitude to the Bay Area’s former redevelopment program to support development in PDAs where the market is weak” (Draft Technical Appendix: Predicted Land Use Patterns, p. 27). The difference seems to be that for the Proposed Plan Alternative, the subsidy amount was fixed in advance and supplemented with scaling whereas for the EEJ Alternative, increasing subsidy levels were modeled to approximate the desired regional outcomes.

⁴ An additional inconsistency in land use modeling approach is evident for another DEIR scenario, the Enhanced Alternative (or Network of Communities). It used a development fee to discourage non-infill development that was used to offset some of the subsidies used for infill parcels. As a result, the reported subsidies are not the gross subsidies, but are net subsidies after subtracting development fees. For this reason, the Enhanced Alternative cannot be compared to the other alternatives, in terms of level of subsidies.

The inconsistencies in land use modeling approaches are likely to substantially affect the magnitude and direction of the Proposed Plan Alternative's environmental impacts. Correspondence with ABAG⁵ staff indicates that the total amount of subsidy required to realize the Proposed Plan Alternative is approximately \$819 million. The corresponding amount for the EEJ alternative is \$2.4 billion. The difference in the magnitude of subsidy required to realize each plan may be driven mostly by the approach to modeling land use rather than substantive differences between the alternatives. Specifically, the Proposed Plan Alternative relied on the setting of regional planning goals as key policy tools. Regional planning goals are important policy tools, but real estate markets will continue to operate in the context of these goals. These goals may not be achieved without additional policies. In requiring subsidies to realize regional development goals and employing UrbanSim on all parcels, the EEJ alternative provides a more realistic accounting of development in the forecast year than the Proposed Plan Alternative.

If the lower level of subsidies employed in the Proposed Plan Alternative relative to EEJ were maintained, but UrbanSim was executed on all parcels without calibrating to the *Jobs/Housing Connection* PDA/TAZ totals, the resultant predictions for the Proposed Plan Alternative would likely place less housing near transit; if such development had been profitable in the Proposed Plan Alternative, it would have been undertaken without scaling. Without additional subsidies or other stated policies to support the housing allocation described in the *Jobs/Housing Connection*, land use outcomes for the Proposed Plan Alternative would move closer to the No Project Alternative which assumes no change in current zoning. The No Project Alternative allocates 24% of housing growth to PDAs compared to 77% for the Proposed Plan and 57% for the EEJ Alternatives (DEIR, p. 3.1-15). With relatively less housing near to transit in a free market version of the Proposed Plan Alternative, its performance on the key metrics of greenhouse gas emissions and vehicle-miles traveled would be likely to decrease.

4. CONSISTENCY WITH CALIFORNIA TRANSPORTATION COMMISSION RECOMMENDATIONS

The California Transportation Commission (CTC) promulgates guidance to be used by MPOs as they prepare regional transportation plans (RTPs). This guidance includes best practices for the use of travel demand and land use models in the planning process. In early 2010, the CTC adopted revisions to their guidelines to address changes in planning and modeling practice prompted by the passage of Senate Bill 375 [2]. According to the introductory letter by then-CTC chair James Earp,

the revisions were prepared through the work of an Advisory Committee representing MPOs, RTPAs, federal, state and local governments, organizations knowledgeable in the creation and use of travel

⁵ Email from Mike Reilly, April 29, 2013.

demand models, and organizations concerned with the impacts of transportation investments on communities and the environment. [ref. 2, introductory letter, p. 1]

The CTC guidelines are intended to synthesize relevant federal and state requirements for transportation planning and to promote consistency in transportation planning throughout California, among other goals [2, p. 3]. The DEIR notes that the CTC guidelines regarding validation and sensitivity analysis were followed (DEIR, p. 2.1-21). However, Chapter 3 of the CTC document contains other provisions related to the integration of travel demand and land use models and scenario consistency that appear to not have been followed in the DEIR. Failing to follow the guidance set forth by the CTC puts the DEIR modeling at variance with best practices.

The CTC recommends that California's largest MPOs transition to integrated travel demand-land use models which "allow planners to study the interactions between land use and the transportation system" [2, p. 47]. Specifically, "Land use models should be sensitive to transportation scenarios such that the effects of land use and transportation policies can interact with feedback in an integrated transportation and land use model" [2, p. 50]. Transportation investments are likely to increase accessibilities in parts of the region proximate to them, increasing their attractiveness for development. Prior to the use of integrated models, this relationship was not captured.

As noted above, MTC and ABAG have transitioned to an integrated modeling framework, but the differences in modeling approaches between the Proposed Plan Alternative and the EEJ Alternative noted above mean that the degree to which the models are truly integrated, and therefore the degree of influence land use and transportation outcomes are able to exert on each other differs by scenario. By taking land use outcomes from the *Jobs/Housing Connection* (as described in the previous section), the Proposed Plan Alternative does not fully allow regional transportation investments to affect the relative attractiveness of parcels for development. On the other hand, the EEJ Alternative is illustrative of a fuller integration between the travel demand and land use models. In the latter scenario, decisions regarding development on particular parcels are based solely on the market faced by a developer, including the relative accessibility of an area. By not consistently integrating travel demand and land use models across alternatives, the DEIR violates CTC modeling guidelines.

Another relevant CTC guideline relates to consistency between modeled alternatives. It states that,

The same land use model used in the RTP modeling should be used in the impact assessment for the No Action alternative, the Proposed Plan alternative, and the Environmentally Preferable Alternative. Only in this way will all of the outputs in the RTP and EIR be comparable. [ref. 2, p. 51].

By employing UrbanSim differently between the Proposed Plan Alternative and the EEJ alternative as described in the previous section, MTC and ABAG effectively applied different land use modeling methods to assess the Proposed Plan Alternative and the environmentally

preferable EEJ Alternative.⁶ This modeling decision violates the CTC guidelines and limits the utility of comparing the performance of each alternative.

In the next RTP/SCS update, MTC and ABAG should use the same population and employment projections and the same urban growth boundaries for all scenarios. They should also use UrbanSim to fully model all of the scenarios, using only developer subsidies in the model to get the desired levels of infill in designated zones so that officials and citizens can compare the scenarios on a consistent basis. There should be no manual assignment of households or employees to smaller scale zones, especially for some scenarios and not others.

5. CONSIDERATION OF GENTRIFICATION AND DISPLACEMENT

One major benefit of employing an integrated simulation of land use and travel behavior is that zonal demographics and land uses are not assumed to equal a pre-determined value in the future, as was the case in historic analyses that ran a travel model in isolation. As a result, UrbanSim has been used to predict demographic changes including gentrification and displacement expected in response to transportation investments. In one example, Joshi et al. [3] studied the gentrifying and displacing effects of the Phoenix-area light rail and supportive transit-oriented development (TOD) measures including upzoning and mixed-use development near stations. Their results showed that the low-income, high-accessibility areas near Arizona State University in Tempe gradually gentrified. In the build scenario, these areas had lower housing densities, higher average incomes, and higher proportions of white residents than a no-build scenario. Importantly, their results demonstrate that projections of future racial and ethnic demographics are possible.⁷

Joshi et al. [3] did not link their results dynamically to a travel model, but instead assumed arbitrary light rail mode share increases; they also did not represent policies designed to mitigate gentrification. Linking UrbanSim to a travel model and representing policies designed to mitigate gentrification are vital to truly understanding the link between gentrification, displacement, TOD, equity, and mitigation options.

Instead of conducting an analysis of demographic changes expected in response to *Plan Bay Area*, the Equity Analysis Report employs a static indicator of “potential for displacement” which overlays

concentrations of today’s households spending more than half their incomes on rent (and who are thus considered already overburdened by housing costs considered high relative to their household incomes) with locations of more intensive planned housing growth by 2040 (defined as an 30% or

⁶ The EEJ Alternative was identified as the environmentally superior alternative as defined by CEQA in the DEIR (DEIR, p. 3.1-146).

⁷ Although a race and ethnicity variable could be associated with simulated individuals in both the travel demand and land use models used in *Plan Bay Area*, modeling staff have so far not included one, for reasons discussed elsewhere [see, e.g., ref. 4].

greater increase in housing units relative to today, slightly above the regional average of 27% growth. (Equity Analysis Report, p. 4-18).

The resultant indicators are presented as a percentage of overburdened households located in high growth areas for two subsets of the Bay Area – communities of concern and (for comparison) the remainder of the region. Communities of concern were defined using overlapping geographic thresholds at the TAZ-level including proportion of minority and low-income residents, and proportion of elderly residents, among others (see Equity Analysis Report, pp. 2-4 – 2-7, for additional details). The results of this analysis show that communities of concern contain higher proportions of overburdened renter households in high growth areas than the remainder of the region under all *Plan Bay Area Alternatives* (Equity Analysis Report, Table 4-10, p. 4-19). This result highlights the region-wide need for policies that mitigate displacement; however, it does not provide information regarding the actual responses of individuals and families to changing market conditions and transportation investments.⁸ Future analyses of gentrification and displacement should take full advantage of the UrbanSim model outputs to summarize demographic changes over time. This type of analysis would identify changing demographics across the region in response to transportation investments and land use policies rather than simply identifying the areas that are expected to experience a risk of such changes.

6. EFFECT OF ADDITIONAL LOCAL STREETS AND ROADS FUNDING

The EEJ Alternative would allocate an additional \$3.4 billion for Local Streets and Roads Maintenance relative to the Proposed Plan Alternative (Summary of Funding Shifts Table). An approximation of the total number of additional lane-miles that can be maintained using this funding can be determined using data from the Local Streets and Roads Appendix.

There are 42,500 lane-miles classified as Local Streets and Roads in the Bay Area (Local Streets and Roads Appendix , p. 3). Maintaining these lane-miles in a state of good repair will cost \$45 billion over the *Plan Bay Area* period. To maintain the region’s current pavement condition index (a measure of pavement quality) would require \$32.5 billion over the same time period. Inferring an average per mile maintenance cost for each scenario results in an estimate of the number of additional lane miles that would be improved in the EEJ Alternative relative to the Proposed Plan Alternative:

⁸ The potential for displacement indicator was designed prior to the DEIR process based on discussions with the “Regional Equity Working Group” (Equity Analysis Report, p. 1-9). UrbanSim was only introduced for the DEIR analysis. Updating the equity analysis methods to take full advantage of the possibilities of the land use model would have afforded additional analytical possibilities.

- $\$3.4 \cdot (10^9) / \$45 \cdot (10^9) / 42.5 \cdot (10^3)$ lane-miles = **3,200** additional lane-miles (or 7.5% of total local streets and road lane miles) maintained in a state of good repair in the EEJ Alternative relative to the Proposed Plan Alternative
- $\$3.4 \cdot (10^9) / \$32.5 \cdot (10^9) / 42.5 \cdot (10^3)$ lane-miles = **4,400** additional lane-miles (or 10.4% of total local streets and road lane miles) maintained to the current pavement condition index in the EEJ Alternative relative to the Proposed Plan Alternative

7. TRANSIT SERVICE IMPROVEMENTS

The DEIR reports the capacity of the regional transit system by mode in daily seat-miles (DEIR, Table 3.1-7, p. 3.1-8) for the base year and 2040 for each alternative. Table 1 reproduces i) the capacity in 2010 and 2040 for each major transit mode, ii) the capacity increase within each mode from 2010 to 2040, and iii) the proportion of the total increase in transit capacity that is attributable to each mode. For example, capacity on local bus measured in daily seat-miles increases by 9.72% from 2010 to 2040 under the Proposed Plan Alternative. That capacity increase accounts for 10.8% of the total growth in transit seat-miles expected from 2010 to 2040.

Table 1 provides important insights related to the relative proportions of capacity increases accounted for by modes typically associated with “choice” rides (i.e. transit users who have the option of driving) and “transit dependents” for whom transit is the only option [see, e.g. ref. 5]. Here we consider choice modes to consist of heavy rail, commuter rail, and ferry and dependent modes to consist of local bus and light rail. The Proposed Plan and EEJ Alternatives allocate 75.8% and 64.8% of their total capacity increases to choice modes, respectively.⁹ The Proposed Plan Alternative allocates 19.4% of its capacity increases to transit dependent modes and the EEJ alternative allocates 28.8% of its capacity increases to same.¹⁰ These percentage allocations translate into a 101% increase in seat-miles of service on transit dependent modes for the EEJ Alternative relative to the Proposed Plan Alternative.¹¹ Thus, the EEJ Alternative effectively doubles the increase in service for modes used by transit dependent individuals relative to the Proposed Plan Alternative.

Table 2 shows the expected transit ridership in 2040 for the Proposed Plan and EEJ Alternatives by mode and major operator. Increases in local bus and light rail ridership in the EEJ Alternative translate into increased ridership on those modes relative to the Preferred Plan Alternative in 2040.

⁹ Summing the percent increases for heavy rail, commuter rail, and ferry.

¹⁰ Summing the percent increases for local bus and light rail.

¹¹ $(41,887,000 - 34,477,000 + 12,814,000 - 8,114,000) - (37,828,000 - 34,477,000 + 10,781,000 - 8,114,000) = 6,092,000$ additional seat-miles of service on transit dependent modes in the EEJ Alternative. The Proposed Plan Alternative has 6,018,000 seat-miles of transit dependent service, resulting in an increase of 101% for the EEJ Alternative relative to the Proposed Plan Alternative on this metric.

Table 1. Transit system capacity (daily seat-miles) in the base year (2010), Proposed Plan Alternative (2040), and EEJ Alternative (2040). Source: DEIR, Table 3.1-7, p. 3.1-8.

Mode	2010 Capacity (1,000 seat-miles)	Proposed Plan Alternative			EEJ Alternative		
		2040 Capacity (1,000 seat-miles)	Increase from 2010	Share of overall transit capacity increase	2040 Capacity (1,000 seat-miles)	Increase from 2010	Share of overall transit capacity increase
<i>Transit Dependent Modes</i>							
Local bus	34,477	37,828	9.7%	10.8%	41,887	21.5%	17.6%
Light rail	8,114	10,781	32.9%	8.6%	12,814	57.9%	11.2%
<i>Choice Modes</i>							
Heavy rail	44,134	56,743	28.6%	40.7%	60,499	37.1%	39.0%
Commuter rail	14,463	22,842	57.9%	27.0%	22,842	57.9%	19.9%
Ferry	4,612	7,099	53.9%	8.0%	7,099	53.9%	5.9%
<i>Other</i>							
Express bus	7,560	9,050	19.7%	4.8%	10,232	35.3%	6.4%
Total	113,360	144,343	27.3%	100.0%	155,373	37.1%	100.0%

Table 2. Summary of 2040 transit ridership for the Proposed Plan and EEJ Alternatives by mode and major operator. Source: MTC Travel model data.

Mode	Proposed Plan Alternative (2040)		EEJ Alternative (2040)		Difference (EEJ – PP)		
	Boardings per Day	% Share	Boardings per Day	% Share	Absolute	Percent	
Local	1,668,103	55%	1,779,367	56%	111,264	7%	
Express	206,646	7%	201,043	6%	-5,603	-3%	
Ferry	25,528	1%	21,265	1%	-4,263	-17%	
Light Rail	503,210	17%	554,155	17%	50,945	10%	
Heavy Rail ¹	536,760	18%	553,657	17%	16,897	3%	
Commuter Rail	83,743	3%	82,424	3%	-1,319	-2%	
Total	3,023,990	100%	3,191,911	100%	167,921	6%	
<i>Major operator</i>							
AC Transit	374,222	12%	455,484	14%	81,262	22%	
VTA	617,166	20%	701,659	22%	84,493	14%	
SamTrans	103,227	3%	153,958	5%	50,731	49%	
BART ¹	536,364	18%	553,497	17%	17,133	3%	
MUNI	984,855	33%	921,335	29%	-63,520	-6%	
Total	2,615,834	87%	2,785,933	87%	170,099	7%	

¹Note that heavy rail boardings do not equal BART boardings because the Oakland Airport Connector was included in the travel demand model in 2040 as a separate “operator” but was grouped under the heavy rail mode.

8. BART CAPACITY ANALYSIS

To investigate whether BART is expected to operate at or near capacity in the forecast year, we aggregated the loaded transit network data using MTC's travel model outputs for both the Proposed Plan and EEJ Alternatives. These data included total boardings per day, total boardings by mode (local bus, express bus, ferry, light rail, heavy rail, and commuter rail), and total boardings by major operator (AC Transit, VTA, SamTrans, BART, and MUNI) for each modeled time period.

BART capacity during the AM peak period (6 – 10 AM) was estimated using these data and the following approach. A maximum number of passenger seats at any given point on a line was calculated using information from BART: a maximum of 60 seats per car in current car models¹² and 10 cars per train due to station platform limitations.¹³ The current number of cars owned by BART does not allow for all trains to have 10 cars simultaneously. The passenger seat information was then used to calculate the total seat-mile capacity for the line during the morning peak. Percent utilization was calculated for each line using passenger-mile totals from the MTC model outputs.

As an example, the Bay Point – SFO line has 15 minute headways in the AM peak period and its route is 53 miles in length. Morning seat-mile capacity is thus:

$$(60 \text{ minutes/hour}) / (15 \text{ minutes/train}) \times 4 \text{ hours} \times 60 \text{ seats/car} \times 10 \text{ cars/train} \times 53 \text{ miles} = 510,720 \text{ seat-miles.}$$

The passenger-miles given by the model outputs indicate that demand is 528,005 passenger-miles over the morning period. Utilization for the Bay Point – SFO line is thus:

$$528,005 / 510,720 = 103\%$$

Results are summarized in Table 3.¹⁴ Those lines with utilization rates greater than 80% were considered critical per the DEIR guideline that “an exceedance [in transit capacity] is defined as passenger seat-mile demand for any transit technology being greater than 80 percent of passenger seat-miles supplied by transit operators” (DEIR, Table ES-2). Note that the passenger-miles are spread out over the length of each line; in the cases where demand imbalances exist (i.e. boardings increase with proximity to urban centers) the actual number of passengers on board the train would exceed capacity more readily.

In an attempt to describe capacity during the worst transit crowding conditions, a 15-minute peak estimate was also calculated. This number was calculated using a conservative peak hour

¹² <http://www.bart.gov/about/history/cars.aspx>

¹³ <http://www.bart.gov/news/articles/2008/news20080924a.aspx>

¹⁴ It is important to note that while the total boardings taken from the model outputs (as reported in DEIR Table 3.1-8) match the boardings reported in Table 3, the daily percent utilization rates from the DEIR do not reflect the model's output passenger-mile values (as reported in DEIR Table 3.1-13). This may reflect an unspecified weighting of travel times and peak hours. This weighting factor should not affect the results presented in Table 3 because our calculations do not use the DEIR percent utilization rates.

factor of 0.8¹⁵ and results in a significantly higher utilization rate than for the four hour AM peak period. Overall, we estimate a high risk that four lines will be operating at or near peak capacity for portions of the AM peak period (Richmond – Millbrae, Bay Point – SFO, Dublin/Pleasanton – Civic Center, and Santa Clara – Daly City) in the Proposed Plan Alternative in 2040.

The results of a similar capacity analysis for the EEJ Alternative are summarized in Table 4. Since the EEJ Alternative allocates an additional \$3.2 billion in BART operating funding, peak period headways are reduced on some routes.¹⁶ Accordingly, the risk of meeting or exceeding capacity is reduced relative to the Proposed Plan Alternative. No routes operate at 80% of capacity over the entire AM peak, while three operate above 80% of capacity during the peak 15 minute period.

9. ABSOLUTE PERFORMANCE MEASURES ANALYSIS

In order to better interpret the DEIR performance indicators, we used several data sources to convert their reported percentage changes into absolute values. The sources included the Plan itself, the DEIR, the Equity Analysis Report, the Summaries of Predicted Land Use/ Traveler Responses, and the Performance Assessment Report. In the case of region-wide coarse particulate emissions, a BAAQMD document [7] was used to help establish the baseline emissions; for all other metrics the *Plan Bay Area* documentation was enough to estimate absolute metric values. Two tables summarizing the absolute performance of the EEJ alternative relative to the Proposed Plan Alternative are included in Appendix B.

These tables summarize the performance of the EEJ Alternative relative to the Proposed Plan Alternative, demonstrating the EEJ Alternative’s superiority on a number of important metrics. Specifically, the EEJ Alternative performs best on combined housing and transportation cost, a critical equity indicator. It also shows the largest increase in non-auto mode share. This indicator is very important in a long-term analysis. The benefits of increasing non-auto mode share will compound over time, as land uses will follow ridership, creating a virtuous cycle.

Resolving key differences in model inputs between the EEJ and Proposed Plan Alternatives would also have been likely to further improve EEJ’s performance. The Proposed Plan Alternative allocated 100% of new households into designated infill zones (PDAs and transit

¹⁵ A peak hour factor (PHF) accounts for fluctuations in ridership during the peak period. A PHF of 0.8 assumes that the peak hour ridership will only be 80% of the peak 15-minute ridership multiplied by four (rather than 100%). Our calculations conservatively assumed that all morning hours would have equal ridership, and then calculated the peak 15-minute period from the averaged hour-long period. The PHF of 0.8 was taken from the *Transit Capacity and Quality of Service Manual* [ref. 6, Exhibit 5-8] and represents a conservative value among those presented in that publication.

¹⁶ Contradictory statements taken from the DEIR seem to indicate that BART capacity was not increased. E.g., “[The EEJ] alternative seeks to strengthen public transit by significantly boosting service frequencies in most suburban and urban areas, other than on Muni, BART or Caltrain” (DEIR, p. 3.1-8). Despite this statement, capacity increases on BART appear to have been modeled for the EEJ Alternative. Route-specific increases for local bus were provided by MTC staff (Transit Frequency Increases Table).

priority project zones) while the EEJ Alternative only allocated 93% (Draft Predicted Land Use Responses Report, Table 7, p. 33). The percentage of new households placed into the infill zones is a strong predictor of lower VMT per capita. If the EEJ scenario had been modeled as the Proposed Plan Alternative had (with all housing units assigned to the infill zones), performance results would have improved on most measures. Another difference in the modeling of alternative scenarios was the treatment of California Environmental Quality Act (CEQA) streamlining. In the modeling of the Proposed Plan Alternative, developers received cost savings related to CEQA streamlining if they constructed high density housing in designated infill zones. This was not the case in the EEJ Alternative (DEIR, p. 3.1-7 – 3.1-8). If the EEJ Alternative would have included CEQA streamlining its performance results would have improved on travel-related metrics.

10. TRANSPORTATION PROJECTS AND SEA LEVEL RISE

Transportation projects within the Mid-Century Sea Level Rise Zone and the Mid-Century Low-Lying Zone which were included in the Proposed Plan Alternative but not in the EEJ Alternative were aggregated based on the information in DEIR Tables 3.1-30, 3.1-31. Information in the DEIR, Appendix C was used to assign a cost estimate to each of these projects and create a sum total cost for the projects with future flood risk. These projects are shown in Table 5.

Table 3. Proposed Plan Alternative AM BART/Heavy Rail Ridership, 2040. Dark blue shading indicates AM peak route utilization over 80%, while light blue indicates those routes which do not near capacity over the entire morning period but have a peak 15-minute utilization over 80%.

Line	Sum of Passenger Miles	Headway (Min.)	Line Distance (Miles)	Vehicle Revenue Miles	Calculated Max Occupancy	Line % Utilization ¹	Est. Peak 15-Min % Utilization ²	Sum of Boardings	Avg Boardings /Train
Millbrae – Richmond	201,749	15	38	608	364,800	55%	69%	16,826	1,052
Richmond – Millbrae	313,531	15	38	608	364,800	86%	107%	22,602	1,413
Richmond - Santa Clara	343,148	12	58	1,150	690,000	50%	78%	18,685	934
Santa Clara – Richmond	259,337	12	58	1,150	690,000	38%	59%	17,679	884
SFO - Bay Point	195,949	15	53	851	510,720	38%	48%	15,749	984
Bay Point – SFO	528,005	15	53	851	510,720	103%	129%	27,345	1,709
Pleasant Hill - Civic Center	144,872	15	26	413	247,680	58%	73%	10,783	674
Civic Center - Pleasant Hill	31,959	15	26	413	247,680	13%	16%	2,932	183
Civic Center - Dublin/Pleasanton	53,843	15	32	518	311,040	17%	22%	3,820	239
Dublin/Pleasanton - Civic Center	245,098	15	32	518	311,040	79%	98%	14,373	898
Daly City - Santa Clara	209,476	12	60	1,204	722,400	29%	45%	15,330	767
Santa Clara - Daly City	582,621	12	60	1,204	722,400	81%	126%	28,449	1,422
Oakland Airport Connector (Outbound)	396	4	3	192	115,200	0%	2%	124	2
Oakland Airport Connector (Return)	19	4	3	192	115,200	0%	0%	6	0
Grand Total	3,110,003	N/A	N/A	9,873	5,923,680	53%	75%	194,703	N/A

Maximum number of Seats Available Per Line ³	600
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¹Note that the DEIR defines capacity exceedance as "as passenger seat-mile demand for any transit technology being greater than 80 percent of passenger seat-miles supplied by transit operators" (DEIR, Table ES-2).

²A conservative peak hour factor of 0.8 was used to calculate peak 15-minute ridership. See the discussion in text for additional details.

³With standing room, approximately 200 people can fit per car, for a maximum train ridership of 2,000 at any given time.

Table 4. EEJ Alternative AM BART/Heavy Rail Ridership, 2040. Light blue shading indicates those routes which do not near capacity over the entire morning period but have a peak 15-minute utilization over 80%.

Line	Sum of Passenger Miles	Headway (Min.)	Line Distance (Miles)	Vehicle Revenue Miles	Calculated Max Occupancy	Line % Utilization ¹	Est. Peak 15-Min % Utilization ²	Sum of Boardings	Avg. Boardings /Train
Millbrae – Richmond	253,300	12	38	760	456,000	56%	69%	19,913	996
Richmond - Millbrae	254,072	12	38	760	456,000	56%	70%	18,929	946
Richmond - Santa Clara	414,112	12	58	1,150	690,000	60%	75%	21,906	1,095
Santa Clara – Richmond	215,613	12	58	1,150	690,000	31%	39%	15,382	769
SFO - Bay Point	244,931	12	53	1,064	638,400	38%	48%	18,564	928
Bay Point – SFO	433,879	12	53	1,064	638,400	68%	85%	23,965	1,198
Pleasant Hill - Daly City	129,001	15	32	518	311,040	41%	52%	9,546	597
Daly City - Pleasant Hill	65,607	15	32	518	311,040	21%	26%	6,437	402
24th St - Santa Clara	161,119	12	56	1,112	667,200	24%	30%	11,164	558
Santa Clara - 24th St	513,426	12	56	1,112	667,200	77%	96%	23,981	1,199
Daly City - South Hayward	19,667	30	32	254	152,640	13%	16%	2,153	269
South Hayward - Daly City	68,111	30	32	254	152,640	45%	56%	4,783	598
Daly City - Dublin/Pleasanton	78,507	12	39	780	468,000	17%	21%	7,094	355
Dublin/Pleasanton – Daly City	344,069	12	39	780	468,000	74%	92%	19,080	954
Oakland Airport Connector (Outbound)	178	4	3	192	115,200	0%	0%	56	1
Oakland Airport Connector (Return)	0	4	3	192	115,200	0%	0%	0	0
Grand Total	3,195,592	N/A	N/A	11,662	6,996,960	46%	67%	202,953	N/A

Maximum number of Seats Available Per Line ³	600
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¹Note that the DEIR defines capacity exceedance as "as passenger seat-mile demand for any transit technology being greater than 80 percent of passenger seat-miles supplied by transit operators" (DEIR, Table ES-2).

²A conservative peak hour factor of 0.8 was used to calculate peak 15-minute ridership. See the discussion in text for additional details.

³With standing room, approximately 200 people can fit per car, for a maximum train ridership of 2,000 at any given time.

Table 5. Transportation projects subject to risks from sea level rise in the Proposed Plan Alternative but not in the EEJ Alternative. Source: DEIR, Table 3.1-30 and Appendix C.

Project ID	County	Description	Total Cost (Millions)
230668	Bay Area Region / Multi-County	Convert I-880 HOV lanes to express lanes between Hengenberger Road and Route 237 southbound, and Hacienda Drive to 237 northbound	\$58
230685	Bay Area Region / Multi-County	Express Lanes on I-680: Widen I-680 northbound for express lane from Rudgear to North Main; Convert HOV lanes to express lanes between Benicia Bridge and Alcosta Boulevard in each direction	\$24
230686	Bay Area Region / Multi-County	Widen I-680 in each direction for express lanes between Martinez Bridge to I-80	\$335
240587	Bay Area Region / Multi-County	Widen I-680 northbound for express lanes from Marina Vista Avenue to North Main Street	\$93
240581	Bay Area Region / Multi-County	Widen I-80 in each direction for express lanes from Air Base Parkway to I-505	\$139
240691	Marin	Marin Sonoma Narrows HOV Lane and corridor improvements	\$119
21325	Marin	Improve U.S. 101 Greenbrae/Twin Cities Corridor (includes modifying access ramps, new bus stops, improving transit stops and facilities, and adding pedestrian/bicycle facilities)	\$155
21613	San Mateo	Widen Route 92 between San Mateo-Hayward Bridge to I-280, includes uphill passing lane from U.S. 101 to I-280	\$35
240060	San Mateo	Modify existing lanes on U.S. 101 from Whipple to County line to accommodate HOV/T lane	\$117
240436	Santa Clara	Improve southbound U.S. 101 between San Antonio Road to Carlestone Road/Rengstorff Avenue	\$51
240441	Santa Clara	Improve interchange at U.S. 101/ Oregon Expressway/ Embarcadero Road	\$128
Total for Sea Level Rise Zone (11 Projects)			\$1,254

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FUNDING ADJUSTMENTS FOR EEJ ALTERNATIVE <i>compared to Preferred Transportation Investment Strategy</i>	Equity Advocates' Initial Estimate <i>July 23, 2012</i>	MTC DRAFT Alt. #5 <i>August 30, 2012</i>
NEW REVENUES + COST SAVINGS FROM SPENDING CUTS		
VMT Tax	\$5.3 billion	\$7.9 billion
Increased Bay Bridge Tolls	\$1.0 billion	\$1.1 billion
Canceled Road Projects (uncommitted funds)*	\$7.1 billion	\$5.4 billion
Canceled Express Lane Network*	\$0.9 billion	\$0.6 billion
TOTAL	\$14.3 billion	\$15.0 billion
FUNDING INCREASES		
BART Metro	\$3.0 billion	\$3.2 billion
Bus Frequency Improvements (capital + operating)	\$6.3 billion	\$6.7 billion
AC Transit	\$2.3 billion	\$2.2 billion
VTA	\$2.3 billion	\$2.2 billion
SamTrans	\$1.3 billion	\$1.3 billion
Marin Transit	\$0.1 billion	\$0.2 billion
Golden Gate Transit	\$0.1 billion	\$0.2 billion
LAVTA	\$0.1 billion	\$0.2 billion
County Connection	\$0.1 billion	\$0.2 billion
Santa Rosa CityBus	\$0.1 billion	\$0.1 billion
Sonoma County Transit	--	\$0.1 billion
Regional Youth Bus Pass	\$1.0 billion	\$1.8 billion
LSR Maintenance (via OBAG)	\$4.1 billion	\$3.4 billion
TOTAL	\$14.3 billion	\$15.0 billion

* = in general, uncommitted funds had to be shifted through OBAG to make them flexible for spending on transit operations

Operator	Route	Service Type	Alternative 2 (Project) Peak Frequency	Alternative 5 (EE) Peak Frequency	Alternative 2 (Project) Midday Frequency	Alternative 5 (EE) Midday Frequency	Alternative 2 (Project) Evening Frequency	Alternative 5 (EE) Evening Frequency
AC Transit	72R	Rapid	11	8	11	8	n/a	n/a
AC Transit	40	Urban Trunk	18	10	18	15	18	18
AC Transit	57	Urban Trunk	13	8	13	10	18	12
AC Transit	51A	Urban Trunk	9	5	10	7	18	9
AC Transit	51B	Urban Trunk	9	5	10	7	18	9
AC Transit	11	Local	30	15	30	30	n/a	n/a
AC Transit	12	Local	20	15	30	30	30	30
AC Transit	14	Local	15	12	30	15	30	15
AC Transit	18	Local	13	10	13	10	22	15
AC Transit	20	Local	30	15	30	30	30	30
AC Transit	21	Local	30	15	30	30	30	30
AC Transit	22	Local	30	15	30	15	30	15
AC Transit	25	Local	40	30	40	30	240	240
AC Transit	31	Local	30	15	30	30	30	30
AC Transit	45	Local	20	15	30	15	30	15
AC Transit	46	Local	60	30	60	30	n/a	n/a
AC Transit	49	Local	30	15	30	15	240	240
AC Transit	52	Local	15	10	35	20	30	20
AC Transit	54	Local	12	10	15	12	40	20
AC Transit	62	Local	20	15	20	15	30	20
AC Transit	65	Local	30	20	30	20	90	90
AC Transit	67	Local	40	30	40	30	120	120
AC Transit	73	Local	15	10	15	12	22	15
AC Transit	74	Local	35	20	35	20	35	20
AC Transit	76	Local	30	15	30	20	n/a	n/a
AC Transit	85	Local	60	30	60	30	240	240
AC Transit	86	Local	30	30	30	30	240	60
AC Transit	97	Local	20	15	20	15	20	15
AC Transit	98	Local	20	15	30	15	30	15
AC Transit	99	Local	30	20	30	20	60	20
AC Transit	210	Local	30	20	30	20	30	20
AC Transit	O	Regional All-Day	15	7	60	20	60	20
AC Transit	FS	Regional Commute	60	20	n/a	n/a	n/a	n/a
AC Transit	J	Regional Commute	30	15	n/a	n/a	n/a	n/a
AC Transit	OX	Regional Commute	15	10	n/a	n/a	n/a	n/a
AC Transit	P	Regional Commute	30	15	n/a	n/a	n/a	n/a
AC Transit	SB	Regional Commute	40	15	n/a	n/a	n/a	n/a
AC Transit	U	Regional Commute	45	20	n/a	n/a	n/a	n/a
AC Transit	V	Regional Commute	20	10	n/a	n/a	n/a	n/a
AC Transit	W	Regional Commute	20	10	n/a	n/a	n/a	n/a
VTA	900	Urban Truck	13	8	13	10	13	13
VTA	901	Urban Truck	13	8	13	10	13	13
VTA	902	Urban Truck	13	8	13	10	13	13
VTA	25	Local Network	30	10	30	15	60	30
VTA	26	Local Network	30	15	30	20	60	60
VTA	40	Local Network	30	20	30	20	60	60
VTA	46	Local Network	30	20	60	30	n/a	n/a
VTA	51	Local Network	60	30	60	45	n/a	n/a
VTA	52	Local Network	30	15	30	20	n/a	n/a
VTA	53	Local Network	60	30	60	45	n/a	n/a
VTA	54	Local Network	30	15	30	30	240	240
VTA	55	Local Network	20	10	30	20	60	60
VTA	66	Local Network	15	10	20	10	60	60

Operator	Route	Service Type	Alternative 2 (Project) Peak Frequency	Alternative 5 (EE) Peak Frequency	Alternative 2 (Project) Midday Frequency	Alternative 5 (EE) Midday Frequency	Alternative 2 (Project) Evening Frequency	Alternative 5 (EE) Evening Frequency
VTA	70	Local Network	15	10	15	10	60	30
VTA	71	Local Network	15	10	30	20	60	60
VTA	72	Local Network	15	10	20	15	60	30
VTA	73	Local Network	15	10	20	15	60	60
VTA	201	First/Last Mile	10	7.5	15	10	n/a	n/a
SamTrans	KX	Regional All-Day	60	10	60	15	60	30
SamTrans	292	Urban Truck	27	7	27	10	54	30
SamTrans	110	Local Network	60	15	60	30	60	60
SamTrans	120	Local Network	10	7	20	10	30	20
SamTrans	121	Local Network	30	15	30	20	60	60
SamTrans	122	Local Network	20	10	30	15	30	30
SamTrans	130	Local Network	20	10	30	20	60	60
SamTrans	250	Local Network	30	15	30	20	60	60
SamTrans	260	Local Network	30	15	60	30	n/a	n/a
SamTrans	296	Local Network	30	10	30	10	60	30
Marin Transit	36	First/Last Mile	25	20	240	240	n/a	n/a
Marin Transit	17	Community Bus	30	20	60	60	120	120
Marin Transit	22	Community Bus	30	20	60	30	90	90
Marin Transit	23	Community Bus	60	30	60	60	60	60
Marin Transit	29	Community Bus	60	30	60	60	240	240
Marin Transit	35	Community Bus	20	7.5	30	15	30	30
Marin Transit	71	Community Bus	45	30	60	45	n/a	n/a
LAVTA	70	Regional Commute	45	30	n/a	60	n/a	n/a
LAVTA	10	Local Network	30	10	30	15	120	60
LAVTA	8	Community Bus	30	15	60	60	240	240
LAVTA	12	Community Bus	45	15	45	20	90	60
LAVTA	14	Community Bus	30	20	30	30	120	120
LAVTA	15	Community Bus	30	20	30	30	60	60
County Connection	6	Local Network	40	30	120	60	n/a	n/a
County Connection	1	Community Bus	60	30	60	60	n/a	n/a
County Connection	4	Community Bus	15	10	15	10	n/a	30
County Connection	10	Community Bus	30	15	30	30	60	30
County Connection	11	Community Bus	45	30	90	60	n/a	n/a
County Connection	14	Community Bus	40	15	40	30	40	40
County Connection	15	Community Bus	60	30	60	40	n/a	n/a
County Connection	17	Community Bus	45	30	75	75	n/a	n/a
County Connection	20	Community Bus	30	15	30	15	30	30
Golden Gate	70	Regional All-Day	45	15	60	60	60	60
Santa Rosa CB	1	Local Network	29	15	29	15	n/a	n/a
Santa Rosa CB	9	Local Network	29	15	29	15	228	228
Santa Rosa CB	10	Local Network	29	15	29	15	228	228
Santa Rosa CB	14	Local Network	29	15	29	15	228	228
Sonoma Cty. Tr.	44/48	Urban Trunk	43	30	43	30	114	114
Sonoma Cty. Tr.	20	Urban Trunk	76	45	114	60	n/a	n/a
Sonoma Cty. Tr.	30	Urban Trunk	114	60	114	114	n/a	n/a
Sonoma Cty. Tr.	62	Community Bus	95	45	95	45	n/a	n/a
= indicates frequency improvement in comparison to Alternative 2 (Project/Preferred Transit Network)								
Routes with no frequency changes from the Preferred Transit Network are not shown; all frequencies are shown as minutes between successive arrivals of a bus at a given stop.								
n/a indicates that a route is not in service during a given timeperiod.								

Summary comparison of Plan Bay Area performance metrics for EEJ and Proposed Plan scenarios

Category		Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040 ^a	Units	
Draft Plan pg 116. Table 4: Target Analysis: Plan Bay Area EIR Alternatives for Year 2040	Reduce per-capita CO2 emissions from cars and light-duty trucks	-1,900	*TOTAL Regional CO2 Emissions From Passenger Vehicles: Tons/Day*	
	Reduce premature deaths from exposure to fine particulates (PM 2.5)	-2	Deaths/Year	
	Reduce coarse particulate emissions (PM 10)	-2.1	Tons/Day	
		-624	Tons/Year ^b	
	Reduce the number of injuries and fatalities from all collisions	-760	People/Year	
	Increase the average daily time walking or biking per person for transportation	0.3	Minutes/Person/Day	
		251	*Regional aggregate hours active transportation per day*	
	Decrease the share of low-income and lower-middle income residents' household income consumed by transportation and housing	HOUSING ONLY		
		< \$38K (\$)	-\$70	Dollars/Month
		< \$38K (%)	-\$79,202,000	*Regional Aggregate dollars per month for low income households*
		< \$38K (%)	-4%	% Income
		\$38K to \$76K (\$)	-\$1	Dollars/Month
		\$38K to \$76K (%)	-\$13,838,000	*Regional Aggregate dollars per month for lower-middle income households*
		\$38K to \$76K (%)	0%	% Income
		HOUSING + TRANSPORTATION		
< \$38K (\$)	-\$28	Dollars/Month		
< \$38K (%)	-\$41,747,000	*Regional Aggregate dollars per month for low income households*		
< \$38K (%)	-1%	% Income		
Increase non-auto mode share	1%	Percent of Trips		
	107,970	Daily Non-Auto Person-Trips		
Decrease automobile vehicle miles traveled (VMT) per capita	-3,460,000	*TOTAL Regional Vehicle Miles Travelled*		
Draft Plan page 117. Table 5: Results of Plan Bay Area Equity Analysis for EIR Alternatives, 2010-2040	Potential for Displacement: Share of today's overburdened-renter households located in high-growth areas	Communities of Concern	-12,696	NUMBER of today's overburdened-renter households located in high-growth areas
		Remainder of Region	-3,117	
		Total	-15,812	
Draft EIR	Total Per Capita Energy Use (Direct and Indirect, Land Use and Transportation)		-1,476	BTU/ Person/ Day
			-67,915,818,000	*Regional Aggregate BTU per Day*
	Vehicles In Use		-83,536	Total Vehicles in Region
	TRANSIT			
	Transit Seat Miles		11,030,000	Seat-miles per day
	Daily Transit Boardings		165,000	Boardings/Day
	Transit Commute Trips ^c		65,184	Regional Trips/Day
	Transit Commute Travel Time ^d		-0.4	Minutes/Trip
			-507,003	*Regional Aggregate Minutes per day*
	Transit Non-Commute Trips ^e		-10,304	Regional Trips/Day
	Transit Non-Commute Travel Time		-0.2	Minutes/Trip
			-190,496	*Regional Aggregate Minutes per day*
	WALKING			
	Walking Commute Trips ^c		14,176	Regional Trips/Day
	Walking Commute Travel Time ^d		0.1	Minutes/Trip
			24,502	*Regional Aggregate Minutes per day*
	EMISSIONS			
	Transportation Emissions Estimates for Criteria Pollutants	ROG	-0.7	Tons/Day
			-210	Tons/Year ^b
		CO	-4.3	Tons/Day
			-1,290	Tons/Year ^b
		PM10	-0.7	Tons/Day
			-210	Tons/Year ^b
		PM2.5	-0.1	Tons/Day
			-30	Tons/Year ^b
		NOx (Summertime)	-0.9	Tons/Day
		NOx (Wintertime)	-0.9	Tons/Day
	NOx Avg. Annual	-270	Tons/Year ^b	
	Total	-7	Tons/Day	
		-2,010	Tons/Year	
Transportation Emissions Estimates for Toxic Air Contaminants	Diesel PM	-15.6	Kilograms/Day	
	1,3 Butadiene	-0.8	Kilograms/Day	
	Benzene	-3.1	Kilograms/Day	
	Total	-19.5	Kilograms/Day	
	-6.4	Tons/Year ^b		
Total Regional GHG Emissions		-568,000	Metric Tons CO2e / Year	
FLOODING RISK				
Number of Proposed Transportation Projects Within the Mid-Century Sea Level Rise Inundation Zone		-11	Number of Projects	
		\$ -1.25 Billion	*Estimated Value of (11) Fewer Projects*	
Number of Proposed Transportation Projects Within the Mid-Century Low-Lying Zone		-6	Number of Projects	
		\$ -1.28 Billion	*Estimated Value of (6) Fewer Projects*	
Residents within the Mid-Century Sea Rise Inundation Zone		-12,220	People	
Residents within the Mid-Century Low-Lying Zone		-17,900	People	
Employment within the Mid-Century Sea Rise Inundation Zone		-13,360	Jobs	
Employment within the Mid-Century Low-Lying Zone		-15,660	Jobs	

^aNegative values indicate that a given metric is lower in the EEJ scenario than the Proposed Plan.

^bAll conversion of emissions from "per day" to "per year" assume a multiplier of 300 to maintain consistency with the Draft EIR, as specified in DEIR Table 2.5-5.

^cNumber of commute trips was calculated as twice the number of commute tours by mode (either all transit modes or walk).

^dChanges in regional aggregate minutes per day were calculated using the EEJ scenario's number of trips/day, but scenario-specific values of travel time.

^eNumber of non-commute trips was calculated as the number of trips whose purpose was not work.

Date: 4/29/2013

Detailed comparison of Plan Bay Area performance metrics for EEJ and Proposed Plan scenarios

Category	Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040 ^a	Units	2005 Value	2040										Source		
				No Project (Alt. 1)			Proposed Plan (Alt. 2)			EEJ (Alt. 5)						
				Value	Change From 2005	% Change from 2005	Value	Change From 2005	% Change from 2005	Value	Change From 2005	% Change from 2005	Change from Alt. 2		% Difference from Alt. 2	
Reduce per-capita CO2 emissions from cars and light-duty trucks	-1,900	*TOTAL Regional CO2 Emissions From Passenger Vehicles: Tons/Day*					77,100				75,200			-1,900	-2%	DEIR Table 3.1-28
Reduce premature deaths from exposure to fine particulates (PM 2.5)	-2	Deaths/Year	224	65	-159	-71%	65	-159	-71%	63	-161	-72%	-2	-3%	Draft Plan pg. 99 & Table 4	
Reduce coarse particulate emissions (PM 10)	-2.1	Tons/Day	208	174.72	-33.28	-16%	172.6	-35.4	-17%	170.56	-37.44	-18%	-2.1	-1%	BAAQMD 2005 Emission Inventory Table 3	
	-624	Tons/Year ^b														
Reduce the number of injuries and fatalities from all collisions	-760	People/Year	39,000	46,020	7,020	18%	46,000	7,000	18%	45,240	6,240	16%	-760	-2%	Draft Plan pg. 99 & Table 4	
Increase the average daily time walking or biking per person for transportation	0.3	Minutes/Person/Day	8.8	9.9	1.1	12%	10.3	1.5	17%	10.6	1.8	20%	0.3	3%	Draft Plan pg. 100 & Table 4	
	251	*Regional aggregate hours active transportation per day*					94,326,088				94,341,176			15,088	0%	Population: DEIR Table 3.1-12
Draft Plan pg 116. Table 4: Target Analysis: Plan Bay Area EIR Alternatives for Year 2040 Decrease the share of low-income and lower-middle income residents' household income consumed by transportation and housing	HOUSING		Base Year 2005-2009 / 2010													
	< \$38K (\$)	-\$70	Dollars / Month	\$818	\$871	\$53	6%	\$810	-\$8	-1%	\$740	-\$78	-10%	-\$70	-9%	Appendices to Draft Equity Analysis Report Tables D-1 and D-2. Total number of low-income households for 2040 derived from Draft Summary of Predicted Land Use Responses pg. 16 and Appendix Table 4. Note that money saved due to there being fewer households in Alt. 4 was not included.
	< \$38K (\$)	-\$79,202,000	*Regional Aggregate dollars per month for low income households for EEJ Population*				828,881,100			749,679,200			-79,201,900	-10%		
	< \$38K (%)	-4%	% Income	46%	49%	3%	N/A	46%	0%	N/A	42%	-4%	N/A	-4%	N/A	
	\$38K to \$76K (\$)	-\$1	Dollars / Month	\$1,814	\$1,951	\$137	8%	\$1,807	-\$7	0%	\$1,806	-\$8	0%	-\$1	0%	
	\$38K to \$76K (\$)	-\$13,838,000	*Regional Aggregate dollars per month for low income households for EEJ Population*				1,312,279,540			1,298,441,760			-13,837,780	-1%		
	\$38K to \$76K (%)	0%	% Income	37%	40%	3%	N/A	37%	0%	N/A	37%	0%	N/A	0%	N/A	
	TRANSPORTATION		Base Year 2005-2009 / 2010													
	< \$38K (\$)	\$42	Dollars / Month	\$470	\$555	\$85	18%	\$498	\$28	6%	\$540	\$70	15%	\$42	8%	
	< \$38K (\$)	\$37,455,000	*Regional Aggregate dollars per month for low income households*				509,608,380			547,063,200			37,454,820	7%		
	< \$38K (%)	3%	% Income	26%	31%	5%	N/A	28%	2%	N/A	31%	5%	N/A	3%	N/A	
	\$38K to \$76K (\$)	\$32	Dollars / Month	\$844	\$952	\$108	13%	\$900	\$56	7%	\$932	\$88	10%	\$32	4%	
	\$38K to \$76K (\$)	\$16,473,000	*Regional Aggregate dollars per month for lower-middle income households*				653,598,000			670,070,720			16,472,720	3%		
	\$38K to \$76K (%)	1%	% Income	17%	20%	3%	N/A	18%	1%	N/A	19%	2%	N/A	1%	N/A	
	H+T		Base Year 2005-2009 / 2010													
	< \$38K (\$)	-\$28	Dollars / Month	\$1,288	\$1,426	\$138	11%	\$1,308	\$20	2%	\$1,280	-\$8	-1%	-\$28	-2%	
	< \$38K (\$)	-\$41,747,000	*Regional Aggregate dollars per month for low income households*				1,338,489,480			1,296,742,400			-41,747,080	-3%		
	< \$38K (%)	-1%	% Income	72%	80%	8%	N/A	74%	2%	N/A	73%	1%	N/A	-1%	N/A	
	\$38K to \$76K (\$)	\$31	Dollars / Month	\$2,658	\$2,903	\$245	9%	\$2,707	\$49	2%	\$2,738	\$80	3%	\$31	1%	
	\$38K to \$76K (\$)	\$2,635,000	*Regional Aggregate dollars per month for lower-middle income households*				1,965,877,540			1,968,512,480			2,634,940	0%		
\$38K to \$76K (%)	1%	% Income	54%	60%	6%	N/A	55%	1%	N/A	56%	2%	N/A	1%	N/A		
Increase non-auto mode share	1%	Percent of Trips	16.0%	19%	3%	N/A	20%	4%	N/A	21%	5%	N/A	1%	N/A	DEIR Tables 3.1-8 and 2.1-13	
Increase non-auto mode share	107,970	Daily Non-Auto Person-Trips	N/A	5,392,770	N/A	N/A	5,973,000	N/A	N/A	6,080,970	N/A	N/A	107,970	1.8%		
Decrease automobile vehicle miles traveled (VMT) per capita	-3,460,000	*TOTAL Regional Vehicle Miles Travelled*					179,408,000				175,948,000			-3,460,000	-2%	DEIR TABLE 3.1-12

^aNegative values indicate that a given metric is lower in the EEJ scenario than the Proposed Plan.

^bAll conversion of emissions from "per day" to "per year" assume a multiplier of 300 to maintain consistency with the Draft EIR, as specified in DEIR Table 2.5-5.

Date: 4/29/2013

Detailed comparison of Plan Bay Area performance metrics for EEJ and Proposed Plan scenarios (cont'd)

Category	Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040 ^a	Units	2040								Source		
			No Project (Alt. 1)		Proposed Plan (Alt. 2)		EEJ (Alt. 5)						
			Number HHs	% of Today's overburdened Renter HHs	Number HHs	% of Today's overburdened Renter HHs	Number HHs	% of Today's overburdened Renter HHs	Change from Alt. 2	% Difference from Alt. 2			
Draft Plan page 117, Table 5: Results of Plan Bay Area Equity Analysis for EIR Alternatives, 2010-2040	Potential for Displacement: Share of today's overburdened-renter households located in high-growth areas	Communities of Concern	-12,696	NUMBER of today's overburdened-renter households located in high-growth area	17,774	21%	30,469	36%	17,774	21%	-12,696	-42%	Appendices to Draft Equity Analysis Report Table D-4
		Remainder of Region	-3,117		7,791	5%	12,466	8%	9,350	6%	-3,117	-25%	
		Total	-15,812		25,565	11%	42,935	18%	27,123	11%	-15,812	-37%	

Category	Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040 ^a	Units	2010	2040											Source
			Value	No Project (Alt. 1)		Proposed Plan (Alt. 2)			EEJ (Alt. 5)						
				Value	Change From 2010	% Change from 2010	Value	Change From 2010	% Change from 2010	Value	Change From 2010	% Change from 2010	Change from Proposed Plan	% Difference from Alt. 2	
Total Per Capita Energy Use (Direct and Indirect, Land Use and Transportation)	-1,476	BTU/ person/ day	268,716	240,163	-28,553	-10.6%	241,254	-27,462	-10.2%	239,778	-28,938	-10.8%	-1,476	-0.6%	DEIR Table 3.1-27
	-67,915,818,000	*Regional Aggregate BTU per day*					2,204,337,798,000			2,136,421,980,000			-67,915,818,000		Population: DEIR Table 3.1-12
Vehicles In Use	-83,536	Total Vehicles in Region	4,608,722	5,493,962	885,240	19%	5,463,760	855,038	19%	5,380,224	771,502	17%	-83,536	-2%	DEIR Table 3.1-14
TRANSIT															
Transit Seat Miles	11,030,000	Seat-miles per day	113,361,000	129,359,000	15,998,000	14%	144,344,000	30,983,000	27%	155,374,000	42,013,000	37%	11,030,000	8%	DEIR Table 3.1-7
Daily Transit Boardings	165,000	Boardings/Day	1,581,000	2,426,000	845,000	53%	3,054,000	1,473,000	93%	3,219,000	1,638,000	104%	165,000	5%	DEIR Table 3.1-8
Transit Commute Trips ^b	65,184	Regional Trips/Day	694,262				1,202,324			1,267,508	573,246	83%	65,184	5%	MTC Travel Model One
Transit Commute Travel Time ^c	-0.4	Minutes/Trip	44	46.3	2.3	5%	44.3	0.3	1%	43.9	-0.1	0%	-0.4	-1%	DEIR Table 3.1-9
	-507,003	*Regional Aggregate Minutes per day*	55,770,352				56,150,604			55,643,601	-126,751	0%	-507,003	-1%	MTC Travel Model One
Transit Non-Commute Trips ^d	-10,304	Regional Trips/Day	505,870				962,784			952,480	446,610	88%	-10,304	-1%	
Transit Non-Commute Travel Time ^e	-0.2	Minutes/Trip	36.2	36.3	0.1	0%	35.5	-0.7	-2%	35.3	-0.9	-2%	-0.2	-1%	DEIR Table 3.1-10
	-190,496	*Regional Aggregate Minutes per day*	34,479,776				33,813,040			33,622,544	-857,232	-2%	-190,496	-1%	MTC Travel Model One
WALKING															
Walking Commute Trips ^b	14,176	Regional Trips/Day	140,756				230,840			245,016			14,176	6%	MTC Travel Model One
Walking Commute Travel Time ^c	0.1	Minutes/Trip	19.5	19.5	0	0%	19.3	-0.2	-1%	19.4	-0.1	-1%	0.1	1%	DEIR Table 3.1-9
	24,502	*Regional Aggregate Minutes per day*	4,777,812				4,728,809			4,753,310			24,502	1%	MTC Travel Model One
EMISSIONS															
Emissions Estimates for Criteria Pollutants	ROG	Tons/Day	93.7	36.5	-57.2	-61%	36.5	-57.2	-61%	35.8	-57.9	-62%	-0.7	-2%	DEIR Table 3.1-15
	CO	Tons/Day	879.9	268.5	-611.4	-69%	266.5	-613.4	-70%	262.2	-617.7	-70%	-4.3	-2%	DEIR Table 3.1-15
	PM10	Tons/Day	36.4	41.3	4.9	13%	41	4.6	13%	40.3	3.9	11%	-0.7	-2%	DEIR Table 3.1-15
	PM2.5	Tons/Day	10.4	10	-0.4	-4%	9.9	-0.5	-5%	9.8	-0.6	-6%	-0.1	-1%	DEIR Table 3.1-15
	NOx (Summertime)	Tons/Day	164.3	48.7	-115.6	-70%	48.5	-115.8	-70%	47.6	-116.7	-71%	-0.9	-2%	DEIR Table 3.1-15
Emissions Estimates for Toxic Air Contaminants	NOx (Wintertime)	Tons/Day	185.3	53.9	-131.4	-71%	53.7	-131.6	-71%	52.8	-132.5	-72%	-0.9	-2%	DEIR Table 3.1-15
	Diesel PM	Kilograms/Day	2,599.60	758.1	-1841.5	-71%	755.9	-1843.7	-71%	740.3	-1859.3	-72%	-15.6	-2%	DEIR Table 3.1-16
	1,3 Butadiene	Kilograms/Day	162.4	49.1	-113.3	-70%	48.2	-114.2	-70%	47.4	-115	-71%	-0.8	-2%	DEIR Table 3.1-16
	Benzene	Kilograms/Day	731.2	224.2	-507	-69%	219.3	-511.9	-70%	216.2	-515	-70%	-3.1	-1%	DEIR Table 3.1-16
Total Regional GHG Emissions	-568,000	Metric Tons CO2e per Year	48,846,000	42,895,000	-5951000	-12%	41,344,000	-7502000	-15%	40776000	-8070000	-17%	-568000	-1%	DEIR Table 3.1-29
FLOODING RISK															
Number of Proposed Transportation Projects Within the Mid-Century Sea Level Rise Inundation Zone	-11	Number of Projects	N/A	15	N/A	N/A	32	N/A	N/A	21	N/A	N/A	-11	-34%	DEIR pg 3.1-64
	\$ 1.25 Billion	*Estimated Value of (11) Fewer Projects*					\$1,254	million dollars		0			-\$1,254		DEIR Appendix C
Number of Proposed Transportation Projects Within the Mid-Century Low-Lying Zone	-6	Number of Projects	N/A	10	N/A	N/A	21	N/A	N/A	15	N/A	N/A	-6	-29%	DEIR Table 3.1-31
	\$ 1.28 Billion	*Estimated Value of (6) Fewer Projects*					\$1,284	million dollars		0			-\$1,284		DEIR Appendix C
Rise Inundation Zone	-12,220	People	78,340	95,720	17380	22%	104,090	25750	33%	91,870	13530	17%	-12220	-12%	DEIR Table 3.1-34
Lying Zone	-17,900	People	31,940	47,870	15930	50%	58,630	26690	84%	40,730	8790	28%	-17900	-31%	DEIR Table 3.1-37
Rise Inundation Zone	-13,360	Jobs	80,920	104,820	23900	30%	108,790	27870	34%	95,430	14510	18%	-13360	-12%	DEIR Table 3.1-40
Lying Zone	-15,660	Jobs	32,060	42,180	10120	32%	48,400	16340	51%	32,740	680	2%	-15660	-32%	DEIR Table 3.1-43

^aNegative values indicate that a given metric is lower in the EEJ scenario than the Proposed Plan.

^bNumber of commute trips was calculated as twice the number of commute tours by mode (either all transit or walk).

^cChanges in regional aggregate minutes per day were calculated using the EEJ scenario's number of trips/day, but scenario-specific values of travel time.

^dNumber of non-commute trips was calculated as the number of trips whose purpose was not work.

Environment, Equity, and Jobs Alternative - Policy Levers

April 16, 2013

Policy Lever	EEJ Requested Policy Input	Included in Analysis?	Comments
UPZONING	Upzone most PDAs (excluding a set of exurban PDAs) and select TPPs located in EEJ-designated cities, ensuring that all upzoned parcels (regardless of existing zoning) are eligible for residential development	Yes	
URBAN GROWTH BOUNDARIES	Apply strict growth boundary assumption (consistent with proposed Plan)	Yes	
LAND USE INCENTIVES	Incentivize growth in PDAs through a revised OBAG program and leverage redevelopment funding to support affordable housing development; discourage CEQA streamlining ability for TPPs	Yes/No	<ul style="list-style-type: none"> • OBAG program was included but additional restrictions on funding availability were not able to be implemented • Redevelopment funding was utilized to subsidize EEJ-identified development sites but could not be isolated to affordable housing • CEQA streamlining benefit was removed consistent with EEJ alternative's assumption of discouraging TPP streamlining
LAND USE FEES & SUBSIDIES	Apply subsidies towards affordable housing and neighborhood stabilization	Yes	<ul style="list-style-type: none"> • Subsidies were applied to support growth in EEJ TPPs (e.g. communities in San Mateo County) • Subsidies could not be specifically directed to only low-income units • Subsidies supported both affordable and market-rate development in those locations
OTHER LAND USE POLICIES	Implement affordable housing and anti-displacement policies such as fair rent laws, inclusionary policies, and condo conversion restrictions	No	
ROAD NETWORK INVESTMENTS	Remove all road/HOT projects (including expansion and efficiency improvements) and redirect uncommitted funding to OBAG/public transit	Yes	

Environment, Equity, and Jobs Alternative - Policy Levers

April 16, 2013

Policy Lever	EEJ Requested Policy Input	Included in Analysis?	Comments
TRANSIT NETWORK INVESTMENTS	Use additional revenues and funding shifts to improve transit frequencies on BART, AC Transit, VTA, SamTrans, and additional small operators; include all transit capital/operating investments from proposed Plan as well	Yes	
ROAD PRICING	Implement a higher peak period Bay Bridge toll (consistent with alternatives 3 & 4) and implement a VMT tax of 1 cent/mile (with exemptions for low-income drivers)	Yes/No	<ul style="list-style-type: none"> Travel model applies VMT tax to all travelers, including low-income drivers, due to modeling limitations
PARKING POLICIES	Reduce parking minimums for developments that provide affordable housing	Yes	<ul style="list-style-type: none"> Reduced parking minimums could not be isolated only to affordable housing Policy was applied to all new housing development, consistent with alternatives 2, 3, and 4
OTHER TRANSPORTATION POLICIES	Provide free regional bus pass for low-income youths	Yes	<ul style="list-style-type: none"> Pass was provided for all transit modes (rather than just bus) and was available for all youths (it is not possible to limit this policy to low-income households in the model)



A New Direction

Our Changing Relationship with Driving
and the Implications for America's Future

U.S. PIRG
Education Fund

FRONTIER GROUP

A New Direction

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and the Implications for America's Future

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Spring 2013

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Executive Summary

The Driving Boom—a six decade-long period of steady increases in per-capita driving in the United States—is over.

Americans drive fewer total miles today than we did eight years ago, and fewer per person than we did at the end of Bill Clinton’s first term. The unique combination of conditions that fueled the Driving Boom—from cheap gas prices to the rapid expansion of the workforce during the Baby Boom generation—no longer exists. Meanwhile, a new generation—the Millennials—is demanding a new American Dream less dependent on driving.

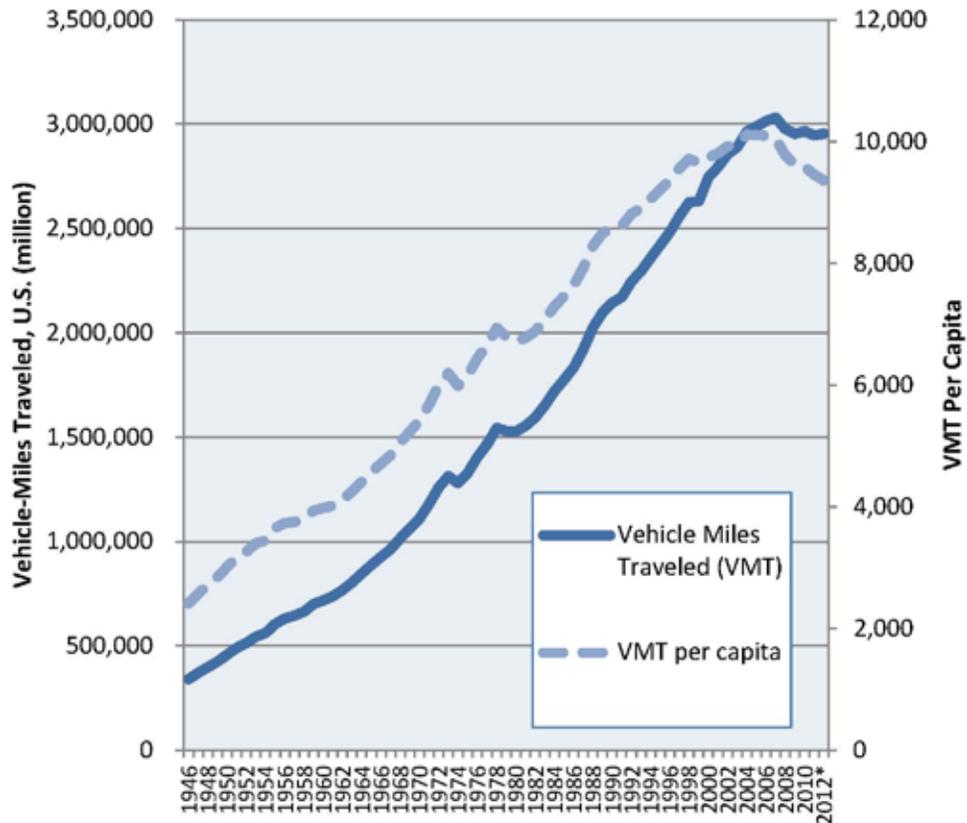
Transportation policy in the United States, however, remains stuck in the past. Official forecasts of future vehicle travel continue to assume steady increases in driving, despite the experience of the past decade. Those forecasts are used to justify spending vast sums on new and expanded highways, even as existing roads and bridges are neglected. Elements of a more balanced transportation system—from transit systems to bike lanes—lack crucial investment as powerful interests battle to maintain their piece of a shrinking transportation funding pie.

The time has come for America to hit the “reset” button on transportation policy—replacing the policy infrastructure of the Driving Boom years with a more efficient, flexible and nimble system that is better able to meet the transportation needs of the 21st century.

The Driving Boom is over.

- Americans drove more miles nearly every year between the end of World War II and 2004. (See Figure ES-1, next page.) By the end of this period of rapid increases in per-capita driving—which we call the “Driving Boom”—the average American was driving 85 percent more miles each year than in 1970.
- Americans drive no more miles in total today than we did in 2004 and no more per person than we did in 1996.
- On the other hand, Americans took nearly 10 percent more trips via public transportation in 2011 than we did in 2005. The nation also saw increases in commuting by bike and on foot.

Figure ES-1. Total and Per-Capita Vehicle-Miles Traveled, U.S.



* 2012 data from U.S. Department of Transportation's (U.S. DOT) *Traffic Volume Trends* series of reports; data from previous years from U.S. DOT's *Highway Statistics* series of reports.

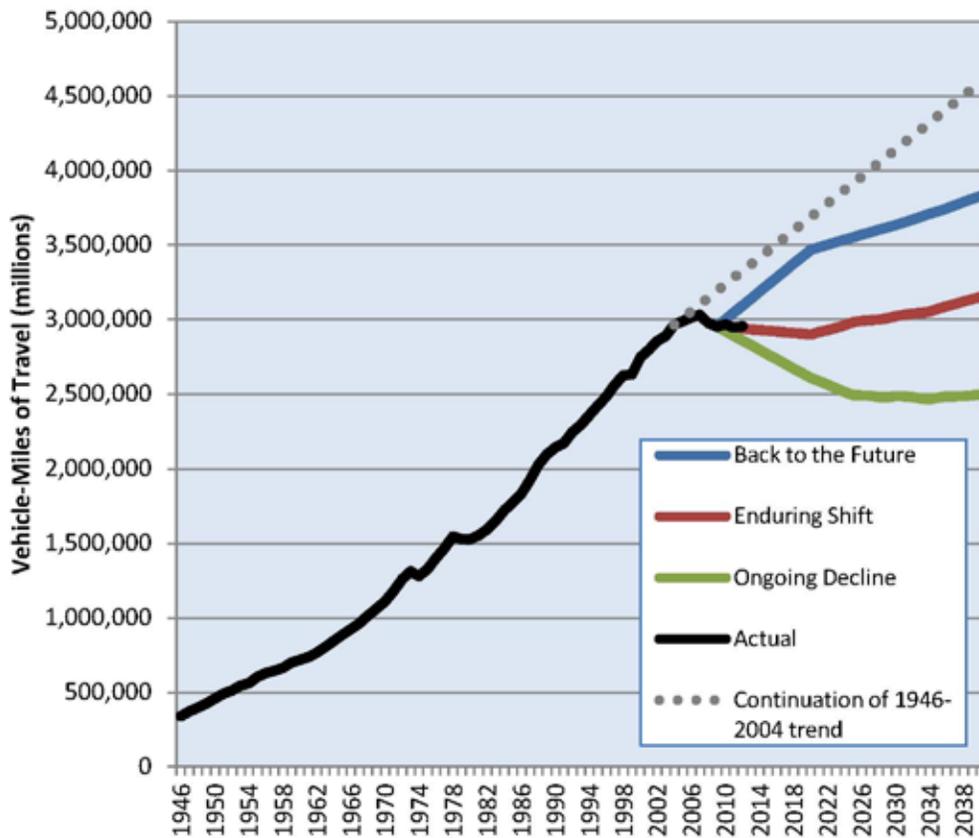
- A return to the steady growth in per-capita driving that characterized the Driving Boom years is unlikely given the aging of the Baby Boom generation, the projected continuation of high gas prices, anticipated reductions in the percentage of Americans in the labor force, and the peaking of demand for vehicles and driver's licenses and the amount of time Americans are willing to spend in travel.

The Millennial generation has led the recent change in transportation

trends—driving significantly less than previous generations of young Americans. Millennials are already the largest generation in the United States and their choices will play a crucial role in determining future transportation infrastructure needs.

- The Millennials (people born between 1983 and 2000) are now the largest generation in the United States. By 2030, Millennials will be far and away the largest group in the peak driving age 35-to-54 year old demographic, and will continue as such through 2040.

Figure ES-2. Aggregate Vehicle-Miles Traveled in the United States under Several Scenarios of Future Travel Growth, 1946-2040



- Young people aged 16 to 34 drove 23 percent fewer miles on average in 2009 than they did in 2001—a greater decline in driving than any other age group. The severe economic recession was likely responsible for some of the decline, but not all.
- Millennials are more likely to want to live in urban and walkable neighborhoods and are more open to non-driving forms of transportation than older Americans. They are also the first generation to fully embrace mobile Internet-connected technologies, which are rapidly spawning new transportation options and shifting the way young Americans relate to one another, creating new avenues for living connected, vibrant lives that are less reliant on driving.
- If the Millennial-led decline in per-capita driving continues for another dozen years, even at half the annual rate of the 2001-2009 period (illustrated by the *Ongoing Decline* scenario in Figure ES-2 above), total vehicle travel in the United States could remain well below its 2007 peak through at least 2040—despite a 21 percent increase in population. If

Millennials retain their current propensity to drive less as they age and future generations follow (*Enduring Shift*), driving could increase by only 7 percent by 2040. If, unexpectedly, Millennials were to revert to the driving patterns of previous generations (*Back to the Future*), total driving could grow by as much as 24 percent by 2040.

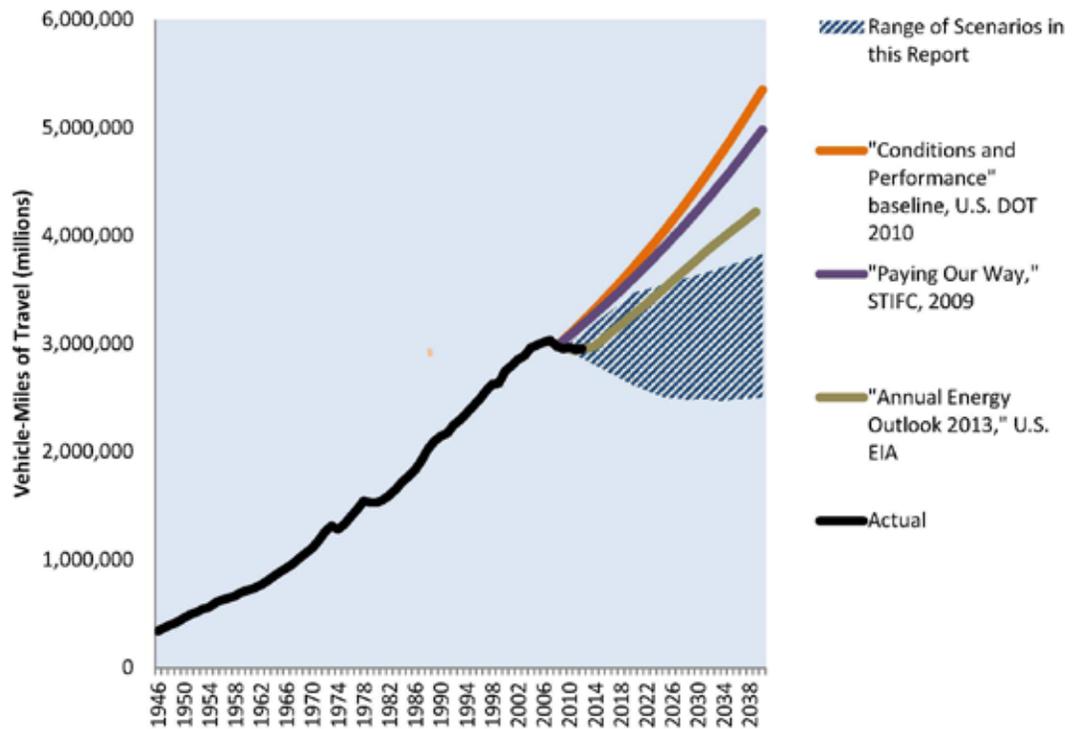
- All three of these scenarios yield far less driving than if the Driving Boom had continued past 2004. Driving declines more dramatic than any of these scenarios would result if future per-capita driving were to fall at a

rate near that of recent years or if annual per-capita reductions continue through 2040.

- Regardless of which scenario proves true, the amount of driving in the United States in 2040 is likely to be lower than is assumed in recent government forecasts. This raises the question of whether changing trends in driving are being adequately factored into public policy. (See Figure ES-3.)

The recent reduction in driving has already delivered important benefits for

Figure ES-3. Recent Official Forecasts of Vehicle Travel Compared to Range of Scenarios, 1946-2040



U.S. DOT = U.S. Department of Transportation
 STIFC = Surface Transportation Infrastructure Financing Commission
 U.S. EIA = U.S. Energy Information Administration

the nation, while raising new challenges. Future driving trends will have major implications for transportation policy and other aspects of American life.

- **Traffic congestion has fallen.** According to data from the Texas Transportation Institute, Americans spent 421 million fewer hours stuck in traffic in 2011 than they did in 2005. Further reductions in driving could lead to additional easing of congestion without massive investments in new highway capacity, as long as roads are maintained in a state of good repair.
- **America is less dependent on oil.** In 2011, gasoline consumption for transportation hit a 10-year low. Further reductions in driving consistent with the *Ongoing Decline* scenario—coupled with expected vehicle fuel economy improvements—could result in the nation using half as much gasoline or other fuels in our cars and trucks by 2040 as we use today.
- **Our roads are getting less use ... but the gas tax is bringing in less income.** Reduced vehicle travel (particularly in large trucks) reduces the wear and tear on our nation’s roads, reducing maintenance needs. Reduced driving, however, also reduces the amount of revenue brought in by the already-strained gasoline tax.

The recent reduction in driving and embrace of less auto-dependent ways of living by Millennials and others creates a golden opportunity for America to adopt transportation policies that use resources more efficiently, preserve our existing infrastructure, and provide support for Americans seeking alternatives to car travel.

A new vision for transportation policy should:

- **Plan for uncertainty.** With future driving patterns uncertain, federal, state and local transportation officials should evaluate the costs and benefits of all transportation projects based on several scenarios of future demand for driving. Decision-makers should also prioritize those projects that are most likely to deliver benefits under a range of future circumstances.
- **Support the Millennials and other Americans in their desire to drive less.** Federal, state and local policies should help create the conditions under which Americans can fulfill their desire to drive less. Increasing investments in public transportation, bicycling and pedestrian infrastructure and intercity rail—especially when coupled with regulatory changes to enable the development of walkable neighborhoods—can help provide more Americans with a broader range of transportation options.
- **Revisit plans for new or expanded highways.** Many highway projects currently awaiting funding were initially conceived of decades ago and proposed based on traffic projections made before the recent decline in driving. Local, state and federal governments should revisit the need for these “legacy projects” and ensure that proposals for new or expanded highways are still a priority in light of recent travel trends.
- **Refocus the federal role.** The federal government should adopt a more strategic role in transportation policy, focusing resources on key priorities (such as repair and maintenance of existing infrastructure and the expansion of transportation options) and evaluating projects competitively on the basis of their benefits to society.

- **Use transportation revenue where it makes the most sense.** Transportation spending decisions should be based on overall priorities and a rigorous evaluation of project costs and benefits—not on the source of the revenue.
- **Do our homework.** Federal and state governments should invest in research to evaluate the accuracy and usefulness of transportation models and better understand changing transportation trends in the post-Driving Boom era.

Introduction

No region of the United States is as closely associated with “car culture” as Southern California. So much of what Americans associate with the car—from hot rodding to drive-ins and from smog to traffic congestion—either began or reached its fullest expression in the region. As early as the mid-1930s, according to one analyst, Los Angeles had become “America’s first thoroughly motorized metropolis.”¹

Like the rest of America, California experienced rapid growth in driving from World War II through the turn of the 21st century. The number of miles driven in the state doubled between 1981 and 2002—an average rate of growth of more than 3 percent per year.²

With all signs in the 1980s pointing to continued increases in the demand for driving, officials in Southern California began looking for ways to expand their clogged freeway network. In Orange County, officials launched a plan to build a series of toll roads to ease existing and anticipated congestion.³ When the first of the toll roads opened in 1993, a state senator confidently stated that the roads would be a success because, “People around

here will do anything to avoid gridlock.”⁴ Several other toll roads—some built and operated by private corporations—opened in the region between the early 1990s and late 2000s.

Far from meeting the initial predictions of success, however, Southern California’s toll roads have served as a cautionary tale of what can happen when millions of dollars are spent on expanded highways ... and the cars don’t show up.

Traffic on Orange County’s San Joaquin Hills toll road fell short of projections almost immediately after opening—by 2010, traffic on the road was less than half of what had been anticipated.⁵ Another Orange County project, the Foothill/Eastern toll road, met expectations until 2008, when traffic slumped.⁶ In San Diego County, the privately built South Bay Expressway, which opened in 2007, fell so far short of its traffic projections that the private enterprise that built and operated the road was forced into a form of bankruptcy.⁷

These failed predictions have serious consequences. In Orange County, tolls on the highways have been raised to among the highest in the nation in a grab for revenue. The bonds issued by one of the toll

road authorities have been downgraded to junk bond status,⁸ and an investigation was launched in late 2012 of the finances of the local government agencies responsible for building and operating the Orange County highways.⁹

Southern California toll roads aren't the only highways getting less traffic these days, either in California or across the country. After decades of relentless growth in vehicle travel, Californians are driving about as much today as they did a decade ago, mirroring nationwide trends.¹⁰

After roughly a decade of stagnation in driving, it is becoming clear that the rapid increases in per-capita driving that took place in California and across the nation between 1946 and the early 2000s—a period we call the “Driving Boom”—are over. Yet, transportation policy in the United States has failed to catch up with the times, leaving the nation at risk of over-investing in transportation infrastructure that we don't need while under-investing in the repair of our existing transportation network and the broader range of transportation choices Americans increasingly seek

in the 21st century.

The nation needs a new transportation policy—one that embraces the recent change in driving patterns and seeks to maximize their benefits. That new transportation policy would accept the fact that future transportation demands are uncertain and prioritize investments that would deliver benefits under a broad range of potential futures. It would create a coherent and refocused role for the federal government in ensuring that our transportation infrastructure is well-maintained and in partnering with cities and states that seek to provide new transportation options to their people. And it would reevaluate whether previous plans for major highway expansion projects still make sense in light of changing trends in driving.

With the fate of tens of billions of dollars in transportation investments at stake, the time has come for policymakers and the public to understand the seismic implications of changing driving trends on transportation policy, and to build a new transportation policy that reflects the needs of 21st century America.

The End of the Driving Boom

The Driving Boom—a six decade-long period of steady increases in per-capita driving—is now over. Americans drove no more per person in 2012 than we did at the end of Bill Clinton’s first term as president. Many long-term economic and demographic trends suggest that the period of prolonged stagnation in vehicle travel may just be beginning.

The recent change in driving trends—led by young Americans—has huge implications for transportation policy. To understand those implications, it is important to answer a few basic questions: Why did the Driving Boom happen? Why did it end? And why is it unlikely to return?

The Rise in Driving from 1946-2004

Throughout the 20th century—with short interruptions for crises such as wars or energy shocks—the number of miles Americans drove each year marched steadily upward. By 2004, the total number of miles

driven annually on America’s roads was approaching 3 trillion—more than double the amount of just three decades earlier.¹¹ Between 1970 and 2004, the number of miles driven per capita skyrocketed by 85 percent—from 5,400 miles per year to just over 10,000.¹²

Rapid increases in driving were so commonplace during this period—which we call the “Driving Boom”—as to be considered inevitable. Rising traffic congestion (or the threat of it), along with the perceived importance of highways to economic growth, spurred government officials to invest hundreds of billions of dollars in expanded highway capacity. Between 1980 and 2010, the nation expanded its freeway capacity (measured in lane-miles) by 35 percent, the equivalent of building a new lane of freeway stretching from New York to Los Angeles every single year.¹³

Table 1. Average Annual Change in Vehicle Travel, Driving Boom and Post-Driving Boom¹⁴

	1946-2004	2004-2012
Total miles	3.8%	0.0%
Miles per capita	2.5%	-1.0%

New highways, in turn, spurred additional driving. New off-ramps in previously rural communities fueled sprawling real estate development in distant suburbs and exurbs consisting largely of housing subdivisions, office parks and shopping centers, many of them designed so as to be accessible only by automobile. The percentage of Americans living in suburbs increased from 23 percent in 1950 to 50 percent in 2000.¹⁵

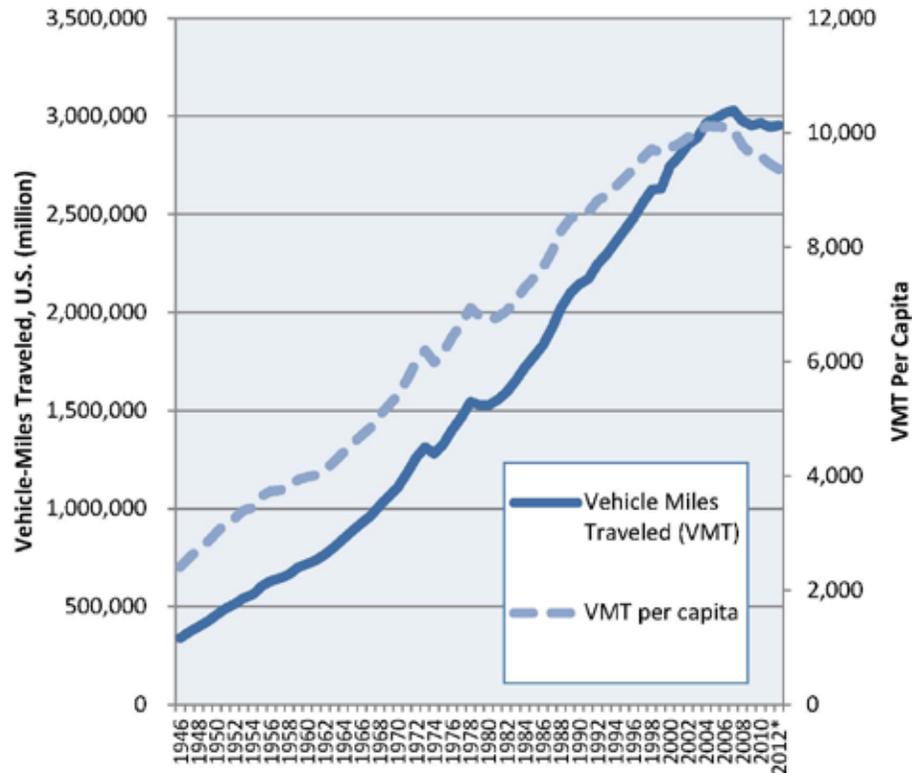
As longer commutes and the need to use a car for virtually every daily task led to more driving, revenues from the gasoline tax increased steadily. Between 1970 and 2000, the real value of highway “user fees”—gasoline taxes, vehicle registration fees and other taxes and fees paid by drivers—collected by all levels of government increased by 34 percent.¹⁶

Because federal and state governments devoted most (and in some cases, all¹⁷) revenues from drivers to highways—and because most of the nation’s existing highways were still relatively new and did not yet require major reconstruction—vast amounts of revenue were available to add new highway capacity. In 2000, for example, even after more than four decades of rapid highway construction, 46 percent of federal highway funding was still being spent on new roads and expansion of capacity on existing roads.¹⁸

This self-reinforcing cycle—new roads fed new development that led to more driving, which created more revenue, which made possible more roads—continued for decades.

Then, around the turn of the 21st century, it stopped.

Figure 1. Total and Per-Capita Vehicle-Miles Traveled, U.S.¹⁹



* 2012 data based on U.S. Department of Transportation’s (U.S. DOT) *Traffic Volume Trends* report. Previous years based on U.S. DOT *Highway Statistics* series of reports.

The Crest of the Wave: Driving Trends in the 21st Century

By the late 1990s, the rapid rise in vehicle travel that characterized the Driving Boom began to slow, then stop, and ultimately reverse. Americans now drive no more in total than they did in 2004 and no more on average than they did at the end of Bill Clinton's first term as president. (See Figure 1.)

The recent reduction in vehicle travel is nearly unprecedented in American history.²⁰ The longest previous drop in vehicle travel was during World War II—a period of gasoline rationing and extraordinary societal disruption. It took five years and the conclusion of the war for 1941 levels of driving to be surpassed again in 1946. The United States has now gone more than five years since its last peak in vehicle travel.²¹

Why the Driving Boom Is Over ... and Why it's not Coming Back

There are many reasons to believe that driving per-capita has peaked, at least for the foreseeable future, signaling the end of the Driving Boom. While the *total* number of miles driven on American roads may inch upwards over time with population growth, the pace of that increase in vehicle travel—if it occurs at all—will be far slower than during the Driving Boom years.

Saturated with Driving

In the decades after World War II, rising incomes put automobile ownership within reach of an increasing number of Americans. The construction of new highways and development of new low-density

suburbs created a new—and to many, appealing—automobile-oriented lifestyle. The increased participation of women in the workforce, particularly from the 1960s onward, put millions of new commuters on the roads and changed travel patterns in fundamental ways. Meanwhile, dramatic improvements in vehicles and the opening of shiny new highways enabled Americans to increase the number of miles they drove without sacrificing time for work or leisure.

Each of these changes led more Americans to take to the roads, helping to fuel the dramatic increase in the number of miles driven between World War II and 2004. By the turn of the 21st century, however, these trends had largely played themselves out, and some had shown signs of beginning to reverse. (See Figure 2, next page.)

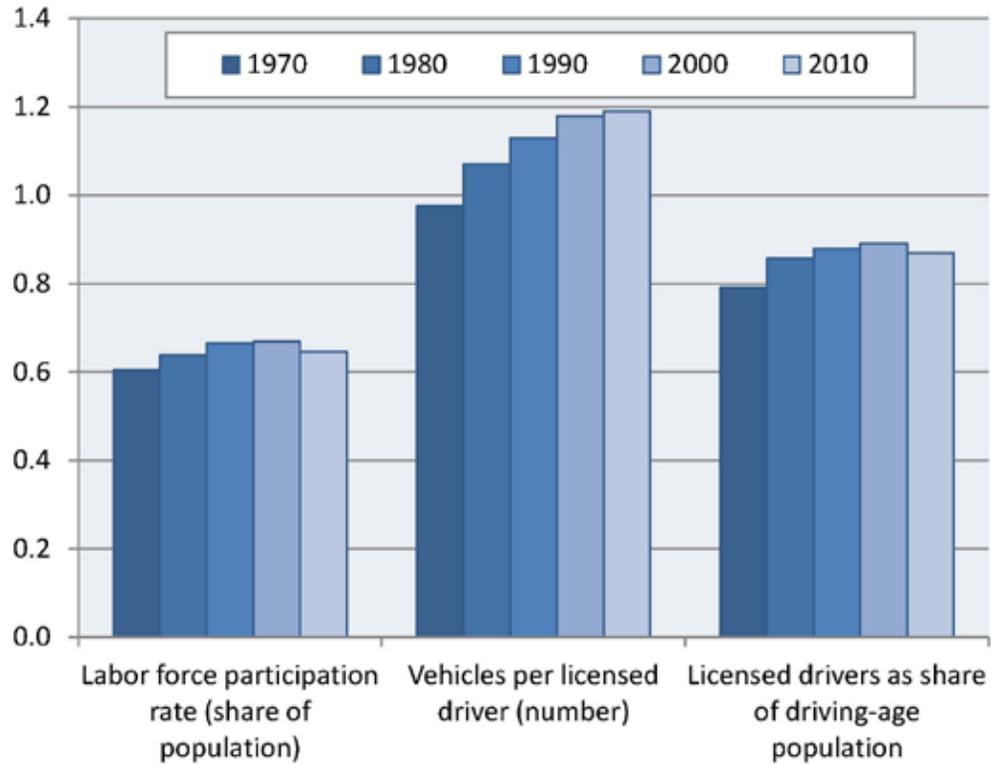
Labor Force Participation

Workers tend to drive more miles than non-workers, and the Driving Boom years saw a dramatic expansion in the share of the American population taking part in the labor force. Between 1970 and 2000, the share of Americans in the labor force increased from just over 60 percent to a peak of 67.3 percent.²³ Since 2000, however, the share of Americans in the labor force has dropped to 63.6 percent, a level roughly equal to that of 1979.²⁴ The drop in labor force participation began well before the current recession and is expected to continue well beyond it, largely due to the aging of the Baby Boom generation. A 2011 Congressional Budget Office report projected that the participation rate would drop to 63 percent by 2021.²⁵

Vehicle Ownership

People who have greater access to a vehicle could be expected to drive more frequently than those with less access—even in situations where they might otherwise walk, take transit, or not travel at all. During the Driving Boom, the number of Americans who owned cars increased dramatically. In

Figure 2. Trends in Driver’s Licensing, Vehicle Ownership and Labor Force Participation Rate²²



1972, the number of vehicles registered in the United States exceeded the number of people licensed to drive them for the first time.²⁶ Over the next three decades, the ratio of vehicles to licensed drivers continued to increase, reaching a peak of 1.24 vehicles per driver in 2006. Since 2006, however, vehicle ownership per licensed driver has declined by 4 percent, suggesting that Americans may have reached a limit in the number of vehicles they can beneficially use.

Driver’s Licensing

Increasing vehicle ownership was matched in the Driving Boom years by an increasing share of the population holding a license to drive. By 1992, 90 percent of the driving-age population of the United States was licensed to drive—an all-time high with

little room for further increase. Since then, however, the percentage of driving-age (16 and older) Americans holding driver’s licenses has stagnated and then declined—by 2011, 86 percent of driving-age Americans held driver’s licenses, the lowest percentage in 30 years.²⁷

Time Spent in Travel

Highway expansion and vehicle improvements during the Driving Boom years meant that Americans could go farther, faster, and in greater comfort than ever before. Improvements in average highway travel speeds continued right up through the 1980s, making it possible for Americans to live or work in ever-more distant suburbs or exurbs without losing precious work or family time. Since the early 1990s, however, travel speeds (at least for commute

trips) have slowed.²⁸ Barring major technological advances, there are few prospects for a repeat of the quantum leap in travel speeds that occurred during the Driving Boom.²⁹

This finding is important because some transportation theorists believe that there are inherent—if difficult to define—boundaries to the average amount of time each day that people are willing to spend in travel.³⁰ This limit is thought to be in the range of 1.1 to 1.3 hours per day.³¹ In 2011, Americans spent an average of 1.17 hours a day in travel, slightly less time than they had spent in travel in 2005.³²

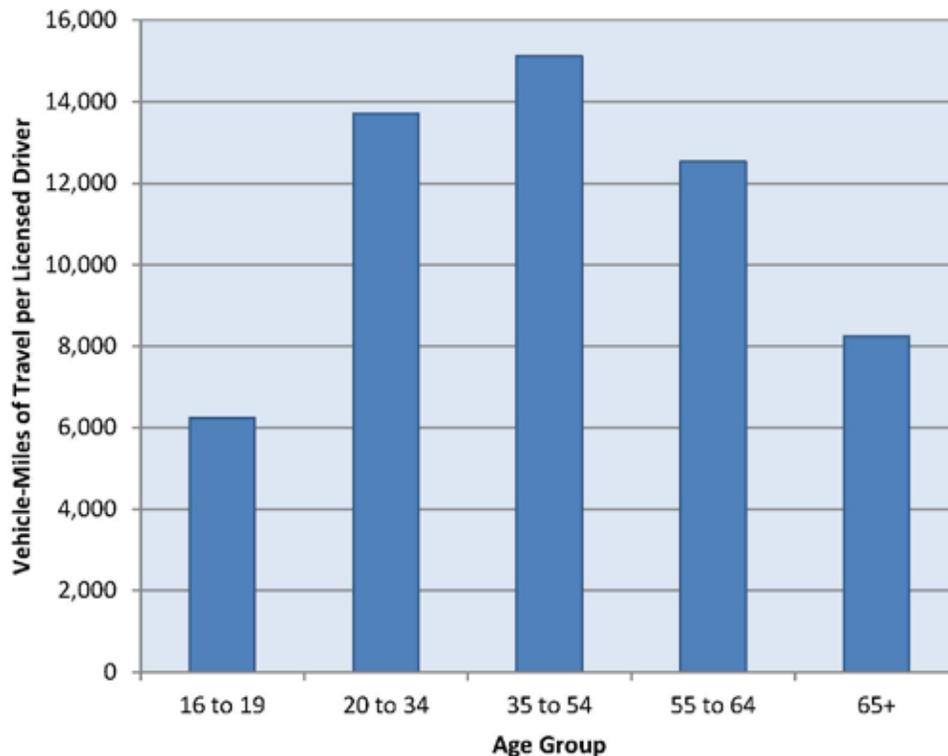
In short, Americans may be hitting the limit of the amount of time they are willing to spend in their cars each day—meaning that, unless travel speeds increase, they may be hitting the limit of the number of miles they are willing to drive each day as well.

Demographics: The Graying of America

The Driving Boom coincided, in large measure, with the lives of those born in the Baby Boom—the massive demographic bubble consisting of those born between 1946 and 1964. The passage of the Baby Boomers through their peak working and child-rearing years turbocharged the trend toward increased driving—especially between the 1980s and 2000s.

Driving is an activity that is highly dependent on one’s stage of life. People in their prime earning and child-rearing years tend to drive the most, as they commute to jobs, shuttle children to activities, and often opt to live in more spacious suburban communities that are also more auto-dependent. Younger people and older people, on the other hand, are less likely to drive. (See Figure 3.)

Figure 3. Vehicle Miles Traveled per Licensed Driver by Age, 2009³³



Regardless of other trends, therefore, the greater the share of Americans in the peak driving-age 35-to-54 age group, the more one can expect per-capita vehicle travel, as averaged across the entire population, to increase. In the latter years of the Driving Boom, the percentage of Americans in the peak driving-age demographic increased rapidly. By 2000, 35 to 54 year-olds accounted for 29.5 percent of the U.S. population, up from 25.3 percent of the population in 1990 and 21.4 percent of the population in 1980. (See Figure 4.)

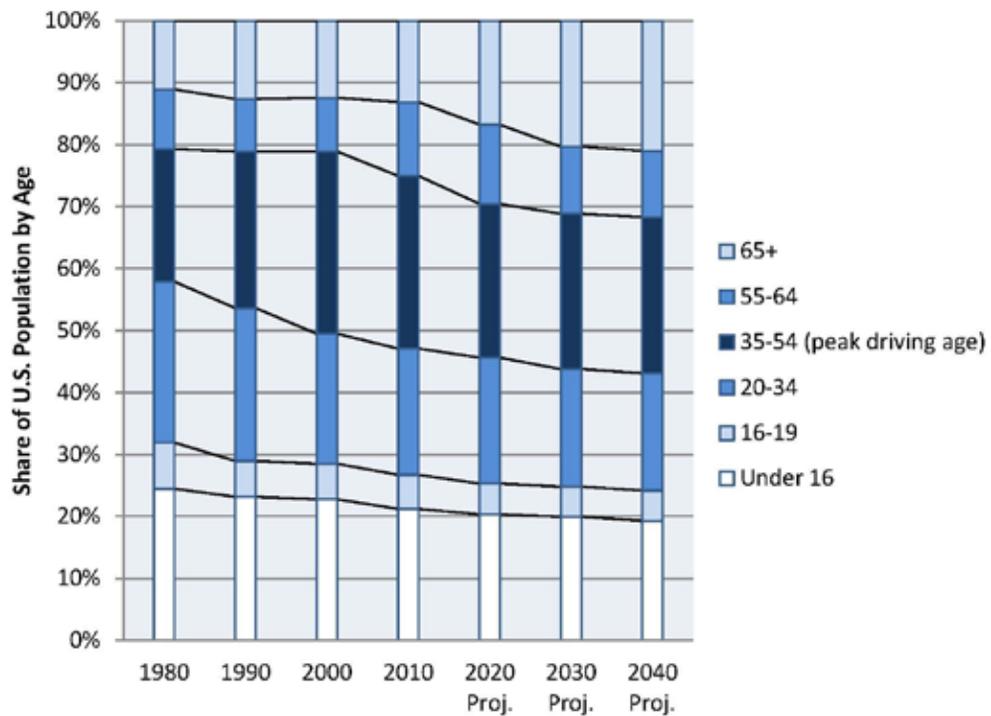
The Baby Boom generation is now passing through the prime driving years and heading toward retirement. By 2010, the share of Americans in the 35 to 54 year-old age bracket fell to 27.9 percent and by

2020 it is projected to fall further to 24.8 percent. In fact, despite overall population growth, there are projected to be fewer 35 to 54 year-olds *in total* in 2020 than there were in either 2010 or 2000.

At the same time, the share of population in the 65 and older age bracket is projected to increase dramatically between now and 2040. In 1980, seniors 65 and older made up 11 percent of the population; by 2040, their share of the population is expected to roughly double to 21 percent.³⁵

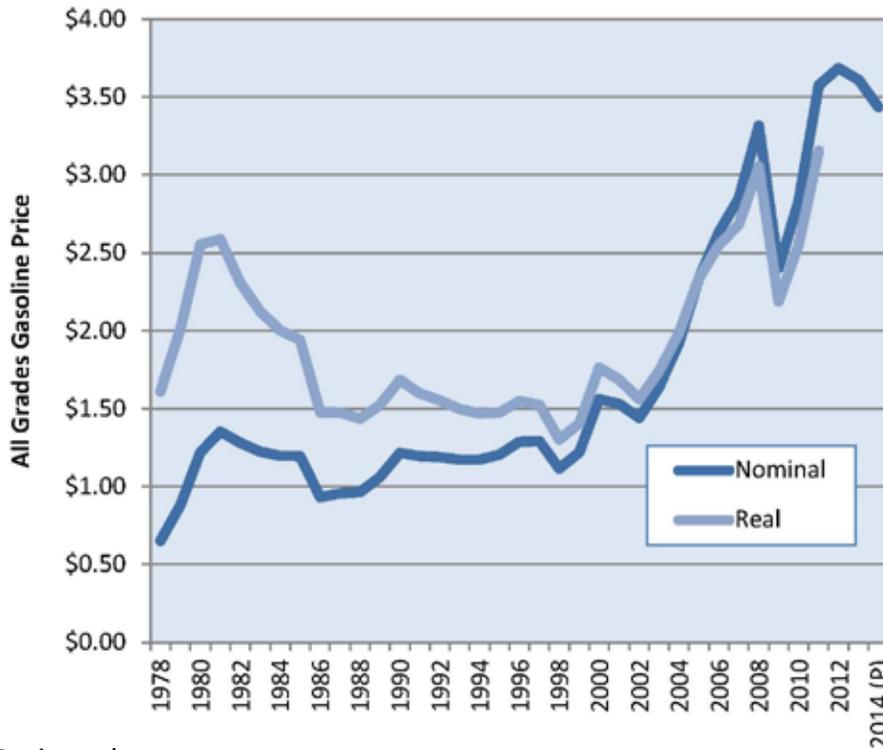
A greater share of Americans, therefore, will soon be in age groups that have historically driven fewer miles. This demographic shift can be expected to reduce the number of miles driven per capita when averaged across the entire population.

Figure 4. Shares of U.S. Population by Age Group³⁴



The share of Americans in their peak driving years (age 35-54) is shown in dark blue. Between 1980 and 2000, the share of Americans in the peak driving demographic ballooned from 21.4 percent of the population to 29.5 percent, as the Baby Boomers reached peak driving age. With the Baby Boom generation now headed toward retirement, the share of Americans in the peak driving age group is projected to decline to 24.8 percent by 2020.

Figure 5. Average Annual Regular Grade Gasoline Prices, United States, Nominal and Real (Adjusted for Inflation)³⁸



(P)=Projected

**Economics:
The Sustained Rise in
Gasoline Prices**

The cost of driving has gone up dramatically in the last decade. Between 2002 and 2011, the average inflation-adjusted price of a gallon of gasoline doubled.³⁶

The cost of gasoline has both short- and long-term impacts on the amount people drive. In the short term, people may pass up the opportunity to take certain trips due to high prices. The perception of higher gasoline prices in the long-term, meanwhile, can cause people to reorient their lives to avoid the expense of fuel—for example, by moving closer to their work or purchasing a more fuel-efficient car.³⁷

U.S. government forecasters project that gasoline prices will remain well above

historical levels, which would tend to depress vehicle travel. However, trends in gasoline prices may become less important over time as vehicle fuel economy improves and alternative fuel vehicles become more common on American roads.

**Rising Use of Transit and Other
Transportation Modes**

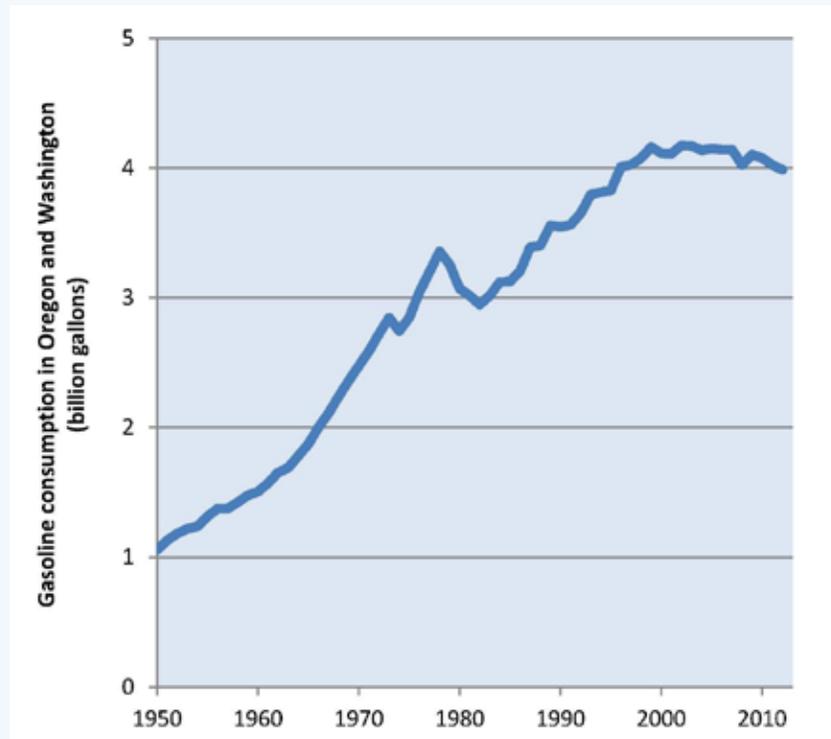
Another contributing factor to the recent decline in driving has been the increasing eagerness of many Americans to choose other modes of transportation—light rail, buses, trains, bicycles or walking—for trips they might once have taken by car. Indeed, while driving has been stagnant or declining in recent years, the use of nearly all of these other modes of transportation has increased. (continued, page 18)

Implications of Changing Driving Trends: The View from the Pacific Northwest

By **Clark Williams-Derry, Sightline Institute**

The Pacific Northwest was well ahead of the curve in the national trend toward reduced driving and fuel consumption. Out here in the land of mist and mountains, gasoline consumption plateaued way back in 1999.⁴³ (See Figure 6.) Total vehicle travel on Washington and Oregon's state highways flattened out in 2002.⁴⁴ And, after factoring in population growth, gas consumption per resident in the two states has now fallen to its lowest level since 1964—a dramatic decline, though one that has received surprisingly little attention from the region's policy-makers.⁴⁵

Figure 6. Gasoline Consumption in Oregon and Washington⁴⁶



Because driving slumped here before it did in the rest of the nation, we're among the first to confront the fiscal fallout of stagnating gas tax revenues.

Like many states across the country, Washington and Oregon financed highway expansion by floating bonds, intending to pay for highway construction by tapping

into ever-growing fuel tax collections anticipated in the future. But flat-lining gas tax receipts have driven the region's transportation officials into a panic. Oregon recently announced that flat or declining revenue from the gasoline tax, coupled with rising debt payments, decreased federal funding, and increasing construction costs, could force deep cuts in the state's transportation budget in the next several years.⁴⁷

Washington is in even worse shape. After years of denial, the state recently slashed long-term revenue forecasts by billions of dollars.⁴⁸ But since the state back-loaded interest payments on many of its highway bonds, its debt obligations will rise even if fuel tax receipts dip. Within just a few years, more than 70 percent of the state's gas tax receipts will go to pay off debts on projects that have *already* been completed—leaving precious little gas tax revenue for maintenance of existing roads, let alone new construction.⁴⁹

Both Oregon and Washington have flirted with tolling to finance new highways—gambling that drivers who are reluctant to pay for expensive gas will prove willing to pay costly tolls instead. Washington took a foray into toll-financed construction on the Tacoma Narrows Bridge. But the fiscal outlook for the project is grim. Traffic across the new span has fallen,⁵⁰ rather than growing as anticipated,⁵¹ leaving a widening gap between toll collections and the rising payments for construction debt. At the same time, a high-occupancy toll (HOT) lane pilot project southeast of Seattle has generated far less revenue than hoped.⁵² And the state has been forced to slash its projected toll revenue from a tunnel project under downtown Seattle; the state now expects to raise at most \$200 million in tolls⁵³ towards a \$4 billion project.⁵⁴

In short, Washington's and Oregon's transportation agencies are speeding towards a fiscal cliff of their own making. If anything, they're stepping on the accelerator by continuing to move forward with costly megaprojects—wider highways, bigger bridges and a budget-busting tunnel—that the states don't need and can't afford.

One obvious solution to the Northwest's transportation finance crisis is to cancel, or at least downsize, some of these megaprojects. (Who needs bigger highways if traffic isn't growing?) Yet so far, transportation officials see flat-lining traffic simply as the cause of a funding shortfall, rather than an opportunity to rethink the region's road construction priorities.

It took the Northwest states nearly a decade to accept that a sea change in car travel trends had sown the seeds of a transportation revenue crisis. Let's hope it doesn't take another decade to accept that the best solution to that crisis is to scale back our highway-building ambitions, so that they match both our financial means and our newly restrained driving habits.

Sightline Institute is an independent, nonprofit research and communications center based in Seattle, dedicated to making the Pacific Northwest a global model of sustainability—strong communities, a green economy and a healthy environment.

Table 2. Factors that Influence Driving: Past, Present and Future⁵⁵ (Green = Indicates Higher Per-Capita Driving, Yellow=Neutral, Stable or Unknown, Red=Indicates Lower Per-Capita Driving)

	Driving Boom	Recent	Future
Labor Force Participation Rate	Rapid increases due to increased participation of women, demographic bubble	Declining	Declining due to Baby Boomer retirements
Speed of Automobile Travel	Increasing due to highway and vehicle improvements	Stable or declining	Unlikely to improve in the absence of major technological changes
Share of Population of Peak Driving Age (35-54)	Steadily increasing due to Baby Boom	Declining	Declining in short term, increasing slowly thereafter, but not above previous Baby Boom peak
Cost of Gasoline	Mostly stable and low	Increasing, followed by relative stability at higher level	Projected to remain high
Vehicle Ownership	Increasing to near-universal vehicle ownership	Stable or declining	Unknown, but potential for further growth above historic, near-saturation highs is limited
Driver's Licensing	Increasing to near-universal licensure	Declining	Unknown, but unlikely to exceed previous peak
Use of Non-Driving Modes	Dramatically decreasing, then stagnant	Increasing	Unknown, though demand for transit among younger and older Americans could be expected to increase

In 2011, Americans took nearly 10 percent—or 900 million—more trips via public transportation than they had in 2005.³⁹ That growth in transit use continued through 2012, despite reductions in service and increases in fares in many cities in the wake of the Great Recession.⁴⁰ A 2011 American Public Transportation Associa-

tion survey of transit agencies found that more than half had either increased fares or cut service since the beginning of 2010, while more than 20 percent of the agencies had both raised fares *and* cut service.⁴¹

Public transportation isn't the only non-automobile mode to experience an increase in recent years. For example, the

number of workers commuting to work by bike increased by 39 percent between 2005 and 2011, while the number of people commuting on foot increased by 20 percent between 2005 and 2009.⁴²

In addition, in recent years, advances in mobile technology have enabled a range of new transportation options—from bike sharing to car sharing to ride sharing—to take root in an increasing number of cities. (See page 26.) It is too soon to determine how these new options might change transportation behaviors over the long term, but they create the potential for further changes in transportation habits that could affect overall demand for driving in the years to come.

Summary

The Driving Boom of the second half of the 20th century coincided with rapid economic, cultural and demographic changes in the United States. Those changes largely pointed in the same direction: toward a more automobile-oriented society.

Many of those trends, however, have either reached their natural limits or have reversed direction. (See Table 2.) A review of those trends points to the conclusion that the trajectory toward increased per-capita driving that prevailed during the Driving Boom has likely reached its end, and that the levels of per-capita driving achieved in the early 2000s are unlikely to be surpassed in the foreseeable future.

What Comes Next? How the Millennials Will Determine the Future of Transportation

Transportation infrastructure lasts for decades. The investments we make in transportation infrastructure, therefore, must be based on anticipated future needs at least as much as the needs of today.

For decades, transportation planners have assumed that economic and population growth would create continuous increases in demand for driving, necessitating new and ever-wider highways to alleviate the crippling congestion that was sure to follow. Over the last decade, though, those anticipated increases in driving have failed to materialize.

The degree to which driving will increase in the future depends crucially on the Millennial generation—otherwise known as “Generation Y”—those born between 1983 and 2000. In 2010, the Millennials surpassed the Baby Boomers as the largest generation in the United States, with the more than 77 million members of the Millennial generation accounting for nearly one in four Americans.⁵⁶

By the end of this decade, Millennials will begin moving into what has traditionally been the peak driving age (35 to 54 year-old) demographic, and by 2030 they

will represent the vast majority of the members of that age group. As a result, the evolving driving behaviors of the Millennials will be a key determinant of whether the trend toward stagnating vehicle travel will continue, reverse or even accelerate in the years to come.

Defining the Generations

There is no standard definition of generational boundaries. In this report, generations are defined as follows:

- **Baby Boomers:** those born between 1946 and 1964
- **Generation X:** those born between 1965 and 1982
- **Millennials (Generation Y):** those born between 1983 and 2000
- **Generation Z:** those born after 2000.

The New Transportation Habits of the Millennials

No age group has experienced a greater change in its driving habits than young Americans.

According to the National Household Travel Survey, from 2001 and 2009, the annual number of vehicle-miles traveled by 16 to 34 year-olds (a group that included a mix of Millennials and younger members of Generation X) decreased from 10,300 miles to 7,900 miles per capita—a drop of 23 percent.⁵⁷ (See “Generation X Has Also Reduced its Driving,” next page.)

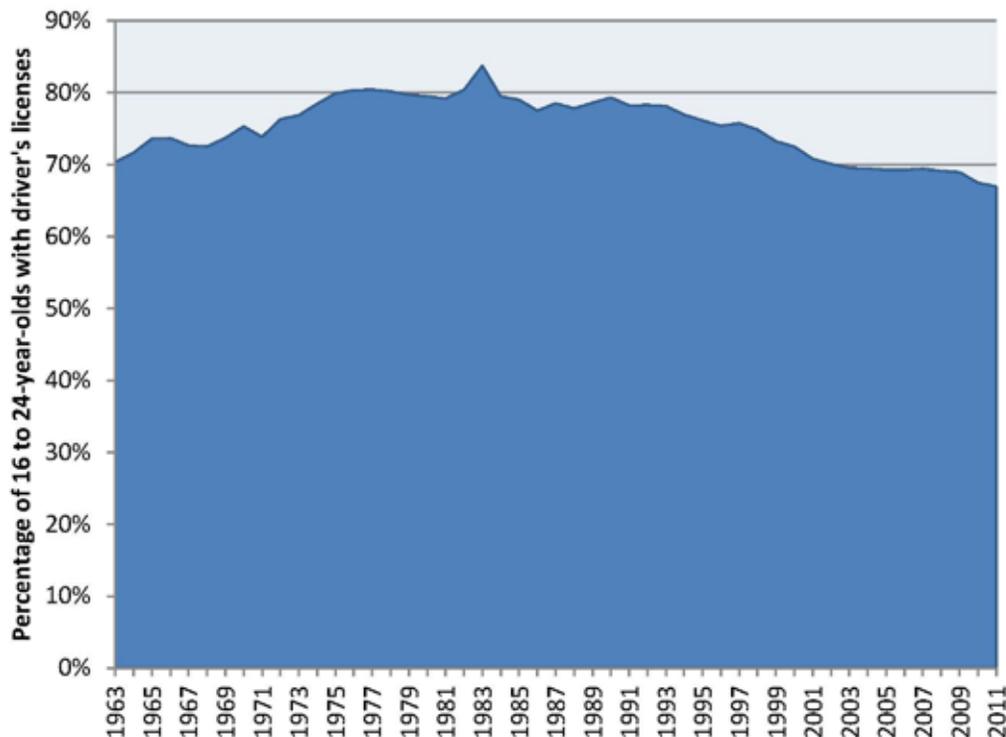
The percentage of young people with a driver’s license has been dropping for years. In 2011, the percentage of 16 to 24 year-olds with driver’s licenses dipped to 67 percent—the lowest percentage since at least 1963.⁵⁸

While young Americans are driving less than they did at the beginning of the 2000s, they have increased their use of other forms of transportation. In 2009, 16 to 34 year-olds as a whole took 24 percent more total bike trips than they took in 2001, despite the age group actually shrinking in size by 2 percent. From 2001 to 2009, the number of passenger-miles traveled per capita by 16 to 34 year-olds on public transit increased by 40 percent.⁵⁹

Why are Millennials driving less? The economy is likely one factor. The recession has been particularly difficult for young Americans—reducing job prospects, curtailing disposable income, and causing many young people to delay forming new households.

However, there are a number of compelling reasons to believe that the economy is not the only factor at play:

Figure 7. Percentage of 16 to 24-Year-Olds with Driver’s Licenses⁵⁸



Generation X Has Also Reduced its Driving

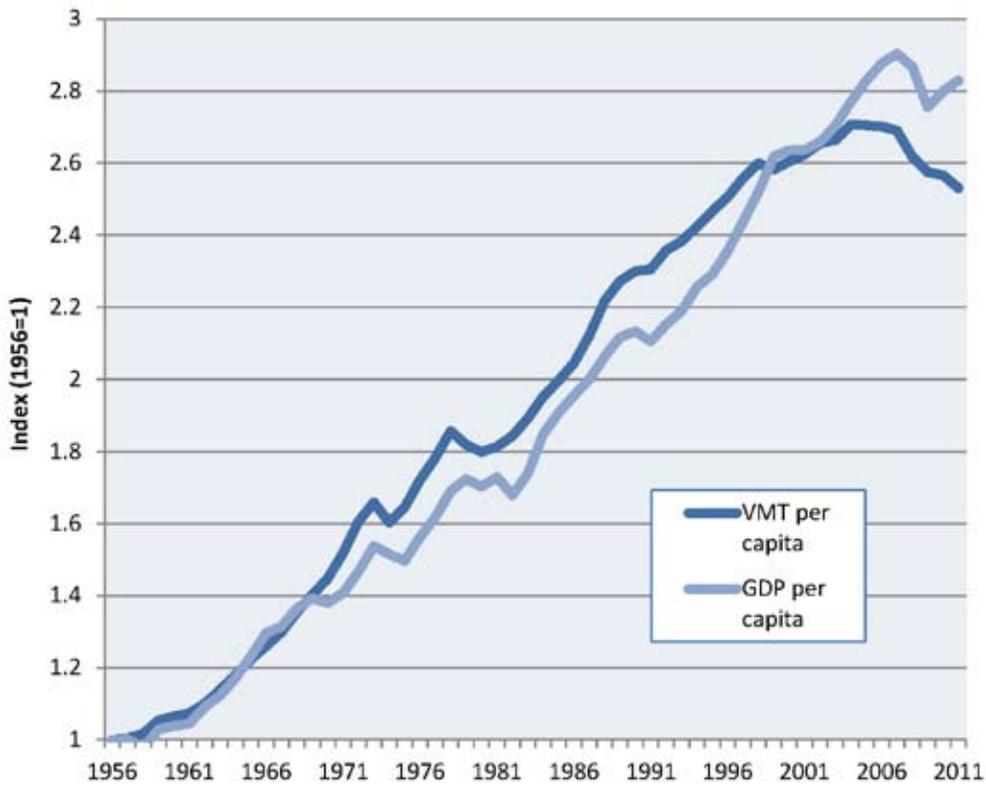
Recent changes in transportation behavior among members of the Millennial generation have attracted great notice, and for good reason—the changes in driving patterns in the United States have been most dramatic among the Millennials, and as America’s largest generation, the preferences and habits of the Millennials have the greatest implications for the future.

However, Millennials were not the only Americans to reduce the number of miles they drove during the 2000s. Members of Generation X (those born between 1965 and 1982) also experienced declines in per-capita driving. Among younger “Gen X’ers” between 30 and 34 years of age in 2009, per-capita driving fell by 17 percent relative to drivers of a similar age in 2001, with a similar decline among those 35 to 39 years of age. The oldest members of Generation X—those between 40 and 44 years of age in 2009—experienced only a slight 3 percent decline in per-capita driving relative to 2001.⁶⁰

- **Driving started to decline before the start of the recession:** The trend toward reduced per-capita VMT began long before the recent recession. Per-capita vehicle travel peaked in 2004, while the recent recession did not begin until the fall of 2007.
- **Driving has fallen among those with jobs:** Among young people, per-capita driving declined among both those with jobs and those without them between 2001 and 2009. Among 16 to 34 year-olds with jobs, per-capita vehicle travel declined by 16 percent during that time span.⁶¹
- **Driving and economic growth have diverged:** After moving in lock-step for decades, trends in economic growth and growth in vehicle travel have diverged in recent years, with per-capita GDP generally growing faster than per-capita vehicle travel since the late 1990s, suggesting that economic growth and vehicle travel are no longer as closely correlated as they once seem to be. (See Figure 8.)
- **New limits have been imposed on young drivers:** Between 1996 and 2006, every state one but one enacted a Graduated Driver’s Licensing law.⁶² These laws impose restrictions on young drivers, limiting the conditions under which new drivers may operate a vehicle and imposing additional costs, thereby discouraging driving.

The recent recession no doubt reduced the number of miles young Americans drove, but the economy is clearly not the only factor at play. Members of the Millennial generation have expressed a greater willingness to pursue less auto-oriented lifestyles than previous generations, and have been the first to grow up with access to the mobile Internet-connected technologies that are reshaping society and how people connect with one another. These changes could be playing a role in the dramatic reduction in driving among young Americans.

Figure 8. Trends in Per-Capita Vehicle-Miles Traveled and Real Gross Domestic Product ⁶³



For decades, economic growth and vehicle travel were closely correlated. Since the beginning of the 21st century, however, economic growth and vehicle travel have diverged, suggesting a weakening link between the state of the economy and the number of miles Americans drive.

Transportation and Lifestyle Preferences of the Millennials

In survey after survey, Millennials express preferences for housing and transportation that differ—sometimes markedly—with those of older generations.

Walkable Neighborhoods

Millennials are twice as likely as Baby Boomers and Generation X'ers to express a desire to live in a city.⁶⁸ According to a survey by the National Association for

Realtors, conducted in March 2011, 62 percent of people ages 18-29 said they would prefer to live in an area described as having a mix of single family houses, apartments and condominiums, with stores, restaurants, libraries, schools and access to public transportation nearby, than in a sprawl-style neighborhood. The percentage of young people who preferred to live in mixed-use, walkable neighborhoods was between four and 11 points higher than that of all other age groups.⁶⁹ Nearly two-thirds of Millennials surveyed for an Urban Land Institute report in 2011 said

Implications of Changing Driving Trends: The View from Wisconsin

By **Bruce Speight, WISPIRG Foundation**

Wisconsin continues to spend heavily on new road capacity and highway expansion, despite the fact that Wisconsinites are driving less.

The average Wisconsinite drove nearly 500 fewer miles in 2010 than in 2004, when total and per-capita VMT peaked. Yet, Wisconsin's transportation spending plans and recent state budgets have been tone deaf to these emerging trends. A January 2013 WISPIRG Foundation report found that Wisconsin has committed a disproportionately large amount of its planned spending to building new and wider highways. Wisconsin ranked 11th among the 50 states in the percentage of funds it is committing to new road capacity, with 30 percent of its State Transportation Improvement Plan (STIP) designated for new capacity, compared to a national average of 20 percent.⁶⁴ Those investment choices appear strange, not only because of the recent reductions in driving but also because Wisconsin's population is expected to grow much more slowly than the U.S. population over the next several decades.⁶⁵

The trends hardly justify diverting limited transportation resources from other transit and repair needs to major highway expansion projects. But that is exactly what state leaders have done. In the 2011-2013 biennial budget, state leaders increased the major highway budget by nearly 10 percent, while decreasing state funding for transit systems by 10 percent, as well as cutting funding for local road repair.

Major components of Wisconsin's transportation system are crumbling and in some cases inadequate. According to a 2008 report, 43 percent of Wisconsin's roads were rated as being in "less than good" condition, and 1,142 structurally deficient bridges in Wisconsin stood in need of repair in 2010. Drivers in Wisconsin pay an average of an extra \$281 per year in vehicle operating costs due to the poor condition of our roads and bridges.⁶⁶

Shrinking transit systems, meanwhile, are leaving Wisconsinites with fewer options for travel. With state budget cuts to transit agencies, local transit systems are increasingly cutting service, raising fares, or both. A University of Wisconsin Milwaukee study found that in Milwaukee, bus service miles have been reduced by nearly 20 percent since 2001. As a result, tens of thousands of jobs have become inaccessible to Milwaukee residents, making economic recovery more difficult for both the city and the state.⁶⁷

The time has come to reevaluate the state's transportation planning process to ensure that transportation investments reflect population, demographic and transportation trends.

WISPIRG Foundation is a non-profit organization that works to protect consumers and promote good government.

that walkability was essential (14 percent) or preferable (50 percent) in their housing choices.⁷⁰

Changing Values and Preferences

According to a recent survey by KRC Research and Zipcar, 44 percent of young people (18-34 years old) polled said they have consciously made an effort to replace driving with other transportation options—this is compared with 33 percent of those aged 35 to 44 and 26 percent of those 55 years old and up.⁷¹ A survey conducted by RCLCO in 20 major metropolitan areas found that 20 percent of Millennials would consider giving up a car as an unjustified expense, a far higher percentage than other generations.⁷²

Fading Car Culture

Mobile communications and computers have supplanted cars as the most important technology in the lives of Millennials. According to a survey conducted for Zipcar, 35 percent of those aged 18 to 34 believe that losing their computer would have the greatest negative impact on them, with 30 percent saying that loss of their mobile phone would be most negative. Only 28 percent said the same thing about their car. Baby Boomers ranked these choices in the opposite order, with nearly half of those aged 55 and up reporting that losing their car would have the greatest negative impact on their life, while 31 percent said the same thing about their computer and only 7 percent said their mobile phone.⁷³ Nearly two out of three college students responding to a 2011 survey by computer networking company Cisco said that they would choose an Internet connection over access to a car.⁷⁴

Millennials are also less likely to express an interest in automobiles as a hobby or cultural phenomenon: less than 15 percent of Millennials describe themselves as “car enthusiasts” as opposed to 30 percent of Baby Boomers.⁷⁵

The Mobile Technology Revolution, Millennials and Transportation

The use of mobile, Internet-connected technology has increased at almost incomprehensible speed. As recently as October 2010, according to the Nielsen market research firm, only 29 percent of all mobile phones in the United States were smartphones.⁷⁶ Less than two years later, that figure had nearly doubled to 55.5 percent.⁷⁷

No generation has adopted high-tech lifestyles as quickly or as enthusiastically as the Millennials. Internet use is near universal among Millennials, with 95 percent of 18 to 29 year-olds using the Internet compared to 52 percent of those 65 years old and up.⁷⁸ Two-thirds of young adults (18 to 29) own smartphones, compared with 45 percent of the population overall.⁷⁹ Cell phone owners between the ages of 18 and 24 exchange more than 100 text messages *per day* on average, compared with 41 for the population as a whole.⁸⁰

Technology has created revolutionary changes in Millennials’ social and economic lives. Three-quarters of 18 to 24 year-olds were using social networking by December 2008, a time when less than one-third of Americans over the age of 35 were using the technology.¹³⁷ A survey by computer networking equipment maker Cisco in 2012 found that two-thirds of college students and young professionals spend at least as much time with friends online as they do in person.⁸¹ Young people report being more likely to purchase items online rather than traveling to a store, and more likely to choose to spend time with friends online than driving to see them.⁸²

The spread of mobile, Internet-connected technology has the potential to change transportation just as it has changed other aspects of society. Specifically:

- **Mobile technology makes non-driving travel options more appealing.** Mobile technology can remove many of the day-to-day barriers that dissuade people—especially casual users—from using public transportation. New mobile apps allow transit riders to obtain real-time information on arrivals and departures, gain assistance with route and schedule planning, and even pay fares by smartphone. Because these tools are relatively new, there is little research on their impact on transit utilization, though a recent study found that the launch of real-time bus information in Chicago had led to a modest increase in bus ridership.⁸³

Mobile technology also allows transit riders to engage in recreational or job-related activities while riding—something that is difficult and dangerous to do while driving—and provides pedestrians and bicyclists with access to navigational information, including the location of nearby stores, transit stops and other amenities.

- **Mobile technologies enable new transportation options.** The past several years have seen an explosion of new transportation alternatives that rely on the Internet or mobile technologies. Several varieties of car sharing, bike sharing, taxi-booking services, and real-time ride sharing have come onto the scene. Again, with the exception of traditional car sharing (which has become mainstream and has been shown to reduce vehicle travel⁸⁴) it is too early to tell if any of these new transportation options will gain broad acceptance or make a significant impact on vehicle travel. Each of them, however, create new options that travelers can use to reduce the need to own a personal vehicle.

- **Mobile technologies can substitute directly for driving.** Telework, e-shopping, social networking, teleconferencing and distance education all have the potential to substitute for trips that might once have been made by car. Research on the impact of activities such as telework and e-shopping on vehicle travel has been mixed, though most studies suggest that telework leads to a reduction in VMT.⁸⁵

Unsurprisingly, Millennials have been the most likely to report having used these new, technology-enabled alternatives. According to the recent Zipcar survey cited above, 25 percent of those aged 18 to 34 reported that mobile transportation apps (such as taxi apps, real-time transit information and car sharing) had reduced their driving frequency, compared with only 9 percent of those 55 years of age and older.⁸⁶ People who use these apps quickly come to rely on them—when a popular bus-tracking application in Washington, D.C., ceased functioning in December 2012, the company’s in-box was quickly flooded with more than 7,000 angry e-mails from customers.⁸⁷

Summary

Millennials are demonstrating significantly different lifestyle and transportation preferences than older generations. They drive less on average than previous generations of young people. More of them say they wish to live in cities and walkable neighborhoods. And more of them are drawn to forms of transportation other than driving. Moreover, the Millennials are the first generation whose lifestyles are shaped by the availability of mobile, Internet-connected technologies, social media, and the innovative forms of social connection, commerce

and mobility that those technologies are spawning.

There is a chance that the differences in transportation and lifestyle habits currently demonstrated by Millennials may fade as they age. But it is also possible that cultural changes and advances in mobile technology will continue or even accelerate Millennials' transition away from

driving—with massive implications for transportation policy.

How could the changing driving behaviors of the Millennials and subsequent generations affect overall demand for driving? And what implications would those changes have on transportation policy? The next two sections address those questions.

Americans Will Drive Less than Was Predicted a Few Years Ago. How Much Less Is Uncertain.

The maturing Millennials play a profound role in determining America's future transportation needs. It is too soon to tell whether their desire for less auto-intensive lifestyles will persist or even grow over time. It is increasingly clear, however, that Americans will likely drive far fewer miles in the future than government agencies forecast even a few years ago. That conclusion has powerful ramifications for transportation policy in the years to come.

Three Scenarios of Future Driving

One way to understand the potential implications of changing driving trends is through the use of **scenario analysis**. According to one definition, "A scenario is a tool for ordering one's perceptions about alternative future environments in which today's decisions might be played out."⁸⁸ Scenario analysis enables the public and policy makers to assess the likely

implications of various "what ifs" of future trends. Scenarios are *not* predictions of the future, but rather visions of possible futures that may unfold.⁸⁹

In this report, we present three simplified scenarios of future trends in driving up to 2040 as a means to consider the possible implications for transportation policy of various pathways. All three scenarios are built on a common set of population projections and demographic assumptions from the Census Bureau. (See "Methodology" for the full details on how the scenarios were constructed.)

In comparison to recent trends in vehicle-miles traveled per capita, the three scenarios are all quite conservative. None portray the possibility that per-capita driving might continue to decline at the annual pace it did for specific age cohorts between 2001 and 2009, much less accelerate. Nor does any scenario portray a future in which per-capita driving continues to fall for any age cohort after 2025. The amount of vehicle travel under scenarios with more aggressive or persistent reductions would fall far below any of those represented here, with far more dramatic consequences.

Back to the Future

The **Back to the Future** scenario assumes that the decline in driving in the United States since 2004 is a temporary “blip,” not a lasting trend. It is consistent with a worldview that attributes the recent decline in driving largely to economic factors (such as slower economic growth and higher gas prices) and assumes that those conditions will fully reverse. The *Back to the Future* scenario is consistent with a world in which the housing and transportation preferences of Millennials increasingly come to mimic those of previous generations, economic growth returns to its brisk pace of the late 20th century, and the net effect of mobile, Internet-connected technology on demand for driving is minimal to non-existent. We represent the *Back to the Future* scenario by assuming that driving among members of a particular age group and sex will return to that group’s per-capita driving levels of 2004 by 2020 and continue at those levels thereafter.

Enduring Shift

The **Enduring Shift** scenario assumes that the shift in driving behaviors that has occurred over the last decade is real and lasting. It is consistent with a worldview in which the shift in housing preferences toward walkable neighborhoods and embrace of a broader range of transportation choices by Millennials and others persists as they age and is adopted by future generations as they reach driving age. The *Enduring Shift* scenario represents a world in which the cost of gasoline continues to remain high, a revival of economic growth does not result in a proportional increase in vehicle travel, and changes due to advances in mobile, Internet-connected technology continue to alter patterns of vehicle ownership and reduce per-capita driving, but only to the degree they have already done so.

We represent the *Enduring Shift* scenario by assuming that drivers in each age and sex cohort retain the same relative size of their

reduction in driving as they age that they experienced relative to the previous cohort of drivers their age between 2001 and 2009. For example, if 20 year-old males in 2009 drove 20 percent less than 20 year-old males did in 2001, it is assumed that eleven years later in 2020 they will similarly drive 20 percent less than 31-year-old males did in 2001. Similarly, it is assumed that in 2030 this same cohort will drive 20 percent less than 41-year old males did in 2001. New drivers are assumed to reduce their driving (relative to 2001 per-capita driving levels by age) by the same percentage as 16-to-24-year-olds did between 2001 and 2009. Thus, a 20-year-old male in 2020 or 2030 will drive approximately the same amount as a member of this cohort did in 2009.

Ongoing Decline

The **Ongoing Decline** scenario assumes that the decline in driving that has taken place over the last decade is the beginning of a deeper change in transportation patterns. The *Ongoing Decline* scenario is consistent with a worldview in which the recent change in driving patterns among young people is but the start of a broader shift—driven by changes in technology and consumer preferences—that makes driving a less necessary or desirable task for daily living than it has been in the recent past. The *Ongoing Decline* scenario may also represent a world in which external factors—such as dramatically higher gasoline prices, increased concern about the environment, or prolonged economic malaise—will increase the level of urgency for individuals to find alternatives to auto-oriented lifestyles. This scenario does not suggest that driving will become obsolete for Americans, but rather that it will stabilize at a much lower level per-capita after a period of additional change.

We represent the *Ongoing Decline* scenario by assuming that the percentage reduction in driving behavior experienced by each cohort during the eight years between

2001 and 2009 will be replicated over the 16 years between 2009 and 2025, and that new drivers will drive even less than young drivers did in 2009.

Implications of Possible Futures

The three scenarios do not represent predictions of the future. Rather, they are intended to illustrate a range of plausible outcomes.

As can be seen in Figure 9, the *Back to the Future* scenario would result in a rapid return to overall VMT growth, though, due to demographic shifts, driving would

still increase at a slower rate than in the past. Ultimately, VMT would increase by 24 percent by 2040. In the *Enduring Shift* scenario, overall VMT remains roughly at today's levels through the mid-2020s before rising again (though at a slower rate than in previous decades) as Millennials hit peak driving age, resulting in an 7 percent increase in VMT in 2040. That 7 percent increase in VMT compares with a 21 percent increase in population over the same time span. In the *Ongoing Decline* scenario, total VMT declines steadily through the mid-2020s—bottoming out at a level roughly 19 percent below the peak VMT of 2007. VMT remains roughly stable thereafter and fails to ever regain its 2007 peak by the end of the study period in 2040.

These three scenarios represent dra-

Figure 9. Vehicle-Miles Traveled under the Three Scenarios, 1946-2040

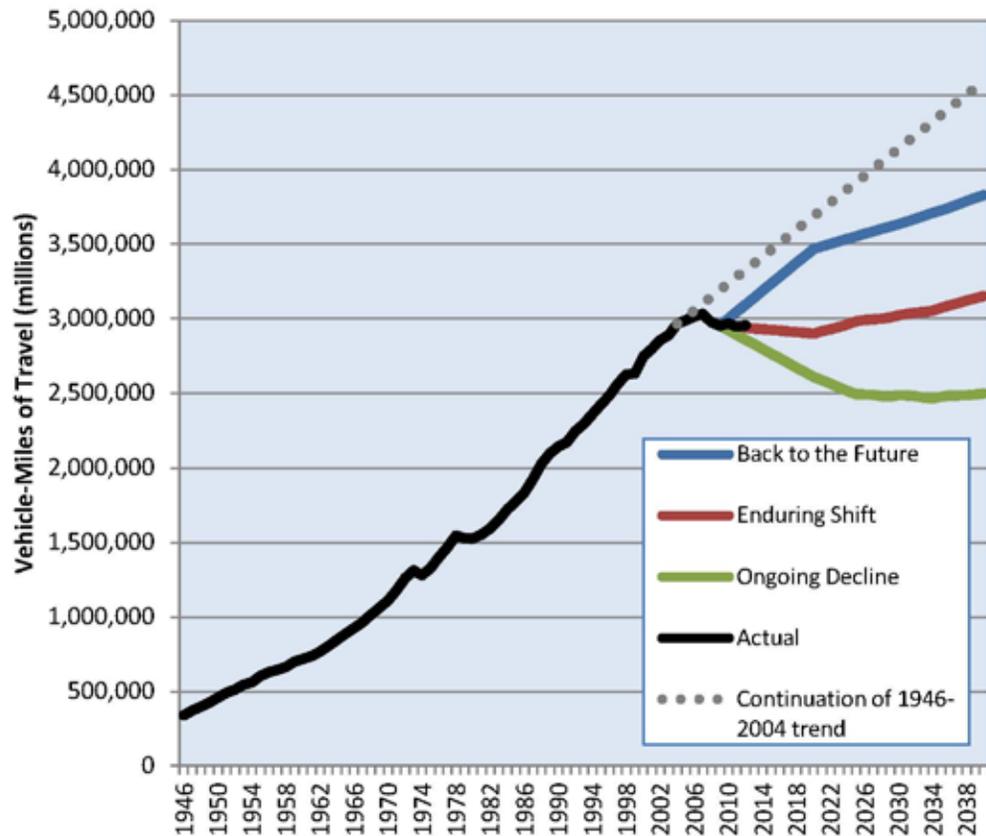
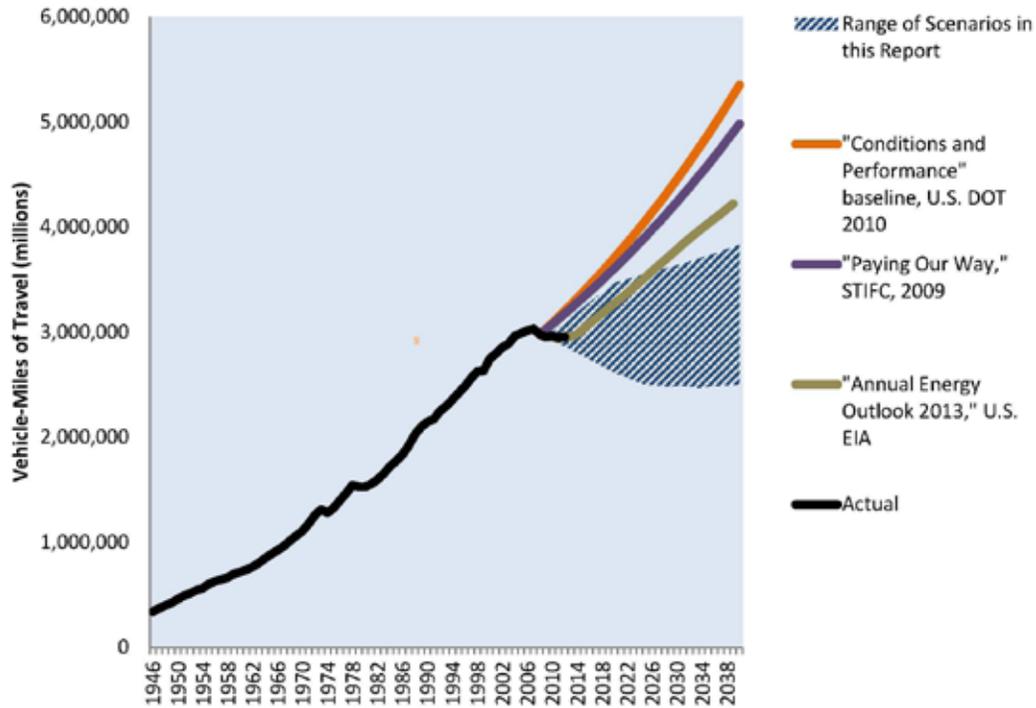


Figure 10. Recent Government Forecasts Compared with the Three Scenarios of VMT, 1946-2040



U.S. DOT = U.S. Department of Transportation
 STIFC = Surface Transportation Infrastructure Financing Commission
 U.S. EIA = U.S. Energy Information Administration

matically different visions of the future. By 2040, the difference in VMT among the three scenarios reaches nearly 1.3 trillion miles. All three scenarios, however, represent a break from the trend in driving during the Driving Boom era. Had those trends continued without change, Americans could have been expected to drive more than 4.5 trillion miles by 2040.

The “starting point” for each of the three scenarios is 2009—the last year for which data on vehicle travel by age are available from the National Household Travel Survey.⁹⁰ Actual aggregate VMT data from 2010, 2011 and 2012 have so far tracked nearly exactly with the *Enduring Shift* scenario. This does not necessarily

mean that the *Enduring Shift* scenario is most likely to represent future driving trends. It does mean that neither the rapid return to previous levels of driving assumed by the *Back to the Future* scenario nor the deeper trend away from driving described by the *Ongoing Decline* scenario appear to have yet begun.

While the three scenarios differ greatly with one another, *all three scenarios* would represent a departure from recent government forecasts of future driving. Figure 10 above compares the range of VMT from the three scenarios above with three recent government documents that forecast future VMT growth rates:

- *Paying Our Way*, the 2009 report of the National Surface Transportation Infrastructure Financing Commission (STIFC), a blue-ribbon panel created by Congress to evaluate the nation’s transportation funding needs.⁹¹
- The U.S. Department of Transportation’s (U.S. DOT) *2010 Status of the Nation’s Highways, Bridges, and Transit: Conditions & Performance* (“*Conditions and Performance*”) report, the latest in a series of biennial reports to Congress on the status of the nation’s transportation system.⁹²
- The U.S. Energy Information Administration’s (U.S. EIA), *Annual Energy Outlook 2013: Early Release*, the latest in a series of annual forecasts of energy use in the United States.⁹³

Only the most recent of these projections—published by the EIA—is near the boundaries of the three scenarios evaluated

here. (Although previous EIA forecasts have failed to foresee the recent decline in driving, see page 41.) Indeed, actual levels of vehicle travel have already diverged from the government forecasts made a few years ago, which were issued after the start of the recession and after several years of declining per-capita travel.

While we cannot be certain about the magnitude of future changes in driving trends, it is increasingly clear that Americans will drive significantly fewer miles in the future than was forecast even a few years ago. And if Millennials and others continue to reduce their driving relative to previous generations of Americans, it is possible that future driving behaviors will diverge from those predictions even more dramatically.

Changing driving trends have many important implications for transportation policy and various aspects of American life. The following section explores these implications in detail.

The Implications of Changing Driving Trends: Opportunities and Challenges

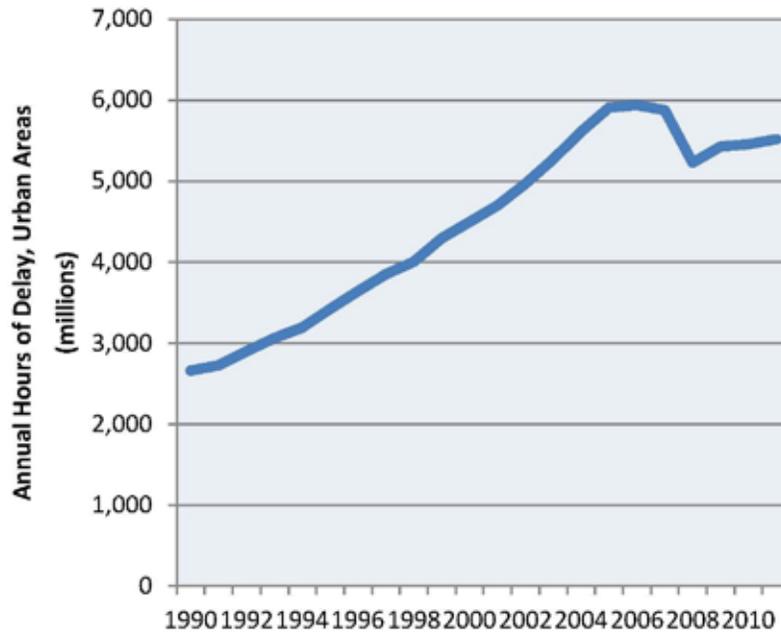
Changing trends in driving both create great opportunities and pose significant challenges to the United States. Flagging demand for driving curbs the threat of traffic congestion, reduces oil consumption and its resulting pollution, curtails the potential need for expensive new investments in highway expansion, and reduces the wear and tear on our roadways. However, reduction in the rate of growth in driving also threatens the stability of the nation's transportation funding system, which is already failing to meet its obligations.

Less Congestion

As driving has fallen in recent years, so has traffic congestion. According to data from the Texas Transportation Institute's (TTI) Urban Mobility Report, Americans spent 421 million fewer hours stuck in traffic in 2011 than they did in the peak congestion year of 2005.⁹⁴ After decades of increasing

road congestion, Americans now spend less total time stuck in traffic than they did in 2004, according to the TTI analysis—despite an 8.5 percent increase in urban population over that span of time.⁹⁵ Congestion continued to fall in 2012, according to the travel monitoring company, INRIX, which estimated that congestion fell by a whopping 22 percent in 2012 before ticking up again in the opening months of 2013.⁹⁶

Congestion levels do not necessarily track with total VMT. If vehicle travel is rising in urban areas and declining in rural areas, or if individuals are shifting travel to more-congested highways or times of day in which congestion is more likely, it is quite possible for congestion to increase even amid stagnating VMT. It is likely, however, that a rapid rise in VMT such as that posited in the *Back to the Future* scenario would cause a rise in congestion, while the *Enduring Shift* scenario would result in congestion remaining at roughly today's levels for at least another decade, and the *Ongoing Decline* scenario resulting in further reductions in congestion. None of these scenarios would result in congestion

Figure 11. Hours Lost to Traffic Delay Annually, 1990-2011⁹⁷

levels that would be predicted by models that assumed the steady increases in VMT common during the Driving Boom.

Thus, transportation investment can safely focus less on preventing massive increases in traffic congestion and more on other priorities.

Reduced Fossil Fuel Consumption and Air Pollution

Gasoline consumption for transportation—which accounts for 45 percent of America’s consumption of oil—contributes to a litany of problems.⁹⁸ It leaves America dependent on foreign regimes for oil (contributing to national security challenges and the trade deficit), it contributes to global warming and to dangerous air pollution in our

cities, and it leaves Americans’ pocketbooks vulnerable to volatile swings in world oil prices.

The recent reduction in driving in the United States has helped reduce our dependence on oil. In 2011, U.S. gasoline consumption for transportation hit a 10-year low, due in part to both stagnant driving and improved vehicle fuel economy.⁹⁹ The decline in transportation oil consumption was one of several factors contributing to a reduction in petroleum imports to their lowest level since 1995.¹⁰⁰ Emissions of carbon dioxide, the leading global warming pollutant, from transportation were the lowest since 1999.¹⁰¹

Consumption of energy for light-duty vehicles is expected to decline in the next several decades as a result of improved fuel economy. However, fuel consumption would decline even more under scenarios with greater reductions in vehicle travel. By 2040, for example, the *Enduring Shift* scenario would result in the United States

using the equivalent of 16 billion fewer gallons of gasoline per year for our cars and light-duty trucks than in the *Back to the Future* scenario—the rough equivalent of all the gasoline currently consumed each year in California. The *Ongoing Decline* scenario, meanwhile, would result in the nation using roughly half as much gasoline or alternative fuels in our cars and light trucks by 2040 as we use today. Proportional reductions in health-threatening air pollution and pollution that contributes to global warming could also be expected.

In sum, a future in which vehicle travel resembles the *Enduring Shift* or *Ongoing Decline* scenarios represents a great opportunity to reduce the nation's persistent problems with oil dependence, as well as the environmental and public health costs associated with our reliance on fossil fuels.

Reduced Expenditures for Highway Expansion and Maintenance

Reduced VMT growth can have a major impact on assumptions of future transportation investment needs. Reduced vehicle travel reduces congestion—undermining the cost-benefit rationale for many highway expansion projects—and reduces wear and tear, reducing the need for maintenance expenditures in the long run.

Two recent estimates of highway investment needs illustrate the dramatic savings that are possible by reducing vehicle travel. The U.S. Department of Transportation's 2010 *Conditions and Performance* report evaluated two scenarios for highway investment needs: one that reflected states' projections that VMT would increase by an annual rate of 1.85 percent per year,

and another that reflected a more modest 1.23 percent per year increase. At the higher VMT projection, the department estimated that there was more than \$105 billion in “cost-beneficial” spending that could occur each year, as opposed to \$80 billion in the lower VMT scenario.¹⁰²

Similarly, the American Association of State Highway and Transportation Officials' (AASHTO) 2009 *Bottom Line* report mapped out alternative transportation investment scenarios assuming 1.4 percent and 1.0 percent annual VMT growth going forward, with the 1.0 percent scenario costing 20 percent less than the one reflecting steeper growth.¹⁰³

Maintenance needs are affected not just by the amount of traffic, but also by the types of vehicles traveling on roads and bridges. Heavy-duty trucks impose far greater damage on roads than light-duty vehicles.¹⁰⁴ As a result, a future in which there are fewer miles driven overall, but more of them in heavy trucks, could result in similar or greater wear and tear on highways. However, the number of miles driven in the heaviest trucks has actually declined *faster* than overall vehicle travel in recent years, falling by 11 percent between 2007 and 2011.¹⁰⁵ There is little evidence thus far for the proposition that reductions in household driving must coincide with an increase in heavy-duty truck traffic.

The *Back to the Future*, *Enduring Shift* and *Ongoing Decline* scenarios, therefore, can be expected to have dramatically different implications for future highway maintenance and construction needs, with the investments required under the *Back to the Future* scenario resembling those described by recent evaluations of transportation investment needs by AASHTO, the U.S. DOT and others. The *Enduring Shift* and *Ongoing Decline* scenarios, however, hold out the possibility that those needs might not be quite so great.

These scenarios speak to future maintenance needs, not the pressing need to

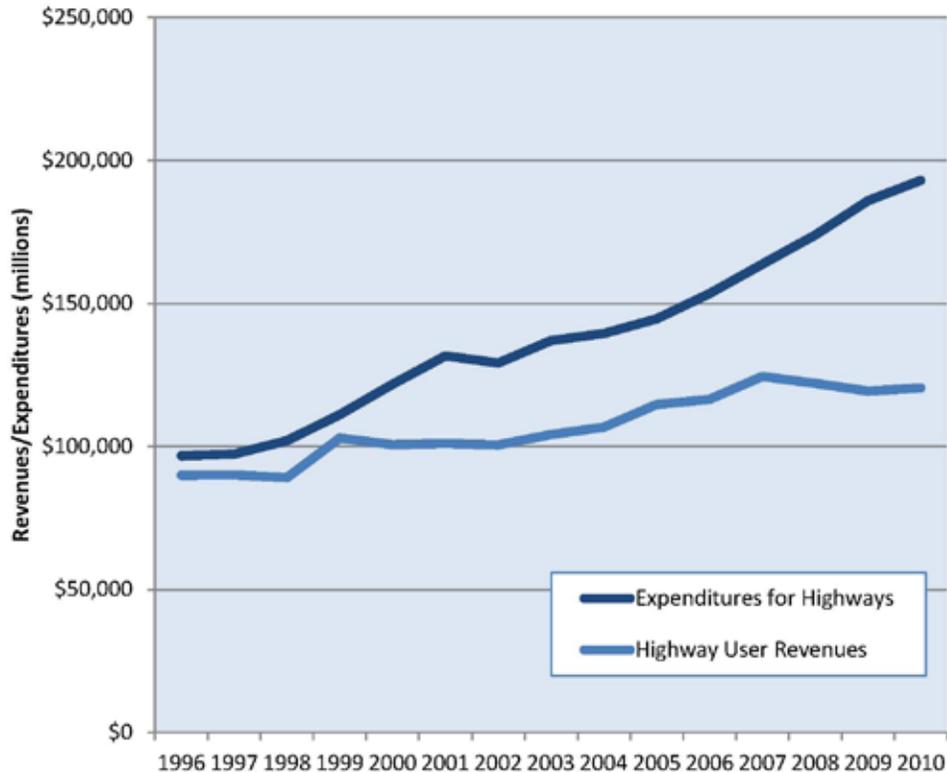
address the significant and mounting backlog of infrastructure repair projects in the United States at present. Shifting funds from highway expansion projects that may not be necessary in the future to repair and maintenance projects would be a reasonable response to any of the three scenarios.

Reduced Revenue from the Gasoline Tax

While reduced driving lessens the need for new highways and repairs of old ones, it also diminishes the amount of money available to fund transportation improvements by eroding the chief source of transportation revenue: the gas tax.

There remains a common misconception that “roads pay for themselves”—that is, that revenues from the gasoline tax are sufficient to cover the costs of highways and driving.¹⁰⁶ By 2010, revenue brought in from gas taxes and other user fees (not all of which is dedicated to highways¹⁰⁷) equaled only 62 percent of highway spending by all levels of government.¹⁰⁸ In other words, for every two dollars of highway improvements paid for by drivers, general taxpayers chipped in a third dollar—a subsidy of \$73 billion in 2010 alone. While projects paid for by the American Recovery and Reinvestment Act helped fuel the continued increase in road spending in 2009 and 2010—widening the gap between revenues and expenditures—the long-term trajectory has been toward increased dependence on general taxpayers for transportation funding, both at the federal level and in many states.¹⁰⁹

Figure 12. Highway User Revenues versus Expenditures for Highways¹¹⁰



In 2009, the National Surface Transportation Infrastructure Financing Commission (STIFC) concluded that the nation faced a “crisis” in transportation finance. The commission concluded that making up the gap between anticipated revenues and the cost of investments needed to maintain the system would require an increase in state and federal gasoline taxes of 53 to 58 cents per gallon, or a per-mile fee on driving (VMT fee) of 3.2 to 3.5 cents per mile.¹³⁸

The recent trend toward reduced driving—coupled with continued moves to improve vehicle fuel economy—makes the commission’s bleak revenue projections look positively rosy.

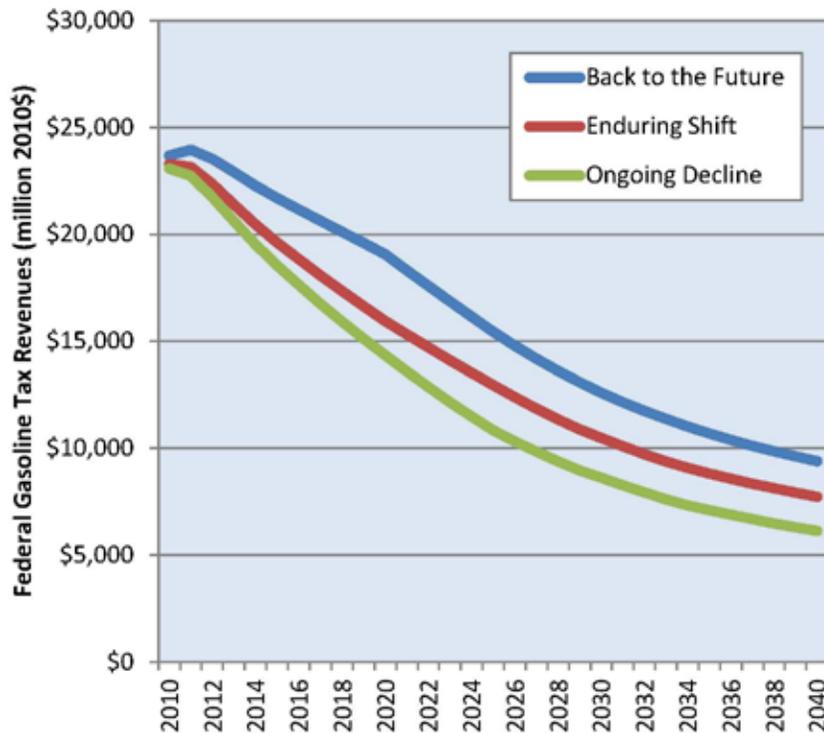
To estimate the impact of the various scenarios on federal gasoline tax revenue, we multiplied the light-duty portion of VMT under each of the three scenarios

presented in this report¹¹¹ by the current federal gasoline tax rate of 18.4 cents per gallon and divided that figure by the fleet average real-world vehicle fuel economy (in miles per gallon) projected by the EIA in its *2013 Annual Energy Outlook*.¹¹²

All three scenarios would result in significantly lower real revenues in future years due to the effects of inflation and improvements in vehicle fuel economy, but the size of the reduction depends greatly on trends in vehicle travel. Under the *Back to the Future* scenario, gasoline tax revenue would decline by 60 percent by 2040 when corrected for inflation, relative to 2011 levels. Under the *Enduring Shift* scenario, the decline is a more significant 67 percent, while under the *Ongoing Decline* scenario it is 74 percent.

Since most states also fail to index their gasoline taxes to inflation, the decline in

Figure 13. Inflation-Adjusted Federal Gasoline Tax Revenue under the Three Scenarios (2010\$)



the real value of the gasoline tax will be magnified.¹¹³ The 36 states with flat rate (i.e., non-indexed) gasoline and diesel taxes have already seen a 29 percent erosion in the value of their fuel taxes since the last time those taxes were raised, contributing to a \$10 billion decline in real state gas tax revenue.¹¹⁴ Stagnation in driving, coupled with improving fuel economy and the effects of inflation, would compound the erosion of transportation funding at the state level as well.

Changes in VMT trends would also affect the sustainability of funding from VMT-based fees, a commonly proposed alternative to the gasoline tax. VMT fees would need to become significantly higher over time in order to generate the same amount of revenue.

Increased Risk for Public-Private Partnerships

As gasoline tax revenues have dried up, federal and state transportation officials have sometimes looked toward public-private partnerships (PPPs) as a potential alternative. There are many possible ways for government to partner with the private sector, including traditional forms of financing and procurement that raise private money through the municipal bond market and hire private contractors to provide materials and labor. But most of the attention given to PPPs involves the potential for a private entity to agree to build and/or maintain a highway for a given period of time in exchange for revenue—in many cases, from vehicle tolls.

Uncertainty regarding VMT trends reduces the attractiveness of toll revenue as a payout to private investors. Fewer investors will be willing to invest the massive amounts of capital required to build and maintain a toll road if the

number of paying customers is not likely to rise over time. In 2005 and 2006, foreign toll road operators financed by large financial companies made large bets on future traffic volume by purchasing a 99-year lease in Chicago and a 75-year lease in Indiana for major toll roads. In each of these deals and many smaller ones, the private investors acted as concessionaires, collecting tolls for their own bottom line. Many people thought these toll concessions were the wave of the future.

Several toll concessions have produced less revenue than expected. Some have needed to be bailed out by the government. Others—such as a brand-new billion-dollar toll road in Texas that sought to attract traffic by posting the nation’s fastest speed limit, 85 miles per hour—have faced the threat of a credit downgrade as a result of flagging traffic.¹¹⁵ These shortfalls in privately collected tolls do not necessarily mean that the government received a “good deal,” since more expensive private capital costs and other potential compensation must also be covered.¹¹⁶

More recently, the trend toward toll concessions has been replaced with an alternative form of long-term PPP arrangement in which private investors are paid a pre-established rate by the government for making toll lanes available.¹¹⁷ A downside of using these so-called “availability payment” arrangements is that they merely shift the risk of lower-than-expected toll revenue from reduced travel from private enterprise to taxpayers, eliminating one of the important potential benefits claimed for PPPs.

The trend away from toll concessions and toward availability payments can be seen as an implicit bet by Wall Street and other investors against the idea that vehicle travel will return to the sustained growth of the Driving Boom years, and an indication that investors are seeking a hedge against VMT trends similar to those

in the *Enduring Shift* and *Ongoing Decline* scenarios.

Emergence of trends similar to those of the *Back to the Future* scenario would likely set off a resurgence of investor interest in toll road concessions, whereas the other scenarios would likely solidify the trend away from toll concessions. Another implication is that governments could doubly lose out if they invest in building and maintaining new toll lanes based on financing projections that assume the *Back to the Future* scenario. If the *Enduring Shift* or *Ongoing Decline* scenarios instead come about, then governments could find they have paid for new lanes that are both unneeded and fall far short of covering their expected costs.

Changing vehicle travel trends pose risks not just for private investors but for taxpayers as well—regardless of how the risks are distributed at the outset of a PPP arrangement.

Summary

Changing trends in driving bring with them tremendous opportunities, as well as significant challenges. Stagnant or declining VMT would significantly reduce many of the environmental and public health problems caused by driving, while reducing growth in congestion and alleviating the need for costly expenditures to maintain and rebuild highways. However, reduced driving has already contributed to the nation's transportation funding woes by eroding gasoline tax revenue, and it also poses major obstacles to potential funding sources that have been suggested as alternatives to the gas tax, including VMT charges and public-private partnerships.

Transportation policy in the United States should work to maximize the benefits of changing driving trends by supporting the desires of Millennials and others to reduce their driving, while also addressing the funding challenges posed by reductions in vehicle travel. The following section lays out a blueprint for how transportation policy could be revised to meet the needs of the 21st century.

A New Vision for Transportation Policy

The nation's current transportation policies were borne out of the needs of early to mid-20th century America. Those policies did an excellent job of raising money for and building new highway capacity. By the end of the 20th century, these policies had succeeded in completing the Interstate Highway System and largely financed the creation of a road network designed to encourage and accommodate the postwar Driving Boom.

The needs of 21st century America are different, but our transportation policies remain stuck in the past. We continue to spend vast sums on highway construction projects of dubious value, even as the highway infrastructure America built in the 20th century ages and deteriorates. Meanwhile, there is little recognition among policymakers that transportation trends have changed, or that the needs and desires of rising generations such as the Millennials may be different from those of previous generations of Americans.

America's current transportation policy framework is unproductive and unsustainable. The nation needs to hit the "reset" button on transportation policy to account for recent changes in driving habits and to

create a transportation system that meets the needs of the 21st century.

A new vision for transportation policy in the United States begins with a few common-sense principles.

1. Plan (and invest) for uncertainty.

The evidence is clear that the Driving Boom—the 60-year period of regular, steady increases in per-capita driving—is now over. We don't yet know, however, what will replace it.

Are the changes that have occurred in driving behaviors—particularly among young Americans—temporary shifts that will be erased by renewed economic growth? Are they just the beginning of a more sustained shift away from auto-oriented lifestyles? Or is the reality somewhere in between?

The scenarios of future demand for driving presented in this report are *all* a sea change from the defining assumptions of the Driving Boom era, and

the investments suggested by any of these scenarios differ from those suggested by recent government forecasts that anticipated a return to rapid and sustained growth in vehicle travel. But differences in the three scenarios in this report illustrate a significant gulf between future possibilities. The investment decisions that would be required to accommodate the increase in driving in the *Back to the Future* scenario are vastly different than those that would be needed if the recent drop in driving is the beginning of a deeper decline. How can policymakers possibly make wise long-term investments in such an atmosphere of uncertainty?

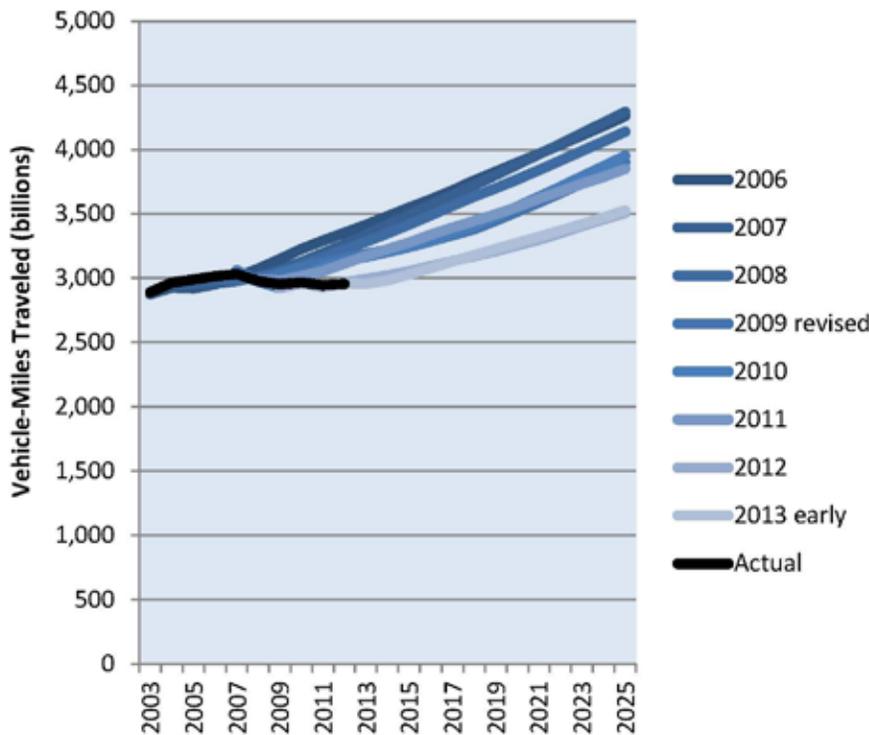
The first step is for policymakers to stop pretending that future increases in driving are foreordained. Over the past decade, official forecasts have continued to predict steady, rapid increases in vehicle travel that have failed to materialize. For example, the

U.S. Energy Information Administration (EIA)—which produces the official U.S. government forecasts of energy use—forecast in 2006 that Americans would be driving more than 3.3 trillion miles per year by 2012. Instead, Americans drove less than 3 trillion miles—10 percent fewer than had been predicted just six years earlier. Figure 14 shows how official forecasts have predicted a resumption of vehicle travel growth year after year, even as that growth has failed to materialize.

To the extent that these forecasts have influenced public policy, America likely finds itself today over-investing in highway capacity at the expense of other transportation and societal priorities.

Transportation planners and public officials must understand that there are important uncertainties in future demand for driving and that these uncertainties are unlikely to be properly accounted for

Figure 14. Recent Energy Information Administration Forecasts of Vehicle-Miles Traveled by Date of Forecast¹¹⁸



using assumptions developed during the Driving Boom.

The second step is for policymakers to incorporate uncertainty into transportation decision-making. Specifically, planners and policymakers should:

- Evaluate transportation proposals under a variety of scenarios of future driving. Regional transportation plans and individual project proposals should be tested against different scenarios for economic growth and gasoline prices, as well as changes in population, demographics and consumer preferences.
- Prioritize projects that are the most likely to deliver benefits under any scenario. Investments in transportation demand management, for example, may compare favorably with large highway expansion projects given that they deliver benefits under a variety of possible future conditions and may be lower in cost and risk.
- Incorporate uncertainty into cost-benefit equations and risk calculations for PPPs. Effective management of PPPs requires a sophisticated understanding of risk. To the degree that private sector entities involved in PPPs take on traffic-related risks in the construction of private toll roads or other infrastructure, the public must be able to understand the potential for and implications of possible default or bailouts. To the extent that the public takes on those risks by agreeing to make future “availability payments,” decision-makers must clearly assess whether the benefits of the project are worth the costs under a variety of scenarios of possible future driving. Consideration of lower-VMT scenarios may be particularly important for selecting

the recipients of the competitive federal “innovative financing” loans (under the Transportation Infrastructure Finance and Innovation Act, TIFIA), so as to avoid overstating the congestion-reducing merits and creditworthiness of highway PPPs.

2. Support the desire of Millennials and other Americans to drive less.

The Millennial generation is saying loud and clear that it is looking for alternatives to auto-oriented lifestyles. Reducing the growth in driving on American roads can bring great benefits to society—curbing the nation’s dependence on oil, reducing congestion without the massive expense and disruption of expanding highways, and reducing emissions of air pollutants that threaten the environment and public health.

Considering that Millennials and subsequent generations will be the primary beneficiaries of the transportation infrastructure we build today (and the ones who will ultimately pay for it) why shouldn’t the investments we make today reflect their needs, particularly if doing so would also deliver broad benefits to society?

At the local level, many city governments are beginning to respond to these new demands, with cities increasingly racing to add bike lanes, streetcars and other infrastructure that enables new transportation options. Development is also now booming in many urban centers. An EPA analysis found that “infill” development in already built-out portions of metropolitan areas attracted a greater share of new residential construction in the late 2000s than earlier in the decade

in nearly three-quarters of the metropolitan areas studied.¹¹⁹ In 2011, the population of large cities grew faster than that of suburban areas for the first time in at least nine decades.¹²⁰ Some state governments are beginning to respond to these new demands as well.¹²¹ But the bulk of America's transportation policy framework is still designed to make building highways easy and investing in other solutions difficult.

In the postwar years, when Americans expressed their desire for suburban housing and greater mobility, the full weight of federal and state governments swung into action, building the Interstate Highway System, enacting automobile-focused planning and zoning codes, and subsidizing new housing in the suburbs.

What might a transportation policy look like that did the same for the Millennials? At minimum, it would:

- Make the expansion of transportation choices to a broader range of Americans a national priority in the 21st century—much as the development of the Interstate Highway System was seen as a national priority in the 20th century.
- Encourage state and local governments to reassess automobile-oriented planning and zoning rules—prioritizing the development of streets and roads suitable for driving, bicycling and walking; revising zoning rules that stand in the way of compact, mixed-use development; and ensuring that transportation infrastructure investments are consistent with land-use plans.
- Refocus federal investment on transportation infrastructure projects that received less investment and attention during the Driving Boom, including investments in the nation's

passenger rail network and in urban transit systems.

While the Millennials will play a critical role in determining future driving trends, transportation policymakers must obviously keep in mind the needs of *all* Americans. The aging members of the Baby Boom generation—largely concentrated in the suburbs—will soon find themselves with new transportation needs. Federal, state and local governments must also consider how the changing mobility needs of the Baby Boom generation will affect demand for public transportation and paratransit services in areas that are often poorly served by current transit systems and must devote resources toward serving those needs.

3. Revisit plans for new or expanded highways.

Short-term and long-term transportation plans are filled with highway projects that were planned under very different expectations of future travel growth. Many of these “legacy projects” were originally proposed decades ago, and approved based on assessments of future travel made a decade ago or more.¹²² Meanwhile, state and federal governments continue to invest vast resources in further expansions of highway capacity, despite nearly a decade of zero growth in vehicle travel. Between 2004 and 2008, states continued to devote 57 percent of highway funding to expansion projects, versus only 43 percent to system preservation.¹²³

The assumptions of future growth in vehicle travel that undergird Long-Range Transportation Plans and short-term Transportation Improvement Programs appear to have not yet been reviewed in any systematic way since the close of the Driving

Boom. For example, the 2010 version of U.S. Department of Transportation's (U.S. DOT) biannual *Conditions and Performance* report—which provides a comprehensive view of the investment needs of the nation's highway and transit systems—was published in March 2012, well after the trend toward stagnant vehicle travel had become apparent. However, the U.S. DOT's study was based on state-supplied VMT growth forecasts that amounted to a 1.8 percent average annual growth rate in VMT—a rate of year-over-year growth that has not been achieved in *any* single year since 2004, and is more than double the average rate of growth between 2000 and 2010.¹²⁴

The period of no growth or slow growth in vehicle travel is likely to continue for at least the next several years, if not longer. Even the Energy Information Administration's 2013 forecast, which anticipates an eventual return to sustained growth in driving, does not anticipate total VMT returning to its peak 2007 level until 2016.¹²⁵ If future driving trends more closely resemble those of the *Enduring Shift* scenario, it will be more than another decade before total VMT returns to its 2007 level; if trends resemble those in the *Ongoing Decline* scenario, they may not return to that level until after 2040, if ever.

This interregnum in vehicle travel growth provides an excellent opportunity to rethink previous transportation investments and reconfigure our priorities. Specifically, federal, state and local governments should:

- Begin an immediate review of projects on state and regional Transportation Improvement Programs and Long-Range Transportation Plans in light of new understandings about trends in vehicle travel. Projects that cannot be justified based on lower levels of expected traffic volume should be delayed or scrapped.
- Refuse to devote additional resources to new highway expansion projects unless the projects have been demonstrated to deliver significantly greater societal benefits compared with other transportation alternatives under a range of possible scenarios of future vehicle travel growth.

4. Refocus the federal role.

The recent sharp decline in federal fuel tax revenues—which has forced the infusion of ever-larger amounts of cash from the general fund to keep the Highway Trust Fund afloat—has led to a new set of conversations about the proper role of the federal government in transportation policy.

The federal government clearly has a role to play in making investments that address strategic national priorities. The current system, however, distributes highway funds to states with little accountability for results and no clear connection to broader strategic objectives.

The United States should establish clear, relevant national priorities for transportation investment. We propose the following priorities:

- The nation should set a goal of bringing the highway and transit systems to a state of good repair as soon as is practical.
- The federal government should serve the changing transportation needs of Americans by supporting the development of communities with multiple transportation options.
- The federal government should expand efforts to promote innovation in the application of technology and small-scale solutions to transportation chal-

lenges. A collection of inexpensive, small-scale fixes can sometimes be just as effective as a major infrastructure expansion in reducing congestion.¹²⁶

The advent of mobile Internet-connected technology provides more opportunities for such small-scale innovations. The federal government can help states to gain access to new solutions and to share their expertise and experiences with those solutions with one another.

Absent from this list of national priorities is expansion of the existing highway system. State and regional governments would be free, under this new vision of federal priorities, to propose highway projects as solutions to transportation needs, but no longer would those investments be first in line for federal taxpayer resources or receive a favorable federal match compared with transit projects or other transportation alternatives.

Once the nation sets clear priorities, all significant transportation investments should be evaluated based on the degree to which projects meet those objectives. The two-year federal transportation law passed in July 2012 (*Moving Ahead for Progress in the 21st Century*, or MAP-21) mandates the creation of performance metrics for states and the federal government, but those state metrics need not be established until years after the law has expired and will yield little benefit if they are not attached to clear triggers that reallocate transportation resources to better meet those goals and reward success.¹²⁷ The current law places light penalties on states that do not develop risk-based asset management plans after 2014 and can impose some light penalties for neglect of federally financed assets after 2018. While these provisions are a first step toward ensuring that transportation spending is aligned with true priorities and that the projects that receive federal funds are those that can deliver the greatest “bang

for the buck,” much more must be done to ensure the effectiveness and accountability of federal transportation spending.

5. Use transportation revenue where it is most needed.

America’s transportation investments continue to be shaped by policies adopted nearly a century ago when paved roads were uncommon and the automobile was a novelty. In those years, state governments began to adopt statutory or constitutional provisions dedicating revenue from the gasoline tax to roads and bridges.¹²⁸ Many of these provisions remain in effect today, while the assumption that all revenues obtained from drivers should be spent for their exclusive benefit continues to shape the transportation debate.

The needs of 21st century America demand that we spend transportation revenue in ways that maximize the benefits for future Americans. Local, state and federal governments should be free to invest in transportation projects that deliver the greatest benefits to society. Outmoded constitutional provisions that bar the use of gasoline tax revenue for public transportation or other transportation alternatives should be discarded, while current federal policies that require transit projects to undergo a more difficult review process than highways or receive a less generous federal match should be eliminated.

6. Do our homework.

The recent decline in driving has exposed the inadequacy and inaccuracy of the current models and planning tools used

to guide infrastructure investments in the United States. At both the national and local levels, transportation planners have continually overestimated traffic demand.

After roughly eight years of stagnation in vehicle travel, the time has come to revisit whether we know everything we need to know about Americans' travel preferences and choices as we plan for the future.

Federal, state and local officials should launch renewed research efforts to inves-

tigate changing transportation trends and to evaluate the impact of new technologies and new patterns of development on accessibility and mobility. Key travel surveys—especially the National Household Travel Survey—should be conducted more frequently (ideally annually¹²⁹) to provide better, more up-to-date information on transportation behaviors. State and local governments should also take steps to consider the implications of changing travel trends in their own planning processes.

Conclusion

The end of the Driving Boom has brought uncertainty to U.S. transportation policy. But it has also brought opportunity. A future of stabilized demand for driving is one in which roads last longer and are cheaper to maintain, traffic congestion remains stable or declines, America is less dependent on oil, and our cars produce less pollution.

The changing transportation priorities of the Millennial generation, the advance of new technology, and other changes provide an opportunity for the United States to create a new transportation policy that meets the needs of the 21st century. To achieve that goal, however, the nation

must integrate our growing understanding of recent changes in transportation trends into every aspect of transportation decision-making, from the ways in which we estimate future transportation funding needs to the ways in which we choose our investment priorities.

We may not know the exact shape of the future, but it is increasingly likely that it will look very different from the past. By retiring Driving Boom-era assumptions and policies that no longer serve the nation's needs, we can build a transportation system that is more affordable, more efficient and more sustainable for the long haul.

Methodology

The scenarios presented in this report are intended to illustrate various visions for how aggregate vehicle-miles traveled (VMT) could change in the future, so as to better understand the implications of those changes on transportation policy. These scenarios are based on historic trends in per-capita VMT by age and gender from the National Household Travel Survey (NHTS), and projections of future population from the U.S. Census Bureau.

The three scenarios evaluated in this report—the *Back to the Future*, *Enduring Shift* and *Ongoing Decline* scenarios—align conceptually with the alternative hypotheses of future trends in driving (“interrupted growth,” “saturation” and “peak car”) suggested by Phil Goodwin in *Peak Travel, Peak Car and the Future of Mobility: Evidence, Unresolved Issues, Policy Implications and a Research Agenda*, International Transport Forum, discussion paper prepared for the roundtable on long-run trends in travel demand, 29-30 November 2012.

Constructing a Profile of Per-Capita VMT by Age and Sex

The scenario analysis required creation of a year-by-year estimate of per-capita VMT by age and sex. The NHTS includes estimates of vehicle-miles traveled by age category and sex for years in which the survey took place (2001, 2009). Data on annual vehicle-miles traveled by age group and sex were downloaded using the NHTS data extraction tool (nhts.ornl.gov/det/Extraction2.aspx) for the 2001 and 2009 surveys, and were divided by the number of licensed drivers of each sex in each age category (obtained from the FHWA’s *Highway Statistics* series of reports) to arrive at a figure for VMT per licensed driver for members of each age group and sex.

To arrive at an estimate of average per-capita VMT for each age and gender, VMT-per-licensed-driver was multiplied by the number of licensed drivers of that sex and age group¹³⁰ from U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* series of reports, and divided by population for that age and sex from the U.S. Census Bureau.¹³¹

Population Estimates and Projections

Population estimates for the 2001 through 2010 period, broken down by age and sex, were obtained from the U.S. Census Bureau (www.census.gov/popest/data/intercensal/index.html). Population estimates for 2010 and 2011 were also obtained from the Census Bureau. Updated population projections for 2012 through 2040 were obtained from the U.S. Census Bureau in December 2012 (www.census.gov/population/projections/data/national/2012.html).

Constructing the Scenarios

This report uses three scenarios—*Back to the Future*, *Enduring Shift*, and *Ongoing Decline*—to illustrate the implications of various potential trends in per-capita household vehicle travel on transportation policy.

All three scenarios are built on estimates of household VMT, from which estimates of total VMT are calculated as described in the “Factoring in Non-Household VMT” section below. All three scenarios share a base year of 2009, the last year for which age and gender-specific VMT data are available. Household vehicle-miles traveled for 2009 were calculated by multiplying age- and gender-specific estimates of per-capita VMT in 2009 (calculated based on the NHTS and FHWA sources described above) by age- and sex-specific population estimates from the Census Bureau.

Back to the Future

The *Back to the Future* scenario assumes that average per-capita VMT by age and sex will return to its 2004 level by 2020 and continue at those levels thereafter.

For those of driving age (16 and older) at the time of completion of the 2009 NHTS, the following formula was used to estimate per-capita VMT for each sex and year of age, using linear interpolation between 2001 and 2009 values for per-capita VMT by age and sex to estimate values in the peak per-capita driving year of 2004:

$$PCVMT = PCVMT_{2001a} + \frac{\{((PCVMT_{2009a} - PCVMT_{2001a}) + (PCVMT_{2009a} - PCVMT_{2001b})) * 3/8\}}{2}$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by year of age and sex in 2009

$PCVMT_{2001a}$ = Per capita VMT by year of age and sex in 2001

$PCVMT_{2001b}$

= Per capita VMT by year of age and sex in 2001 of those of a particular age in 2009 (e.g. a 21 year old in 2001 who is 29 years old in 2009.).

For those not of driving age in 2009, the formula is as follows:

$$PCVMT = PCVMT_{2001a} + ((PCVMT_{2009a} - PCVMT_{2001a}) * \frac{3}{8})$$

VMT per capita by age and sex were multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Enduring Shift

The *Enduring Shift* scenario assumes that drivers in each age cohort reduce (or increase) their driving as they age by the same percentage by which they changed their driving compared with an older cohort in 2009. For example, if 20-year-old males in 2009 drove 20 percent less than 20-year-old males did in 2001, it is assumed that eleven years later in 2020 they will similarly drive 20 percent less than did 31-year-old males did in 2001. In 2030, this same age cohort will drive 20 percent less than 41-year old males did in 2001. New drivers are assumed to reduce their driving (relative to 2001 per-capita driving levels by age) by the same percentage as 16 to 24 year-olds did between 2001 and 2009. Thus, a 20-year old male in 2020 or 2030 will drive approximately the same amount as members of that age group did in 2009. For those of driving age at the time of the 2001 NHTS, the formula for per-capita VMT by year of age and sex is as follows.

$$PCVMT = PCVMT_{2009a} * \left(\frac{PCVMT_{2009b}}{PCVMT_{2001c}} \right)$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by age and sex in 2009

$PCVMT_{2009b}$
= Per capita VMT by age and sex in 2009 for the cohort being measured in year x
(e.g. VMT in 2009 at age 29 for people who are 40 years old in 2020)

$PCVMT_{2001c}$
= Per capita VMT by age and sex in 2001 for sex and age represented by $PCVMT_{2009b}$
(in the above example, 29 year olds in 2001)

For those who were not of driving age during the 2001 NHTS, the following formula applies:

$$PCVMT = PCVMT_{2001a} * \left(\frac{PCVMT_{16-24\ 2009}}{PCVMT_{16-24\ 2001}} \right)$$

Where:

$\frac{PCVMT_{16-24\ 2009}}{PCVMT_{16-24\ 2001}}$
= the average per capita VMT of drivers 16 to 24 years old in 2009 divided by the average per capita VMT of drivers in that same age group in 2001, by sex.

VMT per capita by age and sex was multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Ongoing Decline

The *Ongoing Decline* scenario assumes that the percentage change in driving behavior experienced by each age group between 2001 and 2009 will be replicated between 2009 and 2025, and that new drivers will drive even less than young drivers did in 2009. It assumes no change in driving behavior after 2025, but total and aggregate per-capita VMT still changes as a result of population growth and demographic shifts.

For those who were of driving age in 2001, the formula for per-capita VMT by year of age and sex in 2020 and subsequent years is as follows:

$$PCVMT = PCVMT_{2009a} * \left(\frac{PCVMT_{2009b}}{PCVMT_{2001c}} \right)^x$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by age and sex in 2009

$PCVMT_{2009b}$

= Per capita VMT by age and sex in 2009 for the cohort being measured in year y (e.g. VMT in 2009 at age 29 for people who are 40 years old in 2020)

$PCVMT_{2001c}$

= Per capita VMT by age and sex in 2001 for sex and age represented by $PCVMT_{2009b}$ (in the above example, 29 year olds in 2001)

$x = 2$ in 2025 and subsequent years, and an amount between 1.6875 and 2 in 2020 through 2024

For those not of driving age in 2001, the formula for per-capita VMT by year of age and sex in 2020 and subsequent years is as follows:

$$PCVMT = PCVMT_{2001a} * \left(\frac{PCVMT_{16-24\ 2009}}{PCVMT_{16-24\ 2001}} \right)^x$$

Where $x=2$ in 2025 and subsequent years, and an amount between 1.6875 and 2 from 2020 through 2024.¹³³

VMT per capita by age and sex was multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Treatment of Non-Household VMT

The National Household Travel Survey only reflects vehicle travel made in households, which accounts for approximately three-quarters of all vehicle travel.¹³⁴ Non-household vehicle travel includes travel in everything from heavy-duty trucks to rental cars to delivery vehicles to pick-up trucks used for work purposes. Not all of these types of vehicle travel are tracked by existing data sources. Complicating matters further, even those portions of non-household VMT that are regularly tracked—such as travel in certain types of commercial trucks—are represented in data sets that have experienced significant methodological changes in recent years, making time-series comparisons difficult.¹³⁵

In this paper, we assume that the proportion of household to non-household

VMT—calculated by subtracting household VMT in 2009 (from NHTS data) from total VMT (as reported by the Federal Highway Administration’s *Highway Statistics* series of reports)—remains constant through 2040. This approach has been used by other analysts seeking to establish a relationship between household and total VMT,¹³⁶ though the relationship between household VMT as estimated by the NHTS and total VMT as estimated in publications such as *Highway Statistics* has been inconsistent over time.

The relationship between household and non-household VMT is particularly challenging to forecast since some changes that might reduce household VMT (e.g., increased e-commerce) could increase non-household VMT (e.g., increasing miles traveled in delivery trucks). We hope that additional research and better data sets will enable a fuller exploration of future trends in aggregate non-household VMT.

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88 Transportation Research Board, *The Future Highway Transportation System and Society*, National Academies Press, 1997.

89 The term “scenario analysis” is often used in a different sense in transportation

and land-use planning, which is to evaluate the potential outcomes of various strategic planning decisions (e.g., adopting a plan that emphasizes “smart growth” style development as opposed to one that enables sprawl-style development).

90 The scenarios are based on assumptions of how driving behavior will change among members of specific age groups and generational cohorts relative to behavior at a defined moment in time. Because the last date for which reliable data on age-specific driving patterns was 2009, we began the scenarios in that year. The decision to begin the scenarios in 2009 (rather than align the scenarios to the aggregate VMT data for 2010-2012) has no bearing on aggregate VMT beyond 2020 (for the *Back to the Future* and *Enduring Shift* scenarios) or 2025 (for the *Ongoing Decline* scenario).

91 National Surface Transportation Infrastructure Financing Commission, *Paying Our Way: A New Framework for Transportation Finance*, February 2009. The commission’s report assumed that light-duty vehicle travel would increase by an average of 1.6 percent per year and that travel in heavy-duty trucks would increase by an average of 1.8 percent per year. Those assumed growth rates are applied here to 2008 vehicle-miles traveled for each type of vehicle, and carried through to 2040.

92 U.S. Department of Transportation, *2010 Status of the Nation’s Highways Bridges and Transit: Conditions & Performance, Report to Congress*, undated, available at www.fhwa.dot.gov/policy/2010cpr/pdfs/cp2010.pdf. The report’s baseline case assumes an average annual rate of VMT growth over 20 years of 1.85 percent, which is predicated on

the maintenance of a consistent level of service on the nation's roads. We applied the annual growth rate to 2008 levels of vehicle travel. The U.S. DOT also modeled an alternative case in which VMT growth was held to 1.23 percent per year. That case yields an estimate of aggregate VMT in 2040 that also exceeds all three scenarios described in this report.

93 U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2013 Early Release*, 5 December 2012. The *Annual Energy Outlook* includes annual forecasts of VMT, which are included here.

94 Tim Lomax, David Schrank and Bill Eisele, Texas Transportation Institute, *2012 Urban Mobility Report*, February 2013. Based on average for 498 urbanized areas studied.

95 U.S. Census Bureau, *Historical Population Estimates* downloaded from www.census.gov/popest/data/historical/index.html, 5 December 2012.

96 Inrix, *INRIX Traffic Scorecard Reports U.S. Congestion on the Rise in 2013 Following Two Years of Double-Digit Declines* (news release), 24 April 2013.

97 See note 94.

98 45 percent: See note 36.

99 Ibid.

100 Ibid.

101 Ibid.

102 U.S. Department of Transportation, Federal Highway Administration, *2010*

Status of the Nation's Highways, Bridges and Transit: Conditions & Performance, undated, accessed at www.fhwa.dot.gov/policy/2010cpr/pdfs/cp2010.pdf 8 April 2013.

103 Cambridge Systematics with Alan E. Pisarski, *Bottom Line Technical Report: Highway and Public Transportation National and State Investment Needs*, prepared for American Association of State Highway and Transportation Officials (AASHTO), March 2009.

104 Pavia Systems, *Pavement Interactive: Design: Equivalent Single Axle Load*, 15 August 2007, accessed at www.pavementinteractive.org/article/equivalent-single-axle-load/.

105 Based on VMT for combination trucks. See note 2.

106 For further discussion, see Tony Dutzik and Benjamin Davis, Frontier Group, and Phineas Baxandall, U.S. PIRG Education Fund, *Do Roads Pay for Themselves? Setting the Record Straight on Transportation Funding*, January 2011.

107 Gasoline tax revenue is often used for purposes other than highways. At the federal level, some highway fuel tax revenue is used to finance public transportation investments through the Mass Transit Account of the Highway Trust Fund, while other revenues can be used to support bicycling, pedestrian and other projects. Some states not only allow gasoline tax revenue to be used for non-automotive forms of transportation but also use fuel taxes as a source of general revenue.

108 Based on comparison between highway user revenue "receipts available for distribution" and "total current disbursements" for highways for all levels

of government from U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* series of reports, Table HF-10. An alternate measure created by the Pew Charitable Trusts places the percentage of highway expenses covered by user fees even lower, at 51 percent. Our measure is more conservative in that it counts driving user fees as funding roads even if, in fact, a portion of the funds are spent on other modes of transportation. Source: Pew Charitable Trusts, *Subsidyscope: Analysis Finds Shifting Trends in Highway Funding: User Fees Make Up Decreasing Share*, 25 November 2009.

109 For a review of the declining value of the motor fuel taxes in the states, see Institute on Taxation and Economic Policy, *Building a Better Gas Tax: How to Fix One of State Government's Least Sustainable Revenue Sources*, December 2011.

110 See note 2.

111 See note 93.

112 Gasoline tax revenues are calculated on a calendar year basis. Our estimate of calendar year 2011 gasoline tax revenues, \$23.6 billion, compares with estimated fiscal year 2011 revenues of \$24.0 billion, per Joseph Kile, Congressional Budget Office, *The Highway Trust Fund and Paying for Highways*, Testimony before the Committee on Finance, United States Senate, 17 May 2011.

113 Institute on Taxation and Economic Policy, *Building a Better Gas Tax: How to Fix One of State Government's Least Sustainable Revenue Sources*, December 2011.

114 Ibid.

115 Associated Press, "85-MPH Toll Road Revenue Falls Short of Need," *Star-Telegram* (Fort Worth, Tex.), 8 April 2013.

116 Phineas Baxandall, U.S. PIRG Education Fund, and Kari Wohlschlegel and Tony Dutzik, Frontier Group, *Private Roads, Public Costs: The Facts About Toll Road Privatization and How to Protect the Public*, Spring 2009.

117 Robert Poole, Reason Foundation, "The Perils of Availability Payment Concessions," *Surface Transportation Newsletter*, 107, 19 September 2012.

118 U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook* series of reports. All projections reflect the EIA's reference case. "2013 early" refers to the *Annual Energy Outlook 2013* Early Release released in December 2012. "2009 revised" refers to the updated *Annual Energy Outlook 2009* Reference Case service report published in April 2009 following enactment of the American Recovery and Reinvestment Act and the revision of economic data to reflect the severe late 2008 recession. Note that in the final *Annual Energy Outlook 2013*, released in late April 2013, the EIA produced a "Low/No Net Imports" side case that posited far slower growth in VMT, similar to the *Enduring Shift* scenario in this paper.

119 Kevin Ramsey, U.S. Environmental Protection Agency, *Residential Construction Trends in America's Metropolitan Regions: 2012 Edition*, December 2012.

120 Hope Yen and Kristen Wyatt, "Cities Grow More than Suburbs, First Time in 100 Years," *NBCNews.com*, 28 June 2012.

121 See, for example, the State Smart Transportation Initiative, www.ssti.us.

122 Sierra Club’s 2012 list of best and worst transportation projects includes several projects that were conceived of between the 1940s and 1960s and at least one of which dates to the turn of the 20th century. Source: Sierra Club, *Smart Choices, Less Traffic: 50 Best and Worst Transportation Projects in the United States*, November 2012.

123 Smart Growth America and Taxpayers for Common Sense, *Repair Priorities: Transportation Spending Strategies to Save Taxpayer Dollars and Improve Roads*, June 2011.

124 See note 102.

125 See note 93.

126 Victoria Transport Policy Institute, “Least-Cost Transportation Planning,” in *TDM Encyclopedia*, 12 November 2010.

127 For more background on MAP-21’s accountability measures, see Transportation for America, *Making the Most of MAP-21: A Guide to the 2012 Federal Transportation Law – and How to Use it for Positive Change in Your Community*, accessed at t4america.org/wp-content/uploads/2012/11/MAP-21-Handbook-Web.pdf, 8 April 2013.

128 Minnesota adopted the first such provision in 1923: Robert Puentes and Ryan Prince, Brookings Institution, *Fueling Transportation Finance: A Primer on the Gas Tax*, March 2003.

129 Australia, Germany, the Netherlands and Great Britain, for example, conduct travel surveys continuously or annually. Juan de Dios

Ortuzar, et al., “Continuous Mobility Surveys: The State of Practice,” *Transport Reviews*, 31(3): 293-312, doi: 10.1080/01441647.2010.510224, May 2011.

130 The number of licensed drivers was divided by the number of years in each age group to arrive at an estimated number of licensed drivers by year of age and gender.

131 The use of non-NHTS estimates of population and the number of licensed drivers means that the aggregate household VMT estimates that form the basis of these scenarios differ from the aggregate household VMT figures from the NHTS. We opted to use population and driver’s licensing data from other sources in order to minimize the impact of sampling error in the NHTS. A comparison of NHTS estimates of population and licensed drivers by age group with Census Bureau and FHWA sources suggests that the 2001 NHTS sample was skewed toward males in the 18 to 24-year-old demographic, toward older age groups, and toward drivers. A similar comparison with the 2009 NHTS suggests that the sample may be skewed toward drivers and the young. The underrepresentation of younger Americans in the 2001 NHTS was acknowledged at the time of the data’s release, and is discussed in greater detail in Hart Nadav Feuer, *Paradigm Inertia in the U.S. National Household Travel Survey (NHTS)*, 1 February 2006.

132 The exponent increases by 0.625 annually between 2020 and 2025.

133 Ibid.

134 Based on comparison of household VMT from the 2009 National Household Travel Survey and total VMT for 2009 from the Federal Highway

Administration, *Highway Statistics* series of reports.

135 For example, the Federal Highway Administration changed its methodology for calculating vehicle-miles traveled by vehicle type in 2007, making comparisons between pre-2007 and post-2007 reports invalid. As a result, 2007 is the earliest year for which accurate time-series comparisons for commercial vehicles can be made.

136 Frank Southworth, Tim Reuscher and Pat Hu, *Estimation and Short Range Forecasting of County Level Vehicle Miles of Travel and Motor Fuel Use for the United States (Through 2015)*, 26 March 2009.

137 Amanda Lenhard, Pew Internet & American Life Project, *Adults and Social Network Websites*, 14 January 2009.

138. See note 91.

Attachment A—GHG Emission Reduction Targets

Regulation	Sectors Covered	2010 Actual	2020 Target	2035 Target	2040 Target	2050 Target
S-3-05	All		1990 levels			-80% Re: 1990
AB 32	All		1990 levels			
SB 375	Light-duty motor vehicles		-7% per capita Re: 2005	-15% per capita Re: 2005		
B-16-2012	Transportation					-80% Re: 1990
EIR Criterion #						
1	Light-duty motor vehicles		-7% per capita Re: 2005	-15% per capita Re: 2005		
2	Mobile sources, waste, electricity, natural gas				-0% Re: 2010	
3	Mobile sources, waste, electricity, natural gas					Not impede - 80%
4	Mobile sources, waste, electricity, natural gas		No Conflict with other plans			

Attachment B—SCS Performance re: Targets

EIR Criterion DEIR pg. #	Sectors Covered	2010 Actual	2020 Projection	2035 Projection	2040 Projection	2050 Projection
1 2.5-50	Light-duty motor vehicles		-10.3% per capita <input checked="" type="checkbox"/> Re: 2005	-16.4% per capita <input checked="" type="checkbox"/> Re: 2005	-18.0% per capita Re: 2005	
2 2.5-56 & 59	Mobile sources, waste, electricity, natural gas	48.8 MMTCO ₂ e			41.3 MMTCO ₂ e <input checked="" type="checkbox"/> -15% Re: 2010	
3 2.5-59	Mobile sources, waste, electricity, natural gas					38.8 MMTCO ₂ e <input checked="" type="checkbox"/> -20.5% Re: 2010
4 2.5-59	Mobile sources, waste, electricity, natural gas		46.4 MMTCO ₂ e <input checked="" type="checkbox"/> -4.9% Re: 2010		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

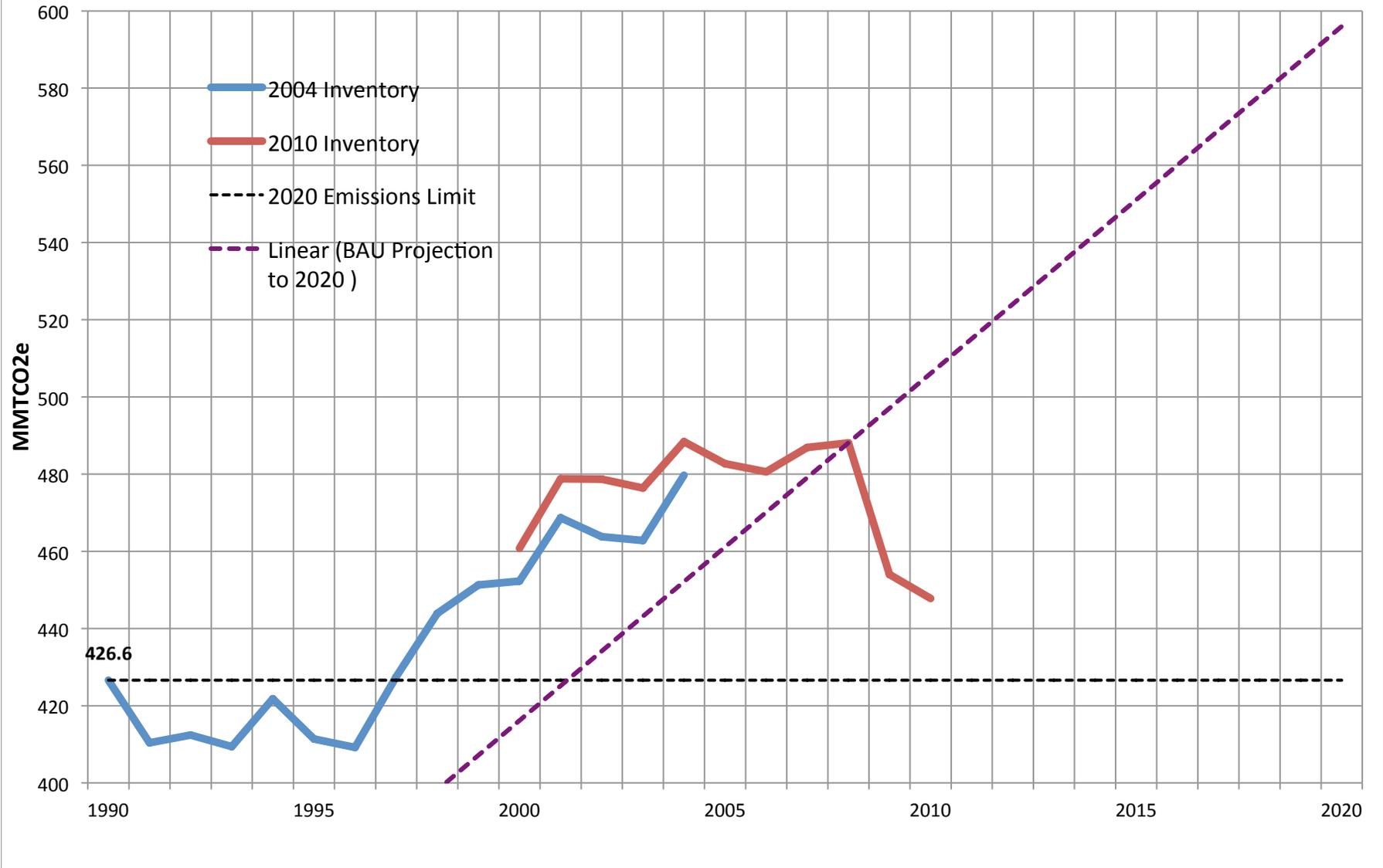
Attachment C—Scoping Plan Targets

		2010 Actual	2020 Target	2035	2040	2050
Scoping Plan	Total Reductions		-174 MMTCO ₂ e			
Scoping Plan Reductions	Mobile sources, waste, electricity, natural gas sectors only		-97.4 MMTCO ₂ e			
Scoping Plan Reductions	Mobile sources, waste, electricity, natural gas sectors only		56% of Total Reductions			
Statewide	Emissions Inventory	448 MMTCO ₂ e	427 MMTCO ₂ e (1990 Level)			85 MMTCO ₂ e
Statewide	Emissions Reductions for AB 32 Compliance		-21 MMTCO ₂ e			
Statewide	Emissions Reductions from mobile sources, waste, electricity, natural gas sectors only		-11.8 MMTCO ₂ e (56% of 21. See Attachment D)			
Statewide Reduction	Mobile sources, waste, electricity, natural gas sectors only		-2.6% Re: 2010			-81.0% Re: 2010

Attachment D—Scoping Plan Measures Not Included in Regional Totals

Scoping Plan Measures Not Included	MMTCO ₂ e
Vehicle Efficiency	4.5
Medium/HD Vehicles	1.4
Industrial Measures	1.4
Forests	5
Regional Transportation-Related GHG Targets	5
Goods Movement	3.7
High GWP Gases	20.27
High-Speed Rail	1
Additional Reductions	34.4
Total Measures Not Included	76.67
Total Measures	174
Total Measures Included (174-77)	97.4
Percent of Scoping Plan Included in Regional Totals	56%

Attachment E--CA GHG Emissions



Appendix G: Examples of Measures that Could Reduce Impacts from Planning, Development and Transportation Projects

The following list of example measures is intended to function as a resource for lead agencies to consider in identifying mitigation measures to reduce impacts anticipated to result from future projects, as deemed applicable and feasible by such agencies. Some example measures are oriented to planning projects, while some measures are oriented to development and/or transportation projects. Some example measures are oriented to all types of projects. The list is non-exclusive and will not be used by SCAG in any way in reviewing regionally significant projects or project EIRs as part of SCAG's intergovernmental review (IGR) process. Nor are the example measures intended to serve as any kind of checklist to be used on a project-specific basis. Since every project and project setting is different, project specific analysis is needed to identify applicable and feasible mitigation. The following measures may be too generic to be applied on a project-by-project basis and therefore they are presented as examples of measures rather than templates to be followed.

Some of the example mitigation measures include legal requirements that may overlap with federal, state, and/or local regulation. Such legal requirements that incorporate or reference existing regulations are mandatory and any mitigation imposed as a result of a project-specific CEQA process cannot supersede these existing regulations. Nevertheless, SCAG has included these regulations for informational purposes only and to help the reader understand the existing regulatory framework that would assist in mitigating potential environmental impacts.

In addition, the inclusion of these measures that may overlap with existing regulation is not intended to supplant current law. While potential impacts are normally assessed assuming implementation of applicable legal requirements, here, many of the legal requirements are flexible and may require further interpretation or consultation with resource agencies. As such, the resulting reduction in impacts may be difficult to quantify. Thus, in the interest of providing information to the public, SCAG has included these measures containing legal requirements among the example measures.

As part of the CEQA process for each planning, development or transportation project, the Lead Agency is required to identify significant and potentially significant impacts and then mitigate them to the extent feasible. All mitigation measures below are phrased as "may" to allow for tailoring to project and agency-specific conditions as may be applicable and feasible. Use of the word "may" in measures that include legal requirements, or requirements that are otherwise committed, should not be construed to mean that compliance with legal requirements and existing commitments is optional. Furthermore, the text boxes below set forth additional details for the example measures which may apply should agencies choose to implement those measures.

Changes to the measures as compared to the measures presented in the Draft PEIR are shown with new text underlined and deleted text shown in strike-out font. Measures have been renumbered to be continuous.

AESTHETICS

AV1: Prior to the issuance of permits, project sponsors ~~can and should~~ may ~~require and projects should to the extent feasible,~~ construct noise barriers of materials whose color and texture complements the surrounding landscape and development. Noise barriers ~~should~~ may be graffiti resistant and landscaped with plants that screen the barrier, preferably with either native vegetation or landscaping that complements the dominant landscaping of surrounding areas. Natural landscaping ~~should~~ may be used to minimize contrasts between the project and surrounding areas. Wherever possible, interchanges and transit lines at the grade of the surrounding land ~~should~~ may limit view blockage.

Above measure is clarified.

- AV2:** Project sponsors ~~can and should~~may use natural landscaping to minimize contrasts between the project and surrounding areas. Wherever possible, structures ~~should~~may be designed to limit view blockage. Edges of major cut-and-fill slopes ~~should~~may be contoured to provide a more natural looking finished profile. Project sponsors ~~should~~may replace and renew landscaping along corridors with road widenings, interchange projects, and related improvements. New corridor landscaping ~~should~~may be designed to respect existing natural and man-made features and to complement the dominant landscaping of surrounding areas.
- AV3:*** Prior to project approval, project sponsors ~~can and should~~may implement design guidelines, local policies, and programs aimed at protecting views of scenic corridors and avoiding visual intrusions. Projects ~~should~~may be designed to minimize contrasts in scale and massing between the project and surrounding natural forms and developments. Avoid, if possible, large cuts and fills when the visual environment (natural or urban) would be substantially disrupted. Site or design of projects ~~should~~may minimize their intrusion into important viewsheds and use contour grading to better match surrounding terrain.
- AV4:** Project sponsors ~~can and should~~may construct sound walls of materials whose color and texture complements the surrounding landscape and development and use color, texture, and alternating facades to “break up” large facades and provide visual interest. Where there is room, project sponsors ~~should~~may landscape the sound walls with plants that screen the sound wall, preferably with either native vegetation or landscaping that complements the dominant landscaping of surrounding areas.
- AV5** Project sponsors ~~can and should~~may avoid construction of transportation facilities in state and locally designated scenic highways and/or vista points. When avoidance is not possible, project sponsors ~~should~~may minimize visual quality intrusions to the maximum extent feasible.
- AV6:*** For projects in designated or eligible Scenic Highway corridors, prior to project approval, project sponsors ~~can and should~~may complete design studies and develop site-specific mitigation measures to minimize impacts on the quality of the views or visual experience that originally qualified the highway for scenic designation.
- AV7:** If projects are constructed in state- and locally-designated scenic highways and/or vista points, design, construction, and operation of the transportation facility ~~can and should~~may be consistent with applicable guidelines and regulations for the preservation of scenic resources along the designated scenic highway.
- AV8:** Project sponsors ~~can and should~~may design projects to minimize contrasts in scale and massing between the project and surrounding natural forms and development. Project sponsors ~~should~~may design projects to minimize their intrusion into important viewsheds and use contour grading to better match surrounding terrain. To the maximum extent feasible, landscaping along highway corridors ~~should~~may be designed to add significant natural elements and visual interest to soften the hard-edged, linear travel experience that would otherwise occur.
- AV9:** Project sponsors ~~can and should~~may develop design guidelines projects that make elements of proposed buildings/facilities visually compatible with surrounding areas. Visual design guidelines ~~should~~may, at a minimum, include setback buffers, landscaping, color, texture, signage, and lighting criteria. The following methods ~~should~~may be employed whenever possible:
- Transportation systems ~~should~~may be developed to be compatible with the surrounding environment (i.e., colors and materials of construction material).
 - Vegetation used as screening and landscaping ~~should~~may blend in and complement the natural landscape.
 - Trees bordering highways ~~should~~may remain or be replaced so that clear-cutting is not evident.
 - Grading ~~should~~may blend with the adjacent landforms and topography.
- AV10:** In visually sensitive areas and prior to project approval, local land use agencies ~~can and should~~may apply development standards and guidelines to maintain compatibility with surrounding natural areas, including site coverage, building height and massing, building materials and color, landscaping, site grading, etc
- AV11:*** Project sponsors ~~can and should~~may ensure that sites ~~should~~may be kept in a blight/nuisance-free condition. Any existing blight or nuisance ~~should~~may be abated within 60-90 days of approval, unless an earlier date is specified elsewhere.

AV12:* Project sponsors ~~can and should~~ may ensure that proposed lighting fixtures are adequately shielded to a point below the light bulb and reflector and that prevent unnecessary glare onto adjacent properties. Plans ~~should~~ may be submitted to the Lead Agency (or other government agency as appropriate) for review and approval. All lighting ~~should~~ may be architecturally integrated into the site.

AIR QUALITY

AQ1:* Transportation Control Measures (TCMs) ~~shall be implemented as appropriate by SCAG and can and should~~ may be implemented by local agencies and project sponsors as appropriate. TCMs included in the Plan are identified in the Transportation Conformity Appendix to the 2012-2035 RTP/SCS (starting on page 26). CAA Section 108(f)(1)(A) lists ~~the following~~ sixteen measures as illustrative of TCMs:

AQ2:* Local air districts, local jurisdictions and project sponsors ~~can and should~~ may implement measures adopted by ARB designed to attain federal air quality standards for PM2.5 and 8-hour ozone. ARB’s strategy includes the following elements:

- Set technology forcing new engine standards;
- Reduce emissions from the in-use fleet;
- Require clean fuels, and reduce petroleum dependency;
- Work with USEPA to reduce emissions from federal and state sources; and
- Pursue long-term advanced technology measures.
- Proposed new transportation-related SIP measures include:

On-road and off-road Sources

- ✓ Improvements and Enhancements to California’s Smog Check Program
 - ✓ Expanded Passenger Vehicle Retirement
 - ✓ Modifications to Reformulated Gasoline Program
 - ✓ Cleaner In-Use Heavy-Duty Trucks
 - ✓ Ship Auxiliary Engine Cold Ironing and Other Clean Technology
 - ✓ Cleaner Ship Main Engines and Fuel
 - ✓ Port Truck Modernization
 - ~~✓ Accelerated Introduction of Cleaner Line Haul Locomotives~~
 - ✓ Clean Up Existing Commercial Harbor Craft
- Off-road Sources
- ✓ Cleaner Construction and Other Equipment
 - ✓ Cleaner In-Use Off-Road Equipment
 - ✓ Agricultural Equipment Fleet Modernization
 - ✓ New Emission Standards for Recreational Boats
 - ✓ Off-Road Recreational Vehicle Expanded Emission Standards

Above measure revised to provide further clarification of vehicle classifications and ensure consistency with 2012 RTP Goods Movement Strategies.

AQ3:* Project sponsors ~~can and should~~ may ensure that water or “toxic free” dust suppressants are applied to exposed earth surfaces to control emissions as necessary to control dust and comply with applicable regulations.

AQ4:* Project sponsors ~~can and should~~ may ensure that all excavating and grading activities ~~should~~ may cease during second stage smog alerts and periods of high winds.

AQ5:* Project sponsors ~~can and should~~ may ensure that all trucks hauling dirt, sand, soil, or other loose materials off-site ~~should~~ may be covered or wetted or ~~should~~ may maintain at least two feet of freeboard (i.e., minimum vertical distance between the top of the load and the top of the trailer).

AQ6:* Project sponsors ~~can and should~~ may ensure that all construction roads that have high traffic volumes, ~~should~~ may be surfaced with base material or decomposed granite, or ~~should~~ may be paved or otherwise be stabilized.

AQ7:* Project sponsors ~~can and should~~ may ensure that public streets ~~should~~ may be cleaned, swept or scraped at frequent intervals or at least three times a week if visible soil material has been carried onto adjacent public roads.

AQ8:* Project sponsors ~~can and should~~ may ensure that construction equipment ~~should~~ be visually inspected prior to leaving the site and loose dirt ~~should~~ be washed off with wheel washers as necessary.

AQ9:* Project sponsors ~~can and should~~ may ensure that water, hydroseed, or non-toxic soil stabilizers are applied to inactive construction areas as needed to reduce off-site transport of fugitive dust.

AQ10:* Project sponsors ~~can and should~~ may ensure that traffic speeds on all unpaved surfaces ~~should~~ may not exceed 25 mph.

AQ11:* ~~Project sponsors can and should ensure that low sulfur or other alternative fuels or diesel powered vehicles with Tier 3 or better engines or retrofitted/repowered to meet equivalent emissions standards as Tier 3 engines should be used in construction equipment where feasible. Project sponsors may ensure that all construction diesel engines with a rating of 50 horsepower or higher meet, at a minimum, the USEPA Tier 3 standards for non-road engines. From January 1, 2015 onward, project sponsors may ensure that all construction equipment meets or exceeds equivalent emissions performance to that of USEPA Tier 4 standards for non-road engines. In the event that Tier 3 or 4 engines are not available for any off-road equipment larger than 100 hp, that equipment be equipped with a Tier 2 engine, or an engine that is equipped with retrofit controls to reduce exhaust emissions of nitrogen oxides and diesel particulate matter to no more than Tier 2 levels unless certified by engine manufacturers or the on-site air quality construction mitigation manager that the use of such devices is not practical for specific engine types. For purposes of this condition, the use of such devices is “not practical” for the following, as well as other reasons.~~

1. There is no available retrofit control device that has been verified by either the ARB or USEPA to control the engine in question to Tier 2 equivalent emission levels and the highest level of available control using retrofit or Tier 1 engines is being used for the engine in question; or
2. The construction equipment is intended to be on site for five days or less.
3. Relief may be granted from this requirement if a good faith effort has been made to comply with this requirement and that compliance is not practical.

The use of a retrofit control device may be terminated immediately, provided that a replacement for the equipment item in question meeting the required controls occurs within ten days of termination of the use, if the equipment would be needed to continue working at this site for more than 15 days after the use of the retrofit control device is terminated, if one of the following conditions exists:

1. The use of the retrofit control device is excessively reducing the normal availability of the construction equipment due to increased down time for maintenance, and/or reduced power output due to an excessive increase in back pressure.
2. The retrofit control device is causing or is reasonably expected to cause engine damage.
3. The retrofit control device is causing or is reasonably expected to cause a substantial risk to workers or the public.
4. Any other seriously detrimental cause which has the approval of the project manager prior to implementation of the termination.

Above measure revised in response to comments from the US Environmental protection Agency (EPA).

AQ12:* Project sponsors ~~can and should~~ may ensure that deliveries related to construction activities that affect traffic flow ~~should~~ may be scheduled during off-peak hours (e.g., 10:00 a.m. and 3:00 p.m.) and coordinated to achieve consolidated truck trips, where feasible. When the movement of construction materials and/or equipment impacts traffic flow, temporary traffic control ~~should~~ may be provided to improve traffic flow (e.g., flag person).

Above measure edited to reflect that delivery hours should consider operational feasibility.

AQ13:* Project sponsors ~~can and should~~ may ensure that to the extent possible, that construction activity ~~should~~ utilize electricity from power poles rather than temporary diesel power generators and/or gasoline power generators.

AQ14:* Local jurisdictions or agencies ~~can and should~~ may, as practical and feasible, revegetate exposed earth surfaces following construction. Application of xeriscape principles, including such techniques and materials as native or low water use plants and low precipitation sprinklers heads, bubblers, drip irrigation systems and timing devices, ~~should~~ may also be considered.

AQ15: Local jurisdictions ~~can and should~~ may set, and enforce, specific limits on idling time for commercial vehicles, including delivery and construction vehicles, which prohibit vehicle and engine idling in excess of five minutes, where conditions allow.

Above measure revised in response to a comments from the EPA and revised to reflect that idling policies should consider operational feasibility.

AQ16:* Project sponsors ~~can and should~~ may ensure that sandbags or other erosion control measures are installed to prevent silt runoff to public roadways as needed.

AQ17:* Project sponsors ~~can and should~~ may designate a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. Their duties ~~should~~ may include holidays and weekend periods when work may not be in progress. The name and telephone number of such persons ~~should~~ may be provided to the local air district prior to the start of construction as well as posted on-site over the duration of construction.

AQ18:* Project sponsors ~~can and should~~ may ensure that appropriate wind-breaks are installed at the construction site to minimize windblown dust.

AQ19: In order to ~~comply with~~ address the California Air Resources Board Air Quality and Land Use Handbook (June 2005) and achieve an acceptable interior air quality level for sensitive receptors, project sponsors ~~can and should~~ may identify appropriate measures, to be incorporated into project building design for residential, school and other sensitive uses located within 500 feet of freeways, heavily travelled arterials, railways and other sources of Diesel Particulate Matter and other known carcinogens. The appropriate measures ~~should~~ may include one or more of the following methods as may be appropriate:

- a. The project sponsor ~~should~~ may retain a qualified air quality consultant to prepare a health risk assessment (HRA) in accordance with the California Air Resources Board and the Office of Environmental Health and Hazard Assessment requirements to determine the exposure of project residents/occupants/users to stationary and mobile (e.g., cars and trucks) sources of air pollution ~~air quality polluters~~ prior to issuance of a demolition, grading, or building permit. The HRA ~~should~~ may be submitted to the Lead Agency for review and approval. The sponsor ~~should~~ may implement the approved HRA recommendations, if any. If the HRA concludes that the air quality risks from nearby sources are at or below acceptable levels, then additional measures are not required.
- b. The project sponsor ~~should~~ may implement the following features that have been found to reduce the air quality risk to sensitive receptors and ~~should~~ may be included in the project construction plans. These ~~should~~ may be submitted to the appropriate agency for review and approval prior to the issuance of a demolition, grading, or building permit and ongoing.
 - i. Do not locate sensitive receptors near distribution center's entry and exit points.
 - ii. Do not locate sensitive receptors in the same building as a perchloroethylene dry cleaning facility.
 - iii. Maintain a 50-foot buffer from a typical gas dispensing facility (under 3.6 million gallons of gas per year).
 - iv. Install, operate and maintain in good working order a central heating and ventilation (HV) system or other air take system in the building, or in each individual residential unit, that meets the efficiency standard of the MERV 13. The HV system ~~should~~ may include the following features: Installation of a high efficiency filter and/or carbon filter-to-filter particulates and other chemical matter from entering the building. Either HEPA filters or ASHRAE 85% supply filters ~~should~~ may be used.
 - v. Retain a qualified HV consultant or HERS rater during the design phase of the project to locate the HV system based on exposure modeling from the mobile and/or stationary pollutant sources.
 - vi. Maintain positive pressure within the building.
 - vii. Achieve a performance standard of at least one air exchange per hour of fresh outside filtered air.
 - viii. Achieve a performance standard of at least 4 air exchanges per hour of recirculation
 - ix. Achieve a performance standard of .25 air exchanges per hour of unfiltered infiltration if the building is not positively pressurized.
- c. Project sponsor ~~should~~ may maintain, repair and/or replace HV system or prepare an Operation and Maintenance Manual for the HV system and the filter. The manual ~~should~~ may include the operating

instructions and maintenance and replacement schedule. This manual ~~should~~ may be included in the CC&R's for residential projects and distributed to the building maintenance staff. In addition, the sponsor ~~should~~ may prepare a separate Homeowners Manual. The manual ~~should~~ may contain the operating instructions and maintenance and replacement schedule for the HV system and the filters. It ~~should~~ may also include a disclosure to the buyers of the air quality analysis findings.

MM-AQ20: To the maximum extent practicable the Lead Agency ~~can and should~~ may ensure that private (individual and common) exterior open space, including playgrounds, patios, and decks, ~~should~~ may either be shielded from ~~stationary~~ sources of air pollution by buildings or otherwise buffered to further reduce air pollution for project occupants.

AQ21: As applicable and feasible, local jurisdictions may investigate (using for example procedures and guidelines for PM hotspot analysis consistent with USEPA (2010) PM guidance) the relationship between 1) any increases in PM10 and PM2.5 within 500 feet of freeways in their jurisdiction, and 2) existing sensitive receptors in that area that do not have adequate air filtration to reduce such impacts to a less than significant level. To the extent that existing sensitive receptors are identified that do not have adequate air filtration, local jurisdictions may establish a program by which project sponsors can mitigate significant increases in PM10 and PM2.5 (e.g., by providing a retrofit program for older higher emitting vehicles, anti-idling requirements or policies, controlling fugitive dust, routing traffic away from populated zones, replacing older buses with cleaner buses, and paying in to a fund established to retrofit sensitive receptors with HEPA filters when sensitive receptors are located within 500 feet of freeways and high-traffic volume roadways that generate substantial diesel particulate emissions).

AQ22: As applicable and feasible, project sponsors may plant appropriate vegetation to reduce PM10/PM2.5 when constructing a sensitive receptor within 500 feet of freeways and high-traffic volume roadways generating substantial diesel particulate emissions.

AQ23: As applicable and feasible, for major transportation projects (especially those that generate substantial diesel particulate emissions) in the region, if health risks are shown to increase significantly at sensitive receptors within 500 feet of a transportation facility, project sponsors are required under CEQA to consider applicable mitigation. Examples include planting appropriate vegetation and retrofitting existing sensitive uses with air filtration to reduce potential health risk impacts to a less than significant level.

Above measures added to provide additional examples of mitigation to address health risk within 500 feet of transportation facilities with potential health impacts.

BIOLOGICAL RESOURCES AND OPEN SPACE

Ecosystems in the SCAG Region

BIO/OS1:* Project sponsors ~~can and should~~ may assess displacement of habitat due to removal of native vegetation during route planning/project location planning. Routes/project sites ~~can and should~~ may be planned in coordination with state and local resources agencies and ~~should~~ may consider inventories of natural resources, such as CDFG and CNDDDB. Routes ~~can and should~~ may be planned in order to avoid and/or minimize removal of native vegetation, by comparing proposed infrastructure with state and local conservation plans and by creating maps of resource habitat overlaid with the transportation network. Projects located in or adjacent to habitat areas ~~can and should~~ may incorporate buffers to minimize lighting, noise, and other project impacts that can severely disrupt wildlife. Vegetation buffers ~~can and should~~ may be appropriate to the adjacent vegetation association and protect the genetic integrity of the adjacent habitat. If avoidance is not possible, agencies/project sponsors ~~can and should~~ may consult with the appropriate resource agencies to develop mitigation activities.

BIO/OS2: When avoidance of native vegetation removal is not possible, project sponsors ~~can and should~~ may replant disturbed areas with commensurate native vegetation of high habitat value adjacent to the project that will result in a net environmental benefit (i.e., as opposed to ornamental vegetation with relatively less habitat value). When possible, habitat rehabilitation ~~can and should~~ may use recycled material from rehabilitated infrastructure.

Above measure edited in response to a comment from the California Department of Fish and Game (CDFG).

BIO/OS3:* Project sponsors ~~can and should~~ may include on-site habitat enhancement as a first priority and offsite habitat enhancement or restoration to compensate for unavoidable habitat losses from each project site as appropriate and necessary.

Special Status Species and Natural Communities

BIO/OS4:* Pre-construction special status species surveys ~~can and should~~ may be conducted by a qualified biologist to verify presence or absence of species at risk. For rare plants, surveys may be conducted when: 1) natural vegetation occurs on the site; 2) it is unknown if rare, threatened, or endangered plants or habitats occur on the site; and 3) the project has the potential for direct or indirect effects on vegetation. Species surveys ~~can and should~~ may occur during the portion of the species' life cycle where the species is most likely to be identified within the appropriate habitat. In all cases, impacts on special status species and/or their habitat ~~can and should~~ may be avoided during construction to the maximum extent feasible.

Above measure edited in response to a comment from CDFG.

BIO/OS5: For projects located in sensitive habitat areas, project sponsors ~~can and should~~ may develop and implement a Worker Awareness Program (environmental education) to inform project workers of their responsibilities in regards to avoiding and minimizing impacts on sensitive biological resources.

BIO/OS6: Project sponsors ~~can and should~~ may appoint an Environmental Inspector to serve as a contact for issues that may arise concerning implementation of mitigation measures, and to document and report on adherence to these measures.

BIO/OS7:* Project sponsors ~~can and should~~ may schedule construction activities to avoid sensitive times for biological resources (e.g. steelhead spawning periods during the winter and spring) and to avoid the rainy season when erosion and sediment transport is increased.

BIO/OS8:* Project sponsors ~~can and should~~ may schedule projects to avoid construction during critical life stages or sensitive seasons (e.g. the nesting season; see Mitigation Measures **BIO/OS25**, and **BIO/OS15** through **BIO/OS35**).

BIO/OS9: Project sponsors ~~can and should~~ may precede construction, as appropriate, by pre-construction monitoring to ensure no sensitive species' habitat would be unnecessarily destroyed (also see Mitigation Measures **BIO/OS4** through **BIO/OS13**). All discovered sensitive species habitat ~~can and should~~ may be avoided where feasible, or disturbance ~~should~~ may be minimized.

BIO/OS10:* Project sponsors ~~can and should~~ may fence and/or mark sensitive habitat to prevent unnecessary machinery or foot traffic during construction activities.

BIO/OS11:* Project sponsors ~~can and should~~ may ensure that sensitive habitats (native vegetative communities identified as rare and/or sensitive by the CDFG) and special-status plant species (including vernal pools) impacted by projects ~~can and should~~ may be restored and augmented. Project sponsors may consult with CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. The Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

If impacts are temporary, mitigation may be at a 1:1 ratio (compensation acres to impacted acres). Permanent impacts ~~can and should~~ may be compensated for by creating or restoring habitats at a **3:1** ratio as close as possible to the site of the impact. The CDFG may recommend mitigation ratios that vary on a project-by-project basis. ~~and may exceed those recommended in Mitigation Measure MM-BIO/OS17.~~

This measure is revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS12: When work is conducted in or adjacent to identified sensitive habitat areas, and/or areas of intact native vegetation, construction protocols ~~can and should~~ may require the salvage of perennial plants and the salvage

and stockpile of topsoil (the surface material from 6 to 12 inches deep) and ~~can and should~~ may be used in restoring native vegetation to all areas of temporary disturbance within the project area.

BIO/OS13: When removal and/or damage to sensitive species habitat are unavoidable during construction, project sponsors ~~can and should~~ may ensure that any disturbed natural areas are replanted with appropriate native vegetation following the completion of construction activities. In the case of permanent losses to sensitive species habitat, mitigation ~~can and should~~ may follow the offsite habitat compensation guidance.

BIO/OS14:* A qualified wetland scientist ~~can and should~~ may review construction drawings as part of each project-specific environmental analysis to determine whether wetlands will be impacted, and if necessary, perform a formal wetland delineation. Appropriate state and federal permits ~~can and should~~ may be obtained, ~~but~~ and each project EIR ~~will~~ may contain language clearly stating the provisions of such permits, including avoidance measures, restoration procedures, and in the case of permanent impacts compensatory creation or enhancement measures to ensure a no net loss of wetland extent or function and values.

BIO/OS15: Suitable habitat for listed vernal pool crustaceans ~~can and should~~ may be avoided to the extent feasible. If infeasible, impacts ~~should~~ may be mitigated in accordance with the Programmatic Biological Opinion (PBO) for vernal pool invertebrates, issued by the USFWS Sacramento Field Office in 1995. Surveys ~~should~~ may be conducted, with USFWS approval, in accordance with the 1996 *Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods*, to establish whether or not listed invertebrates are present.

BIO/OS16: Project sponsors ~~can and should~~ may avoid removal of wetland or riparian vegetation. Specific vegetation that is not to be removed ~~should~~ may be so marked during construction. Wetland and riparian vegetation removal ~~should~~ may be minimized as much as possible.

BIO/OS17:* Project sponsors ~~can and should~~ may replace any disturbed wetland, riparian or aquatic habitat, either on-site or at a suitable off-site location at ratios to ensure no net loss. See Mitigation Measures **BIO/OS1** through **BIO/OS14**.

BIO/OS18:* Project sponsors ~~can and should~~ may ensure that when individual projects include unavoidable losses of riparian or aquatic habitat, adjacent or nearby riparian or aquatic habitat ~~should~~ be enhanced (e.g., through removal of non-native invasive wetland species and replacement with more ecologically valuable native species).

BIO/OS19:* For projects near water resources project sponsors ~~can and should~~ may implement Best Management Practices (BMPs) at construction sites to minimize erosion and sediment transport from the area. BMPs include encouraging growth of vegetation in disturbed areas, using straw bales or other silt-catching devices, and using settling basins to minimize soil transport. (See also Water Resources Mitigation Measures.)

~~Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS.~~

BIO/OS20:* If specific project area trees are designated as “Landmark Trees” or “Heritage Trees”, then approval for removals ~~can and should~~ may be obtained through the appropriate entity, and appropriate mitigation measures ~~can and should~~ may be developed at that time, to ensure that the trees are replaced. Mitigation trees ~~can and should~~ may be locally-collected native species.

BIO/OS21:* Project sponsors may prioritize retention of trees on-site ~~can and should~~ be prioritized consistent with local regulations. For example, the Lead Agency may require additional adequate protection ~~can and should~~ be provided during the construction period for any trees that are to remain standing, including the ~~following, plus any recommendations of an arborist~~ actions described below.

ACTIONS AS MAY BE RECOMMENDED BY AN ARBORIST.

- a. Before the start of any clearing, excavation, construction or other work on the site, every protected tree deemed to be potentially endangered by said site work, ~~can and should~~ may be securely fenced off. Such fences ~~can and should~~ may remain in place for duration of all such work. All trees to be removed ~~can and should~~ may be clearly marked. A scheme ~~can and should~~ may be established for the removal and disposal of logs, brush, earth and other debris that will avoid injury to any protected tree.

- b. Where proposed development or other site work could encroach upon the protected perimeter of any protected tree, special measures can habitat for listed vernal pool crustaceans ~~can and should~~ may be avoided to the extent feasible. If infeasible, impacts ~~should~~ may be mitigated in accordance with the Programmatic Biological Opinion (PBO) for vernal pool invertebrates, issued by the USFWS Sacramento Field Office in 1995. Surveys ~~should~~ may be conducted, with USFWS approval, in accordance with the 1996 *Interim* and ~~should~~ may be incorporated to allow the roots to breathe and obtain water and nutrients. Any excavation, cutting, filing, or compaction of the existing ground surface within the protected perimeter ~~should~~ may be minimized. No change in existing ground level ~~should~~ may occur from the base of any protected tree at any time. No burning or use of equipment with an open flame ~~should~~ may occur near or within the protected perimeter of any protected tree.
- c. No storage or dumping of oil, gas, chemicals, or other substances that may be harmful to trees ~~should~~ may occur from the base of any protected trees, or any other location on the site from which such substances may enter the protected perimeter. No heavy construction equipment or construction materials ~~should~~ may be operated or stored within a distance from the base of any protected trees. Wires, ropes, or other devices ~~should~~ may not be attached to any protected tree, except as needed for support of the tree. No sign, other than a tag showing the botanical classification, ~~should~~ may be attached to any protected tree.
- d. Periodically during construction, the leaves of protected trees ~~can and should~~ may be thoroughly sprayed with water to prevent buildup of dust and other pollution that would inhibit leaf transpiration.
- e. If any damage to a protected tree ~~should~~ occurs during or as a result of work on the site, the project sponsor ~~can and should~~ may immediately notify the appropriate local agency of such damage. If, such tree cannot be preserved in a healthy state, the local agency ~~can and should~~ may require replacement of any tree removed with another tree or trees on the same site deemed adequate by the local agency to compensate for the loss of the tree that is removed.
- f. All debris created as a result of any tree removal work ~~can and should~~ may be removed by the project sponsor from the property within two weeks of debris creation, and such debris ~~can and should~~ may be properly disposed of by the project sponsor in accordance with all applicable laws, ordinances, and regulations.

Above measure is revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS22:* Project sponsors with projects within the range and within suitable habitat for species listed as threatened or endangered under California Endangered Species Act (such as the Mohave ground squirrel) or the Federal Endangered Species Act (such as the Arroyo toad) ~~can and should~~ may conduct surveys, with CDFG and/or USFWS approval, in accordance with established and approved survey methods appropriate for the species of interest, such as the 1999 USFWS *Survey Protocol for the Arroyo Toad*, to establish whether or not the species is present. If species is determined present ~~then the following applies~~, project sponsors may consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. Project sponsors should obtain an Incidental Take Permit under Section 2081 of the Fish and Game Code before proceeding with authorization of any project subject to CESA. Additional authorization may be required by the USFWS for take of federal-listed species or their occupied habitat. The Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- A pre-construction survey ~~shall~~ ~~should~~ may be conducted by a qualified biologist at each site to identify suitable habitat for the species of interest and to determine what avoidance measures, including relocation, fencing installation, and avoidance of breeding season ~~will~~ may be required.
- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).
- Project sponsors must obtain an Incidental Take Permit under Section 2081 of the Fish and Game Code before proceeding with authorization of any project subject to CESA. Additional authorization may be required by the USFWS for take of federal-listed species or their occupied habitat.

Above measure is revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS23:* Project sponsors with projects within the range and within suitable habitat for the blunt-nosed leopard lizard ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 2004 CDFG *Approved Survey Methodology for the Blunt-Nosed Leopard Lizard*, to establish whether or not the species is present. If species is determined present ~~then the following applies~~ project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or

minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG). No direct taking of the blunt-nosed leopard lizard ~~should~~ may occur as this is a CDFG fully protected species with no regulatory mechanism to authorize direct taking (killing) of individuals.

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS24:* Project sponsors with projects within the range and within suitable habitat for the California red-legged frog ~~can and should~~ may implement the measures detailed in the Programmatic Biological Opinion (PBO) for construction impacts to the red-legged frog that was issued by the USFWS (Federal Register 1999) to the USACE. The measures listed below are taken largely from the PBO and, if applied to the western pond turtle as well as the frog, would be adequate as standard mitigation for both species. A similar level of effort for survey protocol can also be applied to the Mountain yellow-legged frog, with adjustments to its climate, habitat, and breeding requirements.

- The name and credentials of a biologist qualified to act as a construction monitor ~~will~~ may be submitted to USFWS for approval at least 15 days prior to commencement of work;
- The USFWS-approved biologist ~~can and should~~ may survey the site two weeks prior to the onset of work activities and immediately prior to commencing work. If red-legged frog adults, tadpoles, or eggs are found, the approved biologist ~~can and should~~ may contact USFWS to determine whether relocating any life stages is appropriate;
- The USFWS-approved biologist ~~can and should~~ may ensure that the introduction or spread of invasive exotic plant species is avoided to the maximum extent possible, by removing weeds from areas of exposed bare soil within the construction zone where construction occurs in riparian vegetation.
- The number and size of access routes, staging areas, and total area of activity ~~should~~ may be limited to the minimum necessary to achieve the project goal;
- If work sites require dewatering, the intakes ~~can and should~~ may be screened with a maximum mesh sizes of 5 millimeters;
- The USFWS-approved biologist ~~can and should~~ may permanently remove and destroy from within the project area any individuals of exotic species, such as bullfrogs, crayfish, and centrarchid fishes, to the maximum extent practicable.

~~**MM-BIO/OS25:*** Project sponsors with projects within the range and within suitable habitat for the California tiger salamander can and should conduct surveys, with USFWS approval, in accordance with the 2003 USFWS Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander, to establish whether or not the species is present. In addition to measures described for the California red-legged frog, which would also serve to protect the California tiger salamander, the following measures can and should be implemented to further minimize adverse effects to the California tiger salamander:~~

~~A pre construction survey can and should be conducted at each site to identify suitable pond and upland burrow aestivation areas. As feasible within the context of the work area, aestivation areas should be temporarily fenced and avoided:~~

- ~~• At locations where upland aestivation habitat is identified and cannot be avoided, aestivation burrows can and should be excavated by hand prior to construction and individual animals moved to natural burrows or artificial burrows constructed of PVC pipe within 0.25 miles of the construction site as approved by the USFWS.~~
- ~~• To ensure compliance with these measures and minimize California tiger salamander take, a qualified biological monitor can and should be present during all new site disturbance construction activities (vegetation removal, clearing, grubbing, grading) at locations with suitable upland aestivation habitat.~~
- ~~• Impacts on breeding ponds can and should be avoided until the ponds have dried.~~
- ~~• Upon approval by the USFWS, preconstruction surveys to salvage and relocate individual California tiger salamanders can and should include installation of drift fences and pitfall traps within construction sites to identify and relocate animals. Following removal of individuals, construction areas should be fenced with temporary exclusionary silt fencing.~~

- ~~Temporary impacts on upland aestivation habitat can and should be restored to grassland habitat.~~
- ~~Mitigation for occupied habitat permanently impacted is likely to be compensatory off site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG.~~

Above measure deleted in response to a comment from CDFG.

BIO/OS25:* Project sponsors with projects within the range and within suitable habitat for the Coachella Valley fringe-toed lizard ~~can and should~~ may conduct surveys, with USFWS/CDFG approval, in accordance with the CDFG *Protocol for Determining Coachella Valley Fringe-Toed Lizard (CVFTL) Presence*, to establish whether or not the species is present. ~~The measures listed below are taken largely from the CDFG protocol recommendations and would be adequate as standard mitigation for this species. If the species is determined present then the following applies:~~ If species is determined present, project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS26:* Project sponsors with projects within the range and within suitable habitat for the desert tortoise ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 1992 USFWS *Field Survey Protocol For Any Federal Action That may Occur Within The Range Of The Desert Tortoise*, to establish whether or not the species is present. ~~If the species is determined present, then the following applies:~~ project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

Upon approval by the USFWS, preconstruction surveys of project impact areas ~~can and should~~ may be required to salvage and relocate individual desert tortoise out of harms way. Following removal of individuals, construction areas ~~should~~ may be fenced with temporary exclusionary silt fencing.

Mitigation for occupied habitat impacted is likely to be compensatory acquisition of mitigation credits or off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS27:* California species of special concern (CSC), such as the two-striped garter snake and several bat species are considered special-status species that meet the definition of rare, threatened or endangered species for the purposes of CEQA. Projects within the range and within suitable habitat for California species of special concern ~~can and should~~ may conduct surveys in accordance with the best professional judgment of a qualified biologist. ~~The following measures can and should be implemented to further minimize adverse effects to CSC species:~~ Project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- Preconstruction surveys of project impact areas ~~can and should~~ may be required to salvage and relocate individual two-striped garter snakes out of harm's way. Following removal of individuals, construction areas ~~should~~ may be fenced with temporary exclusionary silt fencing.
- Similarly appropriate survey, salvage, and mitigation measures ~~can and should~~ may be taken with regard to other

CSC classified species. If avoidance of impacts to species is not feasible, on site and/or off site protection of appropriate mitigation lands in perpetuity ~~should~~may be secured for these species.

- Mitigation for occupied habitat is likely to be compensatory acquisition of mitigation credits or off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG. The two-striped garter snake is not formally listed but considered a special-status species worthy of measures to avoid and minimize impacts to the extent feasible.

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS28:* Project sponsors ~~can and should~~ may ensure ~~that to~~ avoiding disrupting nesting Swainson’s hawks, by conducting construction activities at known nesting locations ~~can and should occur~~ between September and March, outside the nesting season (nesting typically occurs from March 1 through September 15). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey. Pre-construction surveys may commence in January utilizing approved protocol methods in consultation with CDFG and before the start of construction for any given milepost. no more than two weeks before the start of construction for any given milepost and report whether or not there are nesting Swainson’s hawks within 500 feet of any project (assuming available authorized access). If there are nesting Swainson’s hawks present within the 500 foot buffer areas, construction will be delayed until the CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active Swainson’s hawk nest until the adult and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist. If pre-construction surveys locate a nest site within one-half mile of any project (assuming available authorized access) a Swainson’s hawk Monitoring and Mitigation Plan may be prepared in consultation with CDFG. Plans may be prepared by a qualified biologist approved by the CDFG. Plans may include detailed measures to avoid and minimize impacts to Swainson’s hawks in and near the construction areas. The Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- If a nest site is found, design the project to allow sufficient foraging and fledging area to maintain the nest site.
- During the nesting season, ensure no new disturbances, habitat conversions, or other project-related activities that may cause nest abandonment or forced fledging occur within one-half mile of an active nest between March 1 and September 15. Buffer zones may be adjusted in consultation with CDFG and the Lead Agency.
- Do not remove Swainson’s hawk nest trees unless avoidance measures are determined to be infeasible. Removal of such trees may occur only during the timeframe of October 1 and the last day in February.

Above measure edited in response to a comment from CDFG.

BIO/OS29:* Project sponsors ~~can and should~~ may ensure that no more than two weeks before construction in any given milepost, a survey for burrows and burrowing owls ~~can and should~~ may be conducted by a qualified biologist within 500 feet of the project (assuming available authorized access). The Lead Agency may require subsequent mitigation to be performed in conformance with applicable guidelines as described below.

ADDITIONAL ACTIVITY

The survey ~~will~~ may conform to the protocol described by the California Burrowing Owl Consortium’s 1993 Burrowing Owl Protocol and Mitigation Guideline which includes up to four surveys on different dates if there are suitable burrows present as well as the CDFG’s 1995 Staff Report on Burrowing Owl Mitigation. Both mitigation guidelines also recommend habitat land acquisition and protection in perpetuity for project-related loss of occupied wintering and breeding habitat for burrowing owls. If occupied burrowing owl dens are found within the survey area, a determination ~~can and should~~ may be made by a qualified biologist in consultation with CDFG whether or not project work will impact the occupied burrows or disrupt reproductive behavior.

- If it is determined that construction will not impact occupied burrows or disrupt breeding behavior, construction ~~will~~ may proceed without any restriction or mitigation measures.
- If it is determined that construction will impact occupied burrows during August through February, the subject owls ~~will~~ may be passively relocated from the occupied burrow(s) using one-way doors. There ~~should~~ may be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow before one-way doors are installed. Artificial burrows ~~should~~ may be in place at least one-week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.

- If it is determined that construction will physically impact occupied burrows or disrupt reproductive behavior during the nesting season (March through July) then avoidance is the only mitigation available. Construction ~~should~~ may be delayed within 300 feet of occupied burrows until it is determined that the subject owls are not nesting or until a qualified biologist determines that juvenile owls are self-sufficient or are no longer reliant on the natal burrow as their primary source of shelter and survival.
- Mitigation for occupied habitat is likely to be compensatory acquisition of mitigation credits or off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG.

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS30:* Project sponsors ~~can and should~~ may ensure that when working within 100 feet of salt or brackish marshland presence for the California black rail, California clapper rail, and Yuma clapper rail ~~should~~ may be assumed for either species during the period February 1- August 31 and construction ~~should~~ may be scheduled to begin no earlier than September 1 and end no later than January 31 to avoid potential impact on reproduction. The Department of Fish and Game and United States Fish and Wildlife Service ~~can and should~~ may be consulted when projects identify occupied habitat or habitat capable of supporting California clapper rail, light-footed clapper rail, and Yuma clapper rail.

BIO/OS31:* Project sponsors with projects within the range and within suitable habitat for the coastal California gnatcatcher ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 1997 USFWS *Coastal California Gnatcatcher Presence/Absence Survey Guidelines*, to establish whether or not the species is present. If the species is determined to be present, then the following applies project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- To avoid disrupting nesting coastal California gnatcatchers, construction activities at known nesting locations ~~should~~ may occur between September and March outside the nesting season (nesting typically occurs from March 1 through September 1). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey no more than two weeks before the start of construction for any given milepost and report whether or not there are nesting coastal California gnatcatchers within 500 feet of any project (assuming available authorized access). If there are nesting coastal California gnatcatchers present within the 500-foot buffer areas, construction may ~~will~~ be delayed until the USFWS and/or CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active coastal California gnatcatchers nest until the adults and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist.
- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS32:* Project sponsors with projects within the range and within suitable habitat for the least Bell's vireo ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 2001 USFWS *Least Bell's Vireo Survey Guidelines*, to establish whether or not the species is present. If the species is determined to be present, then the following applies project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- To avoid disrupting nesting least Bell's vireo, construction activities at known nesting locations ~~can and should~~ may occur between September and March outside the nesting season (nesting typically occurs from March 1 through September 1). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey no more than two weeks before the start of

construction for any given milepost and report whether or not there are nesting least Bell's vireo within 500 feet of any project (assuming available authorized access). If there are nesting least Bell's vireo present within the 500-foot buffer areas, construction ~~will~~ may be delayed until the CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active least Bell's vireo nest until the adults and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist.

- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS33:* Project sponsors with projects within the range and within suitable habitat for the southwestern willow flycatcher ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 2000 USFWS *Southwestern Willow Flycatcher Protocol Survey Guidelines (Revision 2000)*, to establish whether or not the species is present. ~~If the species is determined present then the following applies:~~ Project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- To avoid disrupting nesting southwestern willow flycatcher, construction activities at known nesting locations ~~can and should~~ may occur between September and March outside the nesting season (nesting typically occurs from March 1 through September 15). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey no more than two weeks before the start of construction for any given milepost and report whether or not there are nesting southwestern willow flycatcher within 500 feet of any project (assuming available authorized access). If there are nesting southwestern willow flycatchers present within the 500-foot buffer areas, construction ~~will~~ may be delayed until the CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active southwestern willow flycatcher nest until the adults and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist.
- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS34:* Project sponsors ~~can and should~~ may ensure that suitable nesting sites for migratory nongame native bird species protected under the Federal Migratory Bird Treaty Act and/or trees with unoccupied raptor nests (large stick nests or cavities) ~~should~~ may only be removed prior to February 1, or following the nesting season.

A survey to identify active raptor and other migratory nongame bird nests ~~can and should~~ may be conducted by a qualified biologist at least two weeks before the start of construction at project sites from February 1st through August 31st. ~~Active raptor nests can and should be re-located within 500 feet of the project to the extent feasible and assuming available authorized access. Suitable nesting habitat for protected native birds can and should be re-located within 300 feet of the project. Any active non-raptor nests identified within the project area or within 300 feet of the project area may be marked with a 300-foot buffer, and the buffer area may need to be avoided by construction activities until a qualified biologist determines that the chicks have fledged. Active raptor nests within the project area or within 500 feet of the project area may be marked with a 500-foot buffer and the buffer avoided until a qualified biologist determines that the chicks have fledged. If the 300-foot buffer for non-raptor nests or 500-foot buffer for raptor nests cannot be avoided during construction of the project, the project sponsor may retain a qualified biologist to monitor the nests on a daily basis during construction to ensure that the nests do not fail as the result of noise generated by the construction. The biological monitor may be authorized to halt construction if the construction activities cause negative effects, such as the adults abandoning the nest or chicks falling from the nest.~~

- Beginning thirty days prior to the disturbance of suitable nesting habitat, the project sponsor ~~can and should~~ may arrange for weekly bird surveys conducted by a qualified biologist with experience in

conducting breeding bird surveys to detect protected native birds occurring in the habitat that is to be removed and any other such habitat within 300 feet of the construction work area (within 500 feet for raptors) as access to adjacent areas allows. The last survey ~~can and should~~ may be conducted no more than 3 days prior to the initiation of clearance/construction work.

- If an active raptor nest is found within 500 feet of the project or nesting habitat for a protected native bird is found within 300 feet of the project a determination ~~can and should~~ may be made by a qualified biologist in consultation with CDFG whether or not project construction work will impact the active nest or disrupt reproductive behavior.
- If it is determined that construction will not impact an active nest or disrupt breeding behavior, construction will proceed without any restriction or mitigation measure. If it is determined that construction will impact an active raptor nest or disrupt reproductive behavior then avoidance is the only mitigation available. Construction ~~can and should~~ may be delayed within 300 feet of such a nest (within 500 feet for raptor nests), until August 31 or as determined by CDFG, until the adults and/or young of the year are no longer reliant on the nest site for survival and when there is no evidence of a second attempt at nesting as determined by a qualified biologist. Limits of construction to avoid a nest ~~can and should~~ may be established in the field with flagging and stakes or construction fencing marking the protected area 300 feet (or 500 feet) from the nest. Construction personnel ~~can and should~~ may be instructed on the sensitivity of the area.
- Documentation to record compliance with applicable State and Federal laws pertaining to the protection of native birds ~~can and should~~ may be recorded.

Above measure edited in response to a comment from CDFG.

Natural Lands

BIO/OS35: Project sponsors ~~can and should~~ may conduct site-specific analyses of opportunities to preserve or improve habitat linkages with areas on- and off-site before project construction begins. Habitat linkages/wildlife movement corridors ~~can and should~~ may be analyzed on a broader and cumulative impact analysis scale to avoid adverse impacts from linear projects that have potential for impacts on a broader scale or critical narrow choke points that could reduce function of recognized movement corridors on a larger scale. Before construction, a qualified biologist will may review construction drawings and habitat connectivity mapping provided by the CDFG or CNDDDB will may be used to determine the risk of habitat fragmentation. Mitigation banking to preserve habitat linkages and corridors (opportunities to purchase, maintain, and/or restore off-site habitat) is one opportunity that project sponsor and local jurisdictions may pursue.

Above measure edited in response to a comment from CDFG.

BIO/OS36: Project sponsors ~~can and should~~ may evaluate the potential for overpasses, underpasses, and culverts in cases where a roadway or other transportation project may interrupt the flow of species through their habitat. Wildlife crossings/access ~~can and should~~ may be provided in accordance with proven standards, such as FHWA's Critter Crossings or Ventura County Mitigation Guidelines and the Wildlife Crossings Assessment & Mitigation Manual (Meese, et al., 2007.), and in consultation with wildlife corridor authorities with sufficient knowledge of both regional and local wildlife corridors, and at locations useful and appropriate for the species of concern.

Above measure edited in response to a comment from CDFG.

BIO/OS37: Project sponsors ~~can and should~~ may include analysis of wildlife corridors during project planning, in order to minimize or avoid impacts to these corridors. ~~Impacts to these corridors should be avoided and/or minimized.~~ In addition, project sponsors may include analysis to identify where additional linkages and/or culverts/under crossings would be needed that do not exist.

Above measure edited in response to a comment from CDFG.

BIO/OS38: Project sponsors ~~can and should~~ may use wildlife fencing where appropriate to minimize the probability of wildlife injury due to direct interaction between wildlife and roads. Wildlife fencing used ~~can and should~~ may be based on proven designs for impacted species and developed in conjunction with wildlife corridor authorities with sufficient knowledge of both regional and local wildlife corridors. Project sponsors ~~can and should~~ may take advantage of natural environmental buffers (i.e. streams or fields) to protect wildlife habitat from nearby transportation infrastructure. Inclusion of this mitigation measure ~~can and should~~ may be

considered on a case-by-case basis, as use of wildlife fencing could further increase the effects of habitat fragmentation and isolation for many species. Also see **BIO/OS1** through **BIO/OS21**.

BIO/OS39: Project sponsors ~~can and should~~ may avoid siting new 2012-2035 RTP/SCS transportation facilities within areas not presently exposed to impacts from transportation facilities. If avoidance is infeasible, the project ~~should~~ may minimize vehicular accessibility to areas beyond the actual transportation surface. This can be accomplished through fencing and signage. Additionally, the area of native habitats to be lost to proximity to a transportation facility ~~should~~ may be assessed and habitat at a quality of equal or superior value ~~can and should~~ may be secured and protected in perpetuity.

Threats to Biological Resources in the SCAG Region

BIO/OS40: Project sponsors ~~can and should~~ may establish litter control programs in appropriate areas, such as receptacles at road turnouts, rest stops, and viewpoints. All refuse containers ~~can and should~~ may be provided with mechanisms which prevent scavenging animals from gaining access to the contents of such containers.

BIO/OS41: Project sponsors ~~can and should~~ may use road noise minimization methods, such as brush and tree planting, at heavy noise-producing transportation areas that may affect wildlife. Native vegetation ~~can and should~~ may be used.

BIO/OS42: Project sponsors ~~can and should~~ may avoid and/or minimize construction activities that have the potential to expose species to noise, smoke, or other disturbances. Pre-construction surveys ~~can and should~~ may be conducted as appropriate to determine the presence of any species that would need to be protected from such an impact.

Protection of Biological Resources in the SCAG Region

BIO/OS43: Any Conservation opportunity areas identified by SCAG or others may be used by local jurisdictions and project sponsors as priority areas for mitigating impacts to open space resources. SCAG's forthcoming regional conservation planning policy will include additional information on conservation opportunity areas.

Above measure is clarified.

BIO/OS44: Project sponsors ~~can and should~~ may ensure that transportation systems proposed in the 2012-2035 RTP/SCS avoid or mitigate significant impacts to natural lands, community open space and important farmland, including cumulative impacts and open space impacts from the growth associated with transportation projects and improvements.

BIO/OS45: Individual projects ~~submitted for IGR review~~ ~~can and should~~ may either avoid significant impacts to regionally significant open space resources or mitigate the significant impacts ~~through measures consistent with regional open space policies for conserving natural lands, community open space and farmlands~~. All projects submitted for IGR review ~~can and should~~ may demonstrate consideration of alternatives that would avoid or reduce impacts to open space.

Above measure revised to clarify IGR process and to reflect intent to defer to lead agencies' CEQA analysis and mitigation decisions.

BIO/OS46: Project sponsors ~~can and should~~ may include into project design, to the maximum extent practicable, mitigation measures and recommended best practices aimed at minimizing or avoiding impacts to natural lands, including, but not limited to FHWA's Critter Crossings, Ventura County Mitigation Guidelines, CDFG's Wildlife Action Plan and any applicable conservation plans.

BIO/OS47:* For projects adjacent to natural watercourses, project sponsors ~~can and should~~ may submit a vegetation management plan for review and approval by the Lead Agency that includes, as deemed appropriate, the following measures:

- Identify and do not disturb a ~~20-foot~~ buffer distance (to be determined as appropriate on a case-by-case basis) from the top of the natural watercourse. If the top of bank cannot be identified, leave a 50-foot buffer from the centerline of the watercourse or as wide a buffer as possible between the watercourse centerline and the proposed site development.

- Identify and leave "islands" of vegetation in order to prevent erosion and landslides and protect nesting habitat.
- Leave at least 6 inches of vegetation on the site.
- Trim tree branches from the ground up (limbing up) and leave tree canopy intact.
- Leave stumps and roots from cut down trees to prevent erosion.
- Plant fire-appropriate, drought-tolerant, preferably native vegetation.
- Err on the side of caution; if a plant, tree or area is sensitive, obtain a second opinion before cutting.
- Provide erosion and sediment control protection if cutting vegetation on a steep slope.
- Leave tall shrubbery at least 3-feet high.
- Fence off sensitive plant habitats and creek areas to protect from animal grazing as appropriate and necessary.
- Do not clear-cut vegetation. This can lead to erosion and severe water quality problems and destroy important habitat.
- Do not remove vegetation within 20-feet of the top of bank. If the top of bank cannot be identified, do not cut within 50-feet of the centerline of the natural watercourse or as wide a buffer as possible between the natural watercourse centerline and the proposed site development.
- Do not trim/prune branches that are larger than 4 inches in diameter.
- Do not remove tree canopy.
- Do not dump cut vegetation in a creek.
- Do not cut tall shrubbery to less than 3-feet high.
- Do not cut off short vegetation (grasses, ground-cover) to less than 6-inches high.

Above measure edited in response to a comment from CDFG.

BIO/OS48:* As appropriate conduct a biological assessment for any site/corridor where there is the potential for impacts to significant biological resources including threatened or endangered species, sensitive habitats/species and/or protected trees.

BIO/OS49: Shade Tree Planting: Local jurisdictions or agencies ~~can and should~~ may promote the planting of shade trees and establish shade tree guidelines and specifications, including:

- Recommendations for tree planting based on the land use (residential, commercial, parking lots, etc.);
- Recommendations for tree types based on species size, branching patterns, whether deciduous or evergreen, whether roots are invasive, etc.;
- Recommendations for placement, including distance from structures, density of planting, and orientation relative to structures and the sun.

BIO/OS50: Urban Forestry Management: Local jurisdictions or agencies ~~can and should~~ may develop an Urban Forestry Program to consolidate policies and ordinances regarding tree planting, maintenance, and removal, including:

- Establish a tree-planting target and schedule to support the goals of the California Climate Action Team to plant 5 million trees in urban areas by 2020;
- Establish guidelines for tree planting, including criteria for selecting deciduous or evergreen trees low-VOC-producing trees, and emphasizing the use of drought-tolerant native trees and vegetation.

BIO/OS51: Local jurisdictions or agencies ~~can and should~~ may establish policies and programs to restore, protect, manage and preserve conservation areas, including forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas, that remove and sequester carbon from the atmosphere.

BIO/OS52: Conservation Area Development: Local jurisdictions or agencies ~~can and should~~ may consider establishing programs and funding mechanisms to create protected conservation areas, ~~including:~~ For example, local jurisdictions may:

- ~~Imposing~~ Impose mitigation fees for development on lands that would otherwise be conservation areas, and use the funds generated to protect other areas from development;
- ~~Proposing~~ Consider proposals for voters to approve a small tax increment (e.g., a quarter cent sales tax, perhaps for a finite time period that could be renewed) to fund the purchase of development rights in conservation areas, or purchase of the land outright.

Above measure revised to clarify intent to defer to jurisdictional authority on revenue programs.

BIO/OS53: Conservation Area Preservation: Local jurisdictions or agencies ~~can and should~~ may establish policies to preserve existing conservation areas, and to discourage development in those areas.

BIO/OS54: Local jurisdictions or agencies ~~can and should~~ may manage its stock of vegetation to reduce GHG emissions.

BIO/OS55: Local jurisdictions ~~can and should~~ may conduct a comprehensive inventory and analysis of the urban forest, and coordinate tree maintenance responsibilities with all responsible departments, consistent with best management practices.

BIO/OS56: Local jurisdictions or agencies ~~can and should~~ may evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and install or replace vegetation with drought-tolerant, low-maintenance native species or edible landscaping that can also provide shade and reduce heat-island effects.

CULTURAL RESOURCES

CUL1:* As part of the appropriate project/environmental review of individual projects, project sponsors ~~can and should~~ may identify potential impacts to historic resources. A record search at the appropriate Information Center ~~should~~ may be conducted to determine whether the project area has been previously surveyed and whether historic resources were identified.

CUL2:* If indicated as necessary by a records search, prior to construction activities, project sponsors ~~can and should~~ may obtain a qualified architectural historian to conduct historic architectural surveys as recommended by the Information Center. In the event the records indicate that no previous survey has been conducted, the Information Center ~~will~~ may make a recommendation on whether a survey is warranted based on the sensitivity of the project area for historical resources within 1,000 feet of the project.

CUL3:* Project sponsors ~~can and should~~ may comply with Section 106 of the National Historic Preservation Act (NHPA) including, but not limited to, projects for which federal funding or approval is required for the individual project. This law requires federal agencies to evaluate the impact of their actions on resources included in or eligible for listing in the National Register. Federal agencies must coordinate with the State Historic Preservation Officer in evaluating impacts and developing mitigation. These mitigation measures may include, but are not limited to the following:

- Where appropriate, project sponsors ~~should~~ may employ design measures to avoid historical resources and undertake adaptive reuse where appropriate and feasible. If resources are to be preserved, as feasible, project sponsors ~~should~~ may carry out the maintenance, repair, stabilization, rehabilitation, restoration, preservation, conservation or reconstruction in a manner consistent with the Secretary of the Interior's Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings. If resources would be impacted, impacts ~~should~~ may be minimized to the extent feasible.
- Where feasible, noise buffers/walls and/or visual buffers/landscaping ~~should~~ may be constructed to preserve the contextual setting of significant built resources.

CUL4:* Project sponsors ~~can and should~~ may secure a qualified environmental agency and/or architectural historian, or other such qualified person to document any significant historical resource(s), by way of historic narrative, photographs, and architectural drawings, as mitigation for the effects of demolition of a resource. However, such documentation will not mitigate the effects to less than significant.

CUL5:* As part of the appropriate project/environmental review of individual projects, project sponsors ~~can and should~~ may consult with the Native American Heritage Commission (NAHC) to determine whether known sacred sites are in the project area, and identify the Native American(s) to contact to obtain information about the project site. Federal, State, counties, and cities lead agencies may require that a check of the NAHC sacred lands files be undertaken by all projects and that the Native American tribes or individuals identified by the NAHC be contacted by the project proponent for further information and consultation on the project.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL6:* Prior to construction activities, project sponsors ~~can and should~~ may obtain a qualified archaeologist to conduct a record search at the appropriate Information Center of the California Archaeological Inventory to determine whether the project area has been previously surveyed and whether resources were identified. Federal, State, counties, and cities lead agencies may require a qualified archeologist conduct a record search at the appropriate Information Center on the project.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL7:* Prior to construction activities, project sponsors ~~can and should~~ may obtain a qualified archaeologist or architectural historian (depending on applicability) to conduct archaeological and/or historic architectural surveys as recommended by the Information Center. In the event the records indicate that no previous survey has been conducted, the Information Center ~~may~~ may make a recommendation on whether a survey is warranted based on the sensitivity of the project area for archaeological resources. Federal, State, counties, and cities lead agencies may conduct a phase I archeological or historic architectural survey for all project that have not been previously surveyed or have not been surveyed in the past ten years.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL8:* If the record search indicates that the project is located in an area rich with cultural materials, project sponsors ~~can and should~~ may retain a qualified archaeologist to monitor any subsurface operations, including but not limited to grading, excavation, trenching, or removal of existing features of the subject property. Federal, State, counties, and cities lead agencies require that a Native American monitor be employed by the project proponent or tribe to monitor the subsurface operations or any earth movement in all projects. It is also strongly recommended that a pre-excavation agreement be implemented with culturally affiliated tribes.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL9:* Construction activities and excavation ~~can and should~~ may be conducted to avoid cultural resources (if identified). If avoidance is not feasible, further work may be needed to determine the importance of a resource. Project sponsors ~~shall should~~ may obtain a qualified archaeologist familiar with the local archaeology, and/or as appropriate, an architectural historian who ~~should~~ may make recommendations regarding the work necessary to determine importance. If the cultural resource is determined to be important under state or federal guidelines, impacts on the cultural resource ~~will~~ may need to be mitigated. Avoidance is the preferred alternative. If avoidance is not feasible, Federal, State, counties, and cities lead agencies may require that the project sponsor consult with culturally affiliated Native American Tribes in the determination of importance of the resource.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL10:* Project sponsors ~~can and should~~ may stop construction activities and excavation in the area where cultural resources are found until a qualified archaeologist can determine the importance of these resources. Federal, State, counties, and cities lead agencies may require that the project sponsor consult with culturally affiliated Native American Tribes in the determination of importance of the resource.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL11:* As part of the appropriate project/environmental review of individual projects, project sponsors ~~can and should~~ may obtain a qualified paleontologist to identify and evaluate paleontological resources where potential impacts are considered high; the paleontologist ~~should~~ may also conduct a field survey in these areas.

CUL12:* Project sponsors ~~can and should~~ may ensure that construction activities avoid known paleontological resources, if feasible, especially if the resources in a particular lithic unit formation have been determined through detailed investigation to be unique.

CUL13:* Project sponsors ~~can and should~~ may ensure that when a construction activity could significantly disturb soils or geologic formations in areas identified as having a moderate to high potential to support paleontological resources, a qualified researcher must be stationed on-site to observe during excavation operations and recover scientifically valuable specimens. As part of this mitigation, the following actions ~~should~~ may be taken:

- A certified paleontologist ~~should~~may be retained (or required to be retained) by the project sponsor prior to construction to establish procedures for surveillance and the preconstruction salvage of exposed resources if fossil-bearing sediments have the potential to be impacted.
- The paleontologist ~~should~~may provide preconstruction coordination with contractors, oversee original cutting in previously undisturbed areas of sensitive formations, halt or redirect construction activities as appropriate to allow recovery of newly discovered fossil remains, and oversee fossil salvage operations and reporting.
- This measure ~~should~~may be placed as a condition on all plans where excavation and earthmoving activity is proposed in a geologic unit having a moderate or high potential for containing fossils.
- Excavations of paleontological resources ~~should~~may be overseen by the qualified paleontologist and the paleontological resources given to a local agency, or other applicable institution, where they could be displayed or used for research.

CUL14:* Where practicable, project sponsors ~~can and should~~may avoid routes and project designs that would permanently alter unique features with archaeological and/or paleontological significance.

CUL15:* As part of project oversight of individual projects, project sponsors ~~can and should~~may, in the event of discovery or recognition of any human remains during construction or excavation activities associated with the project, in any location other than a dedicated cemetery, ~~should~~may cease further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until the coroner of the county in which the remains are discovered has been informed and has determined that no investigation of the cause of death is required.

CUL16:* If any discovered remains are of Native American origin:

- The coroner ~~shall~~ ~~should~~may contact the Native American Heritage Commission in order to ascertain the proper descendants from the deceased individual. The coroner ~~should~~may make a recommendation to the landowner or the person responsible for the excavation work, for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods. This may include obtaining a qualified archaeologist or team of archaeologists to properly excavate the human remains; or
- If the Native American Heritage Commission is unable to identify a descendant, or the descendant failed to make a recommendation within 24 hours after being notified by the commission, the landowner or their authorized representative ~~can and should~~may obtain a Native American monitor, and an archaeologist, if recommended by the Native American monitor, and rebury the Native American human remains and any associated grave goods, with appropriate dignity, on the property and in a location that is not subject to further subsurface disturbance where the following conditions occur:
 - The Native American Heritage Commission is unable to identify a descendent;
 - The descendant identified fails to make a recommendation; or
 - The landowner or their authorized representative rejects the recommendation of the descendant, and the mediation by the Native American Heritage Commission fails to provide measures acceptable to the landowner.

GEOLOGY, SOILS AND MINERAL RESOURCES

GEO1:* Project sponsors ~~can and should~~may ensure that projects located within or across Alquist-Priolo Zones comply with design requirements provided in Special Publication 117, published by the California Geological Survey, as well as relevant local, regional, State, and federal design criteria for construction in seismic areas.

GEO2:* Project sponsors ~~can and should~~may ensure that projects are designed in accordance with county and city code requirements for seismic ground shaking. The design of projects ~~should~~may consider seismicity of the site, soil response at the site, and dynamic characteristics of the structure, in compliance with the appropriate California Building Code and State of California design standards for construction in or near fault zones, as well as all standard design, grading, and construction practices in order to avoid or reduce geologic hazards.

GEO3:* Project sponsors ~~can and should~~may ensure that site-specific geotechnical investigations conducted by a qualified geotechnical expert ~~should~~may be required prior to preparation of project designs. These investigations would identify areas of potential failure and recommend remedial geotechnical measures to eliminate any problems.

- GEO4:*** Project sponsors ~~can and should~~ may ensure that site-specific geotechnical investigations conducted by a qualified geotechnical expert are conducted to ascertain soil types and local faulting prior to preparation of project designs. These investigations would identify areas of potential failure and recommend remedial geotechnical measures to eliminate any problems.
- GEO5:*** Project sponsors ~~can and should~~ may ensure that project designs provide adequate slope drainage and appropriate landscaping to minimize the occurrence of slope instability and erosion. Design features ~~should~~ may include measures to reduce erosion caused by stormwater. Road cuts ~~should~~ may be designed to maximize the potential for revegetation.
- GEO6:*** Project sponsors ~~can and should~~ may ensure that, prior to preparing project designs, new and abandoned wells are identified within construction areas to ensure the stability of nearby soils.
- GEO7:** Project sponsors ~~can and should~~ may ensure that projects avoid geologic units or soils that are unstable, expansive soils and soils prone to lateral spreading, subsidence, liquefaction, or collapse wherever feasible.
- GEO8:** Project sponsors ~~can and should~~ may ensure that projects avoid landslide areas and potentially unstable slopes wherever feasible.
- GEO9:** Project sponsors ~~can and should~~ may ensure that site-specific geotechnical investigations conducted by a qualified geotechnical expert ~~should~~ may be required prior to preparation of project designs to identify the potential for subsidence and expansive soils. These investigations would identify areas of potential failure and recommend remedial geotechnical measures to eliminate any problems. Recommended corrective measures, such as structural reinforcement and replacing soil with engineered fill, ~~should~~ may be implemented in project designs.
- GEO10:** Local jurisdictions ~~can and should~~ may review availability of aggregate and mineral resources in their jurisdiction and ~~should~~ may develop a long-range plan to meet demand.

GREENHOUSE GAS EMISSIONS

- GHG1:** SCAG member cities and the county governments ~~can and should~~ may adopt and implement Climate Actions Plans (CAPS, also known as Plans for the Reduction of Greenhouse Gas Emissions as described in CEQA Guidelines Section 15183.5 Tiering and Streamlining the Analysis of Greenhouse Gas Emissions) ~~that contain the following information~~

ADDITIONAL ACTIVITY

Climate Action Plans generally follow the steps and contain components described below.

- a) Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within their respective jurisdictions;
- b) Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;
- c) Identify and analyze the GHG emissions resulting for specific actions or categories of actions anticipated within their respective jurisdictions;
- d) Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
- e) Establish a mechanism to monitor the plan's progress toward achieving that level and to require amendment if the plan is not achieving specified levels; and
- f) Be adopted in a public process following environmental review.

CAPs ~~can and should~~ may, when appropriate, incorporate planning and land use measures from the California Attorney General's latest list of example policies to address climate change at both the plan and project level. Specifically, at the plan level, land use plans ~~can and should~~ may, when appropriate, incorporate planning and land use measures from the California Attorney General's latest list of example policies to address climate change (http://ag.ca.gov/globalwarming/pdf/GP_policies.pdf), including, but not limited to policies from that web page such as:

- Smart growth, jobs/housing balance, transit-oriented development, and infill development through land use designations, incentives and fees, zoning, and public-private partnerships

- Create transit, bicycle, and pedestrian connections through planning, funding, development requirements, incentives and regional cooperation, and create disincentives for auto use
- Energy and water-efficient buildings and landscaping through ordinances, development fees, incentives, project timing, prioritization, and other implementing tools

In addition, member cities and the county governments ~~can and should~~ may incorporate, as appropriate, policies to encourage implementation of the Attorney General’s list of project specific mitigation measures available at the following web site: http://ag.ca.gov/globalwarming/pdf/GW_mitigation_measures.pdf, including, but not limited to measures from the web page such as:

- Adopt a comprehensive parking policy that discourages private vehicle use and encourages the use of alternative transportation
- Build or fund a major transit stop within or near development
- Provide public transit incentives such as free or low-cost monthly transit passes to employees, or free ride areas to residents and customers
- Incorporate bicycle lanes, routes and facilities into street systems, new subdivisions, and large developments
- Require amenities for non-motorized transportation, such as secure and convenient bicycle parking.

They ~~should~~ may also incorporate, when appropriate, planning and land use measures from additional resources listed by the California Attorney General at the following webpage: <http://ag.ca.gov/globalwarming/ceqa/resources.php>.

In addition, CAPs ~~can and should~~ may also incorporate analysis of climate change adaptation, in recognition of the likely and potential effects of climate change in the future regardless of the level of mitigation and in conjunction with Executive Order S-13-08, which seeks to enhance the State’s management of climate impacts including sea level rise, increased temperatures, shifting precipitation, and extreme weather events by facilitating the development of State’s first climate adaptation strategy.

Above measure revised to reduce level of detail and to clearly defer to local policy-making process.

GHG2: Project sponsors ~~can and should~~ may require Best Available Control Technology (BACT) during construction and operation of projects, including:

- a) Solicit bids that include use of energy and fuel efficient fleets;
- b) Solicit preference construction bids that use BACT, particularly those seeking to deploy zero- and/or near zero emission technologies;
- c) Employ use of alternative fueled vehicles;
- d) Use lighting systems that are energy efficient, such as LED technology;
- e) Use CEQA Guidelines Appendix F, Energy Conservation, to create an energy conservation plan;
- f) Streamline permitting process to infill, redevelopment, and energy-efficient projects;
- g) Use an adopted emissions calculator to estimate construction-related emissions;
- h) Use the minimum feasible amount of GHG-emitting construction materials that is feasible;
- i) Use of cement blended with the maximum feasible amount of flash or other materials that reduce GHG emissions from cement production;
- j) Use of lighter-colored pavement where feasible;
- k) Recycle construction debris to maximum extent feasible; and
- l) Plant shade trees in or near construction projects where feasible.

Above measure edited in response to a comment from EPA.

GHG3: ~~SCAG shall in its capacity as a Clean Cities Coalition, and Local jurisdictions~~ ~~can and should~~ may establish a coordinated, creative public outreach activities ~~campaign~~, including publicizing the importance of reducing GHG emissions and steps community members ~~can~~ may take to reduce their individual impacts.

GHG4: Pedestrian and Bicycle Promotion: ~~SCAG shall and Local jurisdictions~~ ~~can and should~~ may work with local community groups and ~~downtown~~ business associations to organize and publicize walking tours and bicycle events, and to encourage pedestrian and bicycle modes of transportation.

GHG5: Waste Reduction: Local jurisdictions ~~can and should~~ may organize workshops on waste reduction activities for the home or business, such as backyard composting, or office paper recycling, and ~~will~~ may schedule recycling drop-off events and neighborhood chipping/mulching days.

GHG6: Water Conservation: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may organize support and/or sponsor workshops on water conservation activities, such as selecting and planting drought tolerant, native plants in landscaping, and installing advanced irrigation systems.

Measure is clarified.

GHG7: Energy Efficiency: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may organize workshops on steps to increase energy efficiency in the home or business, such as weatherizing the home or building envelope, installing smart lighting systems, and how to conduct a self-audit for energy use and efficiency.

GHG8: Schools Programs: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may develop and implement a program to present information to school children about climate change and ways to reduce GHG emissions, and ~~will~~ may support school-based programs for GHG reduction, such as school based trip reduction and the importance of recycling.

HAZARDOUS MATERIALS

HM1:* Project sponsors ~~can and should~~ may comply with all applicable laws, regulations, and health and safety standards set forth by federal, state, and local authorities that regulate the proper handling of such materials and their containers to the routine transport, use, and disposal of hazardous materials does not create a significant hazard to the public or the environment.

HM2:* Project sponsors ~~can and should~~ may consider any known or planned school locations when determining the alignment of new transportation projects and modifications to existing transportation facilities as well as any industrial or other use that could pose a hazard to students.

HM3:* Project sponsors ~~can and should~~ may ensure that Best Management Practices (BMPs) are implemented as part of construction to minimize the potential negative effects to groundwater and soils. These ~~should~~ may include the following:

- Follow manufacturer's recommendations on use, storage, and disposal of chemical products used in construction;
- Avoid overtopping construction equipment fuel gas tanks;
- During routine maintenance of construction equipment, properly contain and remove grease and oils;
- Properly dispose of discarded containers of fuels and other chemicals;
- Ensure that construction would not have a significant impact on the environment or pose a substantial health risk to construction workers and the occupants of the proposed development. Soil sampling and chemical analyses of samples ~~should~~ may be performed to determine the extent of potential contamination beneath all UST's, elevator shafts, clarifiers, and subsurface hydraulic lifts when on-site demolition, or construction activities would potentially affect a particular development or building; and
- If soil, groundwater or other environmental medium with suspected contamination is encountered unexpectedly during construction activities (e.g., identified by odor or visual staining, or if any underground storage tanks, abandoned drums or other hazardous materials or wastes are encountered), the project sponsor ~~should~~ may cease work in the vicinity of the suspect material, the area ~~should~~ may be secured as necessary, and the project sponsor ~~should~~ may take all appropriate measures to protect human health and the environment. Appropriate measures ~~should~~ may include notification of regulatory agency(ies) and implementation of actions as necessary, to identify the nature and extent of contamination. Work ~~should~~ may not resume in the area(s) affected until the measures have been implemented under the oversight of the City or regulatory agency, as appropriate.

HM4:* As appropriate, project sponsors ~~can and should~~ may submit documentation to determine whether radon or vapor intrusion from the groundwater and soil is located on-site as part of the Phase I documents. The Phase I analysis ~~should~~ may be submitted to the appropriate government agency for review and approval, along with a Phase II report if warranted by the Phase I report for the project site. The reports ~~should~~ may make recommendations for remedial action, if appropriate, and ~~should~~ may be signed by a Registered Environmental Assessor, Professional Geologist, or Professional Engineer. The project sponsor ~~should~~ may implement the approved recommendations.

HM5:* As appropriate each project sponsor ~~can and should~~ may submit a Hazardous Materials Business/Operations Plan for review and approval by the appropriate local agency. Once approved, this plan ~~should~~ will then be

kept on file with the Lead Agency (or other appropriate government agency) and may be updated as applicable. The purpose of the Hazardous Materials Business/Operations Plan is to ensure that employees are adequately trained to handle the materials and provides information to the local fire protection agency ~~should~~ may emergency response be required. The Hazardous Materials Business/Operations Plan ~~should~~ may include the following:

- The types of hazardous materials or chemicals stored and/or used on-site, such as petroleum fuel products, lubricants, solvents, and cleaning fluids
- The location of such hazardous materials
- An emergency response plan including employee training information
- A plan that describes the manner in which these materials are handled, transported and disposed

HM6:* Project sponsors ~~can and should~~ may implement all of the following Best Management Practices (BMPs) regarding potential soil and groundwater hazards.

- Soil generated by construction activities ~~should~~ may be stockpiled on-site in a secure and safe manner. All contaminated soils determined to be hazardous or non-hazardous waste must be adequately profiled (sampled) prior to acceptable reuse or disposal at an appropriate off-site facility. Specific sampling and handling and transport procedures for reuse or disposal ~~should~~ may be in accordance with applicable local, State and federal agencies laws.
- Groundwater pumped from the subsurface ~~should~~ may be contained onsite in a secure and safe manner, prior to treatment and disposal, to ensure environmental and health issues are resolved pursuant to applicable laws and policies. Engineering controls ~~should~~ may be utilized, which include impermeable barriers to prohibit groundwater and vapor intrusion into the building.
- Prior to issuance of any demolition, grading, or building permit, the sponsor ~~should~~ may submit for review and approval by the Lead Agency (or other appropriate government agency), written verification that the appropriate federal, State and/or local oversight authorities, including, but not limited to the Regional Water Quality Control Board (RWQCB), have granted all required clearances and confirmed that the all applicable standards, regulations and conditions for all previous contamination at the site.

HM7:* Project sponsors ~~can and should~~ may consult all known databases of contaminated sites and undertake a standard Phase I Environmental Site Assessment in the process of planning, environmental clearance, and construction for projects included in the 2012-2035 RTP/SCS, including development projects.

HM8:* Where contaminated sites are identified, project sponsors ~~can and should~~ may develop appropriate mitigation measures to assure that worker and public exposure is minimized to an acceptable level and to prevent any further environmental contamination as a result of construction.

HM9:* If asbestos-containing materials (ACM) are found to be present in building materials to be removed project sponsors ~~can and should~~ may submit specifications signed by a certified asbestos consultant for the removal, encapsulation, or enclosure of the identified ACM in accordance with all applicable laws and regulations, including but not necessarily limited to: California Code of Regulations, Title 8; Business and Professions Code; Division 3; California Health & Safety Code Section 25915-25919.7; and other local regulations as applicable.

HM10:* Prior to issuance of demolition, grading, or building permits, project sponsors ~~can and should~~ may submit to the appropriate agency responsible for hazardous materials/wastes oversight, a Phase II Environmental Site Assessment report if warranted by a Phase I report for the project site. The reports ~~should~~ may make recommendations for remedial action, if appropriate, and ~~should~~ may be signed by a Registered Environmental Assessor, Professional Geologist, or Professional Engineer.

HM11:* Project sponsors ~~can and should~~ may submit a comprehensive assessment report to the appropriate agency, signed by a qualified environmental professional, documenting the presence or lack thereof of ACM, lead-based paint, and any other building materials or stored materials classified as hazardous waste by State or federal law.

HM12:* If a Phase II Environmental Site Assessment report recommends remedial action, the project sponsor ~~can and should~~ may:

- Consult with the appropriate local, State, and federal environmental regulatory agencies to ensure sufficient minimization of risk to human health and environmental resources, both during and after

construction, posed by soil contamination, groundwater contamination, or other surface hazards including, but not limited to, underground storage tanks, fuel distribution lines, waste pits and sumps;

- Obtain and submit written evidence of approval for any remedial action if required by a local, State, or federal environmental regulatory agency; and
- Submit a copy of all applicable documentation required by local, State, and federal environmental regulatory agencies, including but not limited to: permit applications, Phase I and II environmental site assessments, human health and ecological risk assessments, remedial action plans, risk management plans, soil management plans, and groundwater management plans.

HM13:* If lead-based paint is present, project sponsors ~~can and should~~ may submit specifications to the appropriate agency, signed by a certified Lead Supervisor, Project Monitor, or Project Designer for the stabilization and/or removal of the identified lead paint in accordance with all applicable laws and regulations, including but not necessarily limited to: California Occupational Safety and Health Administration’s (Cal OSHA’s) Construction Lead Standard, Title 8 California Code of Regulations (CCR) Section 1532.1 and Department of Health Services (DHS) Regulation 17 CCR Sections 35001-36100, as may be amended. If other materials classified as hazardous waste by State or federal law are present, the project sponsor ~~should~~ may submit written confirmation to the appropriate local agency that all State and federal laws and regulations ~~should~~ may be followed when profiling, handling, treating, transporting and/or disposing of such materials.

HM14:* If materials classified as hazardous waste by State or federal law are present, project sponsors ~~can and should~~ may submit written confirmation to appropriate local agency that all State and federal laws and regulations ~~should~~ may be followed when profiling, handling, treating, transporting and/or disposing of such materials.

LAND USE AND AGRICULTURAL RESOURCES

LU1:* Local jurisdictions ~~can and should~~ may provide for new housing consistent with the regional Housing Needs Assessment (RHNA) to accommodate their share of the forecasted regional growth.

LU2:* Significant adverse impacts to community cohesion resulting from the displacement of residences or businesses ~~can and should~~ may be mitigated with specific relocation measures as dictated by local, state or federal requirements on a project-by project basis. Such measures include assistance in finding a new location, assistance with moving, or compensation for losses. Where it has been determined that displacement is necessary and displaced individuals are eligible, a relocation assistance program consistent with the State Uniform Location Assistance and Real Properties Acquisition Policies Act provides compensation and assistance in finding new residence for displaced individuals.

LU3: Project sponsors ~~can and should~~ may design new transportation facilities that consider access to existing community facilities. During the design phase of the project, community amenities and facilities ~~can and should~~ may be identified and considered in the design of the project.

LU4: Project sponsors ~~can and should~~ may design roadway improvements that minimize barriers to pedestrians and bicyclists. During the design phase, pedestrian and bicycle routes ~~should~~ may be determined that permit connections to nearby community facilities.

LU5:* For projects that require approval or funding by the USDOT, project sponsors ~~can and should~~ may comply with Section 4(f) U.S. Department of Transportation Act of 1966 (USDOT Act).

LU6: Project sponsors ~~can and should~~ may ensure that at least one acre of unprotected open space is permanently conserved for each acre of open space developed as a result of transportation projects/improvements.

LU6: Local jurisdictions ~~can and should~~ may seek funding to prepare specific plans and related environmental documents to facilitate mixed-use development at selected sites, and to allow these areas to serve as receiver sites for transfer of development rights away from environmentally sensitive lands and rural areas outside established urban growth boundaries.

LU7:* Local jurisdictions ~~can and should~~ may preserve and create open space and parks. Preserve existing trees, and plant replacement trees at a set ratio.

- LU8:** Project sponsors ~~can and should~~ may consider corridor realignment, buffer zones and setbacks, and berms and fencing where feasible, to avoid agricultural lands and to reduce conflicts between transportation uses and agricultural lands.
- LU9:*** Prior to final approval of each project and when feasible and prudent, the project sponsor ~~can and should~~ may establish conservation easement programs to mitigate impacts to prime farmland.
- LU10:*** Prior to final approval of each project, the project sponsor ~~can and should~~ may to the extent practical and feasible, avoid impacts to prime farmlands or farmlands that support crops considered valuable to the local or regional economy.
- LU11:** Local jurisdictions ~~can and should~~ may establish programs to direct growth to less agriculturally valuable lands and ensure, where possible, the continued protection of the most agriculturally valuable land within each county. The following are offered as examples of programs:
- The development or participation in transfer of development rights programs to encourage the preservation of agricultural lands.
 - Tools for the preservation of agricultural lands such as eliminating estates and ranchettes and clustering to retain productive agricultural land.
 - Easing restrictions on farmer's markets and encourage cooperative farming initiatives to increase the availability of locally grown food.
 - Considering partnering with school districts to develop farm-to-school programs.
- LU12:** Local jurisdictions ~~can and should~~ may avoid the premature conversion of farmlands by promoting infill development and the continuation of agricultural uses until urban development is imminent; if development of agricultural lands is necessary, growth ~~can and should~~ may be directed to those lands on which the continued viability of agricultural production has been compromised by surrounding urban development on the loss of local markets.
- LU13:** Local jurisdictions ~~can and should~~ may encourage patterns of urban development and land use, which reduce costs on infrastructure and make better use of existing facilities. Strategies that local jurisdictions ~~can and should~~ may pursue include:
- Increasing the accessibility to natural areas lands for outdoor recreation.
 - Promoting infill development and redevelopment to revitalize existing communities
 - Utilizing "green" development techniques
 - Promoting water-efficient land use and development.
- LU14:** Project sponsors and local jurisdictions ~~can and should~~ may promote infill development and redevelopment to encourage the efficient use of land and minimize the development of agricultural and open space lands.
- LU15:** Local jurisdictions ~~can and should~~ may consider the following land use principles that use resources efficiently, and to the extent practical and feasible minimize pollution and reduce waste generation:
- Mixed-use residential and commercial development that is connected with public transportation and utilizes existing infrastructure.
 - Land use and planning strategies to increase biking and walking trips.
- LU16:*** Individual projects must be consistent with federal, state, and local policies that preserve agricultural lands and support the economic viability of agricultural activities, as well as policies that provide compensation for property owners if preservation is not feasible.
- LU17:** For projects in agricultural areas, project sponsors ~~can and should~~ may contact the California Department of Conservation and each county's Agricultural Commissioner's office to identify the location of prime farmlands and lands that support crops considered valuable to the local or regional economy. Impacts to such lands ~~can and should~~ may be evaluated in project-specific environmental documents. The analysis ~~can and should~~ may use the land evaluation and site assessment (LESA) analysis method (CEQA Guidelines §21095), as appropriate. The project sponsors or local jurisdictions ~~can and should~~ may be responsible for ensuring adherence to the mitigation measures prior to construction. Mitigation measures may include conservation easements or the payment of in-lieu fees.

LU18:* For those projects that require federal funding, the federal agency evaluates the effects of the action to agricultural resources using the criteria set forth in the Farmland Protection Policy Act (FPPA). The FPPA is administered by the NRCS, which determines impacts to farmland that could occur due to the proposed project. The determination is made through coordination between the federal agency proposing or supporting the project and NRCS. The assessment of potential impacts to farmland from corridor type projects, which is typical of transportation projects analyzed in this PEIR, ~~will~~ may require completion of Form NRCS-CPA-106, Farmland Conservation Impact Rating for Corridor Type Projects. NRCS ~~will~~ may make a determination, using set thresholds, as to whether additional project specific mitigation would be required.

LU19: Prior to final approval of each project, the project sponsor ~~can and should~~ may encourage enrollments of agricultural lands for counties that have Williamson Act programs, where applicable.

LU20: Project sponsors and local jurisdictions ~~can and should~~ may submit for IGR review projects with potentially significant impacts to important farmlands. ~~Projects can and should include mitigation measures to reduce impacts and demonstrate project alternatives that avoid or lessen impact to agricultural lands. Mitigation can and should~~ may occur at a 1:1 ratio.

Above measure revised to clarify intent of IGR program, defer to future policy consideration by SCAG, and to defer to local discretion in identifying mitigation.

LU21: Local jurisdictions may consider policies to preserve forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, groundwater recharge areas and other open space that provide carbon sequestration benefits.

Above measure revised to resolve ambiguity.

LU22: Local jurisdictions may require best management practices in agriculture and animal operations to reduce emissions, conserve energy and water, and utilize alternative energy sources, including biogas, wind and solar.

LU23: Local jurisdictions ~~can and should~~ may encourage patterns of urban development and land use, which reduce costs on infrastructure and make better use of existing facilities.

LU24:* Local jurisdictions ~~can and should~~ may adopt and implement General Plan Housing Elements that accommodate the housing need identified through the RHNA process. Affordable housing ~~can and should~~ may be provided consistent with the RHNA income category distribution adopted for each jurisdiction.

LU25: Local jurisdictions ~~can and should~~ may consider shared regional priorities, as outlined in the Compass Blueprint, 2012-2035 RTP/SCS and other ongoing regional planning efforts, in determining their own development goals and drafting local plans.

LU26: Local jurisdictions and subregional organizations ~~can and should~~ may encourage the cleanup and redevelopment of brownfield sites.

LU27: Local jurisdictions or agencies ~~can and should~~ may consider adopting and implement a development pattern that utilizes existing infrastructure; reduces the need for new roads, utilities and other public works in new growth areas; and enhances non-automobile transportation.

Above measure revised to emphasize deference in land use authority.

LU28: Local jurisdictions or agencies ~~can and should~~ may consider ~~establish an urban growth boundary (UGB) with related ordinances or programs to limit suburban sprawl; local jurisdictions or agencies can and should may restrict urban development beyond the UGB and with measures that streamlining streamline~~ entitlement processes within the UGB for consistent projects that are not considered sprawl.

Above measure revised to clarify intent to promote orderly growth and development and to defer to local land use authority.

LU29:* Urban development ~~can and should~~ may occur only where urban public facilities and services exist or can be reasonably made available.

- LU30:*** The improvement and expansion of one urban public facility or service ~~can and should~~ may not stimulate development that significantly precedes the local jurisdiction's ability to provide all other necessary urban public facilities and services at adequate levels.
- LU31:** Local jurisdictions ~~can and should~~ may redirect new growth into existing city/urban reserve areas.
- LU32:** Local jurisdictions ~~can and should~~ may maintain a one dwelling unit per 10-acre minimum lot size or lower density in areas outside designated urban service lines.
- LU33:** Local jurisdictions ~~can and should~~ may consider encouraging high-density, mixed-use, infill development and creative reuse of brownfield, under-utilized and/or defunct properties within the urban core.

Above measure revised to clarify intent to promote orderly growth and development and to defer to local land use authority.

- LU34:*** Local jurisdictions ~~can and should~~ may consider increasing densities in urban core areas to support public transit.

Above measure revised to clarify intent to promote orderly growth and development and to defer to local land use authority.

- LU35:** Local jurisdictions ~~can and should~~ may remove barriers to the development of accessory dwelling units in existing residential neighborhoods as appropriate
- LU36:** Local jurisdictions ~~can and should~~ may reduce required road width standards wherever feasible to calm traffic and encourage alternative modes of transportation.
- LU37:** Local jurisdictions ~~can and should~~ may reduce parking space requirements, unbundle parking from rents and charge for parking in new developments.
- LU38:** Local jurisdictions ~~can and should~~ may add bicycle facilities to streets and public spaces.
- LU39:** Local jurisdictions ~~can and should~~ may plan for and create incentives for mixed-use development.
- LU40:** Local jurisdictions ~~can and should~~ may identify sites suitable for mixed-use development and establish appropriate site-specific standards to accommodate the mixed uses. Site-specific standards could include:
- Increasing allowable building height or allowing height limit bonuses;
 - Allowing flexibility in applying development standards (such as FAR2 and lot coverage) based on the location, type, and size of the units, and the design of the development;
 - Allowing the residential component to be additive rather than within the established FAR for that zone, and eliminating maximum density requirements for residential uses in mixed use zones;
 - Allowing reduced and shared parking based on the use mix, and establishing parking maximums where sites are located within 0.25 miles of a public transit stop;
 - Allowing for tandem parking, shared parking and off-site parking leases;
 - Requiring all property owners in mixed-use areas to unbundle parking from commercial and residential leases;
 - Creating parking benefit districts, which invest meter revenues in pedestrian infrastructure and other public amenities;
 - Establishing performance pricing of street parking, so that it is expensive enough to promote frequent turnover and keep 15 percent of spaces empty at all times.
- LU41:** Local jurisdictions ~~can and should~~ may enable prototype mixed-use structures for use in neighborhood center zones that can be adapted to new uses over time with minimal internal remodeling.
- LU42:** Local jurisdictions ~~can and should~~ may identify and facilitate the inclusion of complementary land uses not already present in local zoning districts, such as supermarkets, parks and recreational fields, schools in neighborhoods, and residential uses in business districts, to reduce the vehicle miles traveled and promote bicycling and walking to these uses.

- LU43:*** Local jurisdictions ~~can and should~~ may work with employers developing larger projects to ensure local housing opportunities for their employees, and engage employers to find ways to provide housing assistance as part of their employee benefits packages; major projects in mixed-use areas ~~can and should~~ may include work-force housing where feasible.
- LU44:** Local jurisdictions ~~can and should~~ may revise zoning ordinance(s) to allow local-serving businesses, such as childcare centers, restaurants, banks, family medical offices, drug stores, and other similar services near employment centers to minimize midday vehicle use.
- LU45:** Local jurisdictions ~~can and should~~ may develop form-based community design standards to be applied to development projects and land use plans, using a comprehensive community outreach, for areas designated mixed-use.
- LU46:** Local jurisdictions ~~can and should~~ may mix affordable housing units with market rate units as opposed to building segregated affordable housing developments.
- LU47:** Where practical and feasible, local jurisdictions ~~can and should~~ may develop programs that enable the reuse of underutilized commercial, office and/or industrial properties for housing or mixed-use housing.
- LU48:** Local jurisdictions ~~can and should~~ may ~~ensure~~ consider consistency with “smart growth” principles – mixed-use, infill, and higher density projects that provide alternatives to individual vehicle travel and promote the efficient delivery of services and goods.

Above measure revised to defer to local land use authority and to emphasize discretion.

- LU49:** Local jurisdictions ~~can and should~~ may meet recognized “smart growth” benchmarks.
- LU50:** Project sponsors ~~can and should~~ may incorporate public transit into the project’s design.
- LU51:** Project sponsors ~~can and should~~ may include pedestrian and bicycle facilities within projects and ensure that existing non-motorized routes are maintained and enhanced.
- LU52:** Local jurisdictions ~~can and should~~ may encourage residential development in High Quality Transit Areas (HQTAs). Such development ~~can and should~~ may include a generally walkable transit village that has a minimum density of 20 dwelling units per acre and is within a ½ mile of a well-serviced transit stop, and includes transit corridors with minimum 15-minute or less service frequency during peak commute hours.
- LU53:** Local jurisdictions ~~can and should~~ may promote greater linkage between land uses and transit, as well as other modes of transportation.
- LU54:** Local jurisdictions ~~can and should~~ may ensure new development is designed to make public transit a viable choice for residents, including:
- Locating medium-high density development near activity centers that can be served efficiently by public transit and alternative transportation modes;
 - Locating medium-high density development near streets served by public transit whenever feasible;
 - Linking neighborhoods to bus stops by continuous sidewalks or pedestrian paths.
- LU55:** Local jurisdictions ~~can and should~~ may establish city-centered corridors, directing development to existing transportation corridors.
- LU56:** Local jurisdictions ~~can and should~~ may develop form-based community design standards to be applied to development projects and land use plans, using a comprehensive community outreach program, for areas designated mixed-use
- LU57:** Local jurisdictions ~~can and should~~ may locate affordable housing in transit-oriented development whenever feasible

- LU58:** Local jurisdictions ~~can and should~~ may consider jobs/housing balance, to the extent practical and feasible, and encourage the development of communities where people live closer to work, bike, walk, and take transit as a substitute for personal auto travel.
- LU59:** Project sponsors ~~can and should~~ may consider community cohesion in designing projects through communities. Transit facilities ~~should~~ may be designed to integrate with the community and encourage walking and bicycling as well as park and ride. New or widened roadways (and freeways) ~~should~~ may be designed to minimize impacts to the extent feasible through landscaping, pedestrian furniture as appropriate. New roadways or freeways ~~should~~ may consider feasible innovative designs such as cap parks that maintain community cohesion.
- LU60:** Local jurisdictions ~~can and should~~ may promote development and preservation of neighborhood characteristics that encourage walking and bicycle riding in lieu of automobile-based travel.
- LU61:** Local jurisdictions ~~can and should~~ may create and preserve distinct, identifiable neighborhoods whose characteristics support pedestrian travel, especially within, but not limited to, mixed-use and transit-oriented development areas, including:
- Designing or maintaining neighborhoods where the neighborhood center can be reached in approximately five minutes of walking;
 - Increasing housing densities from the perimeter to the center of the neighborhood;
 - Directing retail, commercial, and office space to the center of the neighborhood;
 - Encouraging pedestrian-only streets and/or plazas within developments, and destinations that may be reached conveniently by public transportation, walking, or bicycling;
 - Allowing flexible parking strategies in neighborhood activity centers to foster a pedestrian-oriented streetscape;
 - Providing continuous sidewalks with shade trees and landscape strips to separate pedestrians from traffic;
 - Encouraging neighborhood parks and recreational centers near concentrations of residential areas (preferably within one quarter mile) and include pedestrian walkways and bicycle paths that encourage non-motorized travel.
- LU62:** Local jurisdictions ~~can and should~~ may ensure pedestrian access to activities and services, especially within, but not limited to, mixed-use and transit-oriented development areas, including:
- Ensuring new development that provides pedestrian connections in as many locations as possible to adjacent development, arterial streets, thoroughfares;
 - Ensuring a balanced mix of housing, workplaces, shopping, recreational opportunities, and institutional uses, including mixed-use structures;
 - Locating schools in neighborhoods, within safe and easy walking distances of residences served;
 - For new development, primary entrances ~~shall~~ should may be pedestrian entrances, with automobile entrances and parking located to the rear;
 - Support development where automobile access to buildings does not impede pedestrian access, by consolidating driveways between buildings or developing alley access;
 - Street parking provided ~~shall~~ should may be utilized as a buffer between sidewalk pedestrian traffic and the automobile portion of the roadway;
 - Establish pedestrian and bicycle connectivity standards for new development, with block sizes between 1 and 2 acres;
 - For existing areas that do not meet established connectivity standards, prioritize the physical development of pedestrian connectors;
 - Prioritizing grade-separated bicycle / pedestrian crossings where appropriate to enhance connectivity or overcome barriers such as freeways, railways and waterways.
- LU63:** Local jurisdictions ~~can and should~~ may review fee structures and other opportunities to provide financial and administrative incentives to support desired land uses, development patterns, and alternative modes of transportation.
- LU64:** Local jurisdictions ~~can and should~~ may promote desired land uses by considering criteria for scaled scaling developer fees. ~~based on desired criteria, for example~~: Examples include:
- Increasing or reducing fees proportionally with distance from the city center or preferred transit sites;
 - Increasing or reducing fees based on the degree to which mixed uses are incorporated into the project;

- Reducing fees for creative re-use of brownfield sites;
- Increasing fees for the use of greenfield sites.

Above measure revised to defer to local authority on revenue programs.

LU65: Local jurisdictions ~~can and should~~ may consider providing ~~provide~~ fast-track permitting and reductions in processing fees for desired projects. Local jurisdictions ~~can and should~~ may research and implement a program of incentives for development projects that are fully consistent with the 2012-2035 RTP/SCS.

Above measure revised to defer to local authority on revenue programs.

LU66: Local jurisdictions ~~can and should~~ may ~~provide~~ consider providing incentive funding and/or infrastructure loans to support desired projects.

Above measure revised to defer to local authority on revenue programs.

LU67: Local jurisdictions ~~can and should~~ may give preference for infrastructure improvements that support or enhance desired land uses and projects.

LU68: Local jurisdictions ~~can and should~~ may reduce heat gain from pavement and other hardscaping, including:

- Reduce street rights-of-way and pavement widths to pre-World War II widths (typically 22 to 34 feet for local streets, and 30 to 35 feet for collector streets, curb to curb), unless landscape medians or parkway strips are allowed in the center of roadways;
- Reinstate the use of parkway strips to allow shading of streets by trees;
- Include shade trees on south- and west-facing sides of structures;
- Include low-water landscaping in place of hardscaping around transportation infrastructure and in parking areas;
- Install cool roofs, green roofs, and use cool paving for pathways, parking, and other roadway surfaces;
- Establish standards that provide for pervious pavement options;
- Remove obstacles to xeriscaping, edible landscaping and low-water landscaping.

NOISE

NO1:* To reduce noise impacts due to construction, project sponsors ~~can and should~~ may require construction contractors to implement a site-specific noise reduction program, subject to the Lead Agency (or other appropriate government agency) review and approval, which includes the following measures:

- Equipment and trucks used for project construction ~~can and should~~ may utilize the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, wherever feasible).
- Except as may be exempted by the Lead Agency (or other appropriate government agency), impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction ~~can and should~~ may be hydraulically or electrically powered to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust ~~should~~ may be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves ~~should~~ may be used, if such jackets are commercially available and this could achieve a reduction of 5 dBA. Quieter procedures ~~should~~ may be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.
- Stationary noise sources ~~can and should~~ may be located as far from adjacent sensitive receptors as possible and they ~~should~~ may be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures as determined by the Lead Agency (or other appropriate government agency) to provide equivalent noise reduction.

NO2: Prior to the issuance of a building permit, along with the submission of construction documents, each project sponsor ~~can and should~~ may submit to the Lead Agency (or other government agency as appropriate) a list of measures to respond to and track complaints pertaining to construction noise. These measures ~~should~~ may include:

- A procedure and phone numbers for notifying the Lead Agency staff and local Police Department; (during regular construction hours and off-hours);
 - A sign posted on-site pertaining with permitted construction days and hours and complaint procedures and who to notify in the event of a problem. The sign ~~should~~may also include a listing of both the Lead Agency and construction contractor's telephone numbers (during regular construction hours and off-hours);
 - The designation of an on-site construction complaint and enforcement manager for the project;
 - Notification of neighbors and occupants within 300 feet of the project construction area at least 30 days in advance of extreme noise generating activities about the estimated duration of the activity; and
 - A preconstruction meeting ~~can and should~~may be held with the job inspectors and the general contractor/on-site project manager to confirm that noise measures and practices (including construction hours, neighborhood notification, posted signs, etc.) are completed.
- NO3:** Project sponsor ~~can and should~~may implement use of portable barriers in the vicinity of sensitive receptors during construction including construction of subsurface barriers, debris basins, and storm water drainage facilities.
- NO4:*** For projects that require pile driving or other construction noise above 90 dBA in proximity to sensitive receptors, to further reduce potential pier drilling, pile driving and/or other extreme noise generating construction impacts greater than 90dBA, a set of site-specific noise attenuation measures ~~can and should~~may be completed under the supervision of a qualified acoustical consultant. Prior to commencing construction, a plan for such measures ~~should~~may be submitted for review and approval by the Lead Agency (or other appropriate government agency) to ensure that maximum feasible noise attenuation ~~will be~~ is achieved. This plan ~~should~~may be based on the final design of the project. A third-party peer review, paid for by the project sponsor, may be required to assist the Lead Agency in evaluating the feasibility and effectiveness of the noise reduction plan submitted by the project sponsor. The criterion for approving the plan ~~should~~may be a determination that maximum feasible noise attenuation ~~will be~~ is achieved. The noise reduction plan ~~can and should~~may include, but not be limited to, an evaluation of implementing the following measures. These attenuation measures ~~can and should~~may include as many of the following control strategies as applicable to the site and construction activity:
- Erect temporary plywood noise barriers around the construction site, particularly along on sites adjacent to residential buildings;
 - Implement "quiet" pile driving technology (such as pre-drilling of piles, the use of more than one pile driver to shorten the total pile driving duration), where feasible, in consideration of geotechnical and structural requirements and conditions;
 - Utilize noise control blankets on the building structure as the building is erected to reduce noise emission from the site;
 - Evaluate the feasibility of noise control at the receivers by temporarily improving the noise reduction capability of adjacent buildings by the use of sound blankets for example and implement such measure if such measures are feasible and would noticeably reduce noise impacts; and
 - Monitor the effectiveness of noise attenuation measures by taking noise measurements.
- NO5:** Noise generated from any rock-crushing or screening operations performed within 3,000 feet of any occupied residence ~~can and should~~may be mitigated by the project sponsor by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the local jurisdiction.
- NO6:** Where feasible, pile holes ~~can and should~~may be pre-drilled to reduce potential noise and vibration impacts.
- NO7:** As necessary, each project sponsor ~~can and should~~may retain a structural engineer or other appropriate professional to determine threshold levels of vibration and cracking that could damage any adjacent historic or other structure subject to damage, and design means and construction methods to not exceed the thresholds.
- NO8:*** Project sponsors ~~can and should~~may comply with all local sound control and noise level rules, regulations, and ordinances.
- NO9:*** As part of the appropriate environmental review of each project, a project specific noise evaluation ~~can and should~~may be conducted and appropriate mitigation identified and implemented.

- NO10:** Project sponsors ~~can and should~~ may employ, where their jurisdictional authority permits, land use planning measures, such as zoning, restrictions on development, site design, and use of buffers to ensure that future development is compatible with adjacent transportation facilities.
- NO11:** As a last resort, project sponsors ~~can and should~~ may eliminate noise-sensitive receptors by acquiring freeway and rail rights-of-way. This would ensure the effective operation of all transportation modes.
- NO12:** Project sponsors ~~can and should~~ may, to the extent feasible and practicable, maximize the distance between noise-sensitive land uses and new roadway lanes, roadways, rail lines, transit centers, park-and-ride lots, and other new noise-generating facilities.
- NO13:** Project sponsors ~~can and should~~ may construct sound reducing barriers between noise sources and noise-sensitive land uses. Sound barriers can be in the form of earth-berms or soundwalls. Constructing roadways so as appropriate and feasible that they are depressed below-grade of the existing sensitive land uses also creates an effective barrier between the roadway and sensitive receptors.
- NO14:** Project sponsors ~~can and should~~ may, to the extent feasible and practicable, improve the acoustical insulation of dwelling units where setbacks and sound barriers do not sufficiently reduce noise.
- NO15:** The project sponsors ~~can and should~~ may implement, to the extent feasible and practicable, speed limits and limits on hours of operation of rail and transit systems, where such limits may reduce noise impacts.
- NO16:** As applicable and feasible, project sponsors may ~~To reduce noise impacts, by maximizing distance of new route alignments from~~ between sensitive receptors and new transportation projects. ~~For example, if a transit project were constructed along the center of a freeway (as opposed to a new route or along the side of the freeway), operational noise impacts would be reduced by the increase in distance to the noise sensitive sites and the masking effects of the freeway traffic noise.~~

Above measure is clarified and simplified.

- NO17:** Transit-related passenger stations, central maintenance facilities, decentralized maintenance facilities, and electric substations ~~can and should~~ may be located away from sensitive receptors to the maximum extent feasible.
- NO18:*** Local jurisdictions or agencies ~~can and should~~ may, as practical and feasible, adhere to published local, state and federal guidelines concerning groundborne vibration impacts.

POPULATION, HOUSING, AND EMPLOYMENT

- POP1:*** For projects with the potential to displace homes and/or businesses, project sponsors ~~can and should~~ may evaluate alternate route alignments and transportation facilities that minimize the displacement of homes and businesses. An iterative design and impact analysis would help where impacts to homes or businesses are involved in order to minimize impacts. ~~Potential impacts should be minimized to the extent feasible. If possible, This may include use of existing rights-of-way should be used.~~
- POP2:** Project sponsors ~~can and should~~ may develop a construction schedule that minimizes potential neighborhood deterioration from protracted waiting periods between right-of-way acquisition and construction.
- POP3:*** Project sponsors ~~shall should~~ may mitigate impacts to affordable housing as feasible through construction of affordable units (deed restricted to remain affordable for an appropriate period of time) or payment of any fee established to address loss of affordable housing.

PUBLIC SERVICES AND UTILITIES

- PS1:*** Project implementation agencies ~~can and should~~ may ensure that prior to construction all necessary local and state road and railroad encroachment permits are obtained. The project implementation agency ~~can and should~~ may also comply with all applicable conditions of approval. As deemed necessary by the governing jurisdiction, the road encroachment permits may require the contractor to prepare a traffic control plan in accordance with professional engineering standards prior to construction. Traffic control plans ~~can and should~~ may include the following requirements:

- Identification of all roadway locations where special construction techniques (e.g., directional drilling or night construction) would be used to minimize impacts to traffic flow.
 - Development of circulation and detour plans to minimize impacts to local street circulation. This may include the use of signing and flagging to guide vehicles through and/or around the construction zone.
 - Scheduling of truck trips outside of peak morning and evening commute hours.
 - Limiting of lane closures during peak hours to the extent possible.
 - Usage of haul routes minimizing truck traffic on local roadways to the extent possible.
 - Inclusion of detours for bicycles and pedestrians in all areas potentially affected by project construction.
 - Installation of traffic control devices as specified in the California Department of Transportation Manual of Traffic Controls for Construction and Maintenance Work Zones.
 - Development and implementation of access plans for highly sensitive land uses such as police and fire stations, transit stations, hospitals, and schools. The access plans would be developed with the facility owner or administrator. To minimize disruption of emergency vehicle access, affected jurisdictions ~~can and should~~ may be asked to identify detours for emergency vehicles, which ~~will~~ may then be posted by the contractor. Notify in advance the facility owner or operator of the timing, location, and duration of construction activities and the locations of detours and lane closures.
 - Storage of construction materials only in designated areas.
 - Coordination with local transit agencies for temporary relocation of routes or bus stops in work zones, as necessary.
- PS2:*** Project sponsors ~~can and should~~ may identify projects in the 2012-2035 RTP/SCS that require police protection, fire service, and emergency medical service and ~~can and should~~ may coordinate with local fire and police departments to ensure that the existing public services would be able to handle the increase in demand for their services. If the current levels of services at the project site are found to be inadequate, infrastructure improvements and/or personnel requirements for the appropriate public service ~~can and should~~ may be identified in each project’s CEQA documentation.
- PS3:** Project sponsors ~~can and should~~ may ensure that during project construction, all construction vehicles and equipment ~~will~~ may be fitted with spark arrestors to minimize accidental ignition of dry construction debris and surrounding dry vegetation.
- PS4:*** Project sponsors ~~can and should~~ may encourage the use of fire-resistant vegetation native to Southern California and/or to the local microclimate (e.g., vegetation that has high moisture content, low growth habits, ignition-resistant foliage, or evergreen growth), eliminate brush and chaparral, and discourage the use of fire-promoting species especially non-native, invasive species (e.g., pampas grass, fennel, mustard, or the giant reed) in the immediate vicinity of development in areas with high fire threat.
- PS5:** Project sponsors ~~can and should~~ may encourage natural re-vegetation or seeding with local, native species after a fire and discourage re-seeding of non-native, invasive species to promote healthy, natural ecosystem re-growth. Native vegetation is more likely to have deep root systems that prevent slope failure and erosion of burned areas than shallow-rooted non-natives.
- PS6:** Project sponsors ~~can and should~~ may submit a fire safety plan (including phasing) to the Lead Agency and local fire agency for their review and approval. The fire safety plan ~~can and should~~ may include all of the fire safety features incorporated into the project and the schedule for implementation of the features. The local fire protection agency may require changes to the plan or may reject the plan if it does not adequately address fire hazards associated with the project as a whole or the individual phase.
- PS7:** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may discourage development on potentially hazardous developments in hillsides, canyons, areas with steep slopes or that are susceptible to flooding, earthquakes, wildfire and other known hazards, and areas with limited access for emergency equipment.
- PS8:*** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may promote Fire-wise Land Management: by encouraging the use of fire-resistant vegetation and the elimination of brush and chaparral in the immediate vicinity of development in areas with high fire threat.
- PS9:** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may ~~shall~~ promote Fire Management Planning that help reduce fire threats in the region as part of the Compass Blueprint process and other ongoing regional planning efforts.

PS10:* ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may encourage the use of fire-resistant materials when constructing projects in areas with high fire threat. Local jurisdictions may discourage development in high fire hazard areas and recommend using project design to reduce risk including building with a compact defensible footprint and minimizing perimeter length.

Above measure edited in response to comments from the Natural Resources Agency Department of Parks and Recreation, and the Wildlife Corridor Conservation Authority

PS11: The growth inducing potential of individual RTP projects ~~shall should~~ may be carefully evaluated so that the full implications of the projects are understood. Individual environmental documents ~~shall should~~ may quantify indirect impacts (growth that could be facilitated or induced) on public services and utilities to the extent feasible. Lead and responsible agencies ~~can and should~~ may then make any necessary adjustments to the applicable General Plan. Any such identified adjustment ~~shall should~~ may be communicated to SCAG.

PS12:* Project sponsors ~~can and should~~ may undertake project-specific review of the impacts to educational facilities as part of project specific environmental review. For any identified impacts, project sponsors ~~can and should~~ may ensure that the appropriate school district fees are paid in accordance with State law. The project sponsors or local jurisdiction ~~can and should~~ may be responsible for ensuring adherence to required mitigation. SCAG ~~should~~ may be provided with documentation of compliance with any necessary mitigation measures.

PS13:* Project sponsors ~~can and should~~ may ensure that projects are consistent with federal, state, and local plans that preserve open space.

PS14:* Project sponsors ~~can and should~~ may consider corridor realignment, buffer zones and setbacks, and berms and fencing where feasible, to avoid open space and recreation land and to reduce conflicts between transportation uses and open space and recreation lands.

PS15: Project sponsors ~~can and should~~ may identify open space areas that could be preserved and ~~should~~ may ~~shall~~ include mitigation measures (such as dedication or payment of in-lieu fees) for the loss of open space.

PS16:* Prior to final approval of each project, the project sponsor ~~can and should~~ may conduct the appropriate project-specific environmental review, including consideration of loss of open space. Potential significant impacts to open space ~~shall should~~ may be mitigated, as feasible. The project sponsors or local jurisdiction ~~can and should~~ may be responsible for ensuring adherence to the mitigation measures prior to construction.

PS17: Local jurisdictions ~~can and should~~ may prepare a Needs Assessment to determine the level of adequate community open space level for their areas.

PS18: Local jurisdictions ~~can and should~~ may ~~work with SCAG~~ participate in regional efforts to identify regionally significant open space resources within their jurisdictions as feasible and appropriate.

Above measure revised to broaden applicability to a variety of open space planning efforts.

PS19: Where practical and feasible, project sponsors and local jurisdictions ~~can and should~~ may consider increasing the accessibility to natural areas and lands for outdoor recreation. Such measures ~~can and should~~ may be coordinated with local and regional open space planning or management agencies.

PS20: Local jurisdictions ~~can and should~~ may encourage multiple use spaces and encourage redevelopment in areas where it will provide more opportunities for recreational uses and access to natural areas close to the urban core.

PS21: Project level mitigation for significant cumulative and growth-inducing impacts on open space resources ~~can and should~~ may include the conservation of natural lands, community open space and important farmland through existing projects in the region.

PS22: Local governments ~~can and should~~ may consider the most recent annual report on open space conservation in planning and evaluating projects and programs in areas with regionally significant open space resources.

- PS23:** Local governments ~~can and should~~ may encourage patterns of urban development and land use, which reduce costs on infrastructure and make better use of existing facilities. Strategies local governments ~~can and should~~ may pursue include:
- Increasing the accessibility to natural areas lands for outdoor recreation.
 - Promoting infill development and redevelopment to revitalize existing communities
 - Utilizing "green" development techniques
 - Promoting water-efficient land use and development.
- PS24:** Project sponsors and local governments ~~can and should~~ may encourage multiple use spaces and encourage redevelopment in areas where it will provide more opportunities for recreational uses and access to natural areas close to the urban core.
- PS25:** Future impacts to open space and recreation lands ~~shall~~ should ~~may~~ be avoided through cooperation, information sharing, and program development as part of SCAG's ongoing regional planning efforts.
- PS26:*** Project sponsors for projects identified in the 2012-2035 RTP/SCS ~~can and should~~ may comply with applicable regulations related to solid waste disposal.
- PS27:*** Projects sponsors ~~can and should~~ may work with the respective local jurisdiction's Recycling Coordinator to ensure that source reduction techniques and recycling measures are incorporated into project construction.
- PS28:** Local jurisdictions may estimate the amount of solid waste generated during construction ~~will be estimated~~ prior to construction, and appropriate disposal sites ~~will~~ may be identified and utilized.

Above measure revised for consistency and to clarify who will carry out.

- PS29:** Project sponsors ~~can and should~~ may integrate green building measures into project design such as those identified in the U.S. Green Building Council's Leadership in Energy and Environmental Design, energy Star Homes, Green Point Rated Homes, and the California Green Builder Program. These measures could include the following:
- Reuse and minimization of construction and demolition (C&D) debris and diversion of C&D waste from landfills to recycling facilities.
 - The inclusion of a waste management plan that promotes maximum C&D diversion.
 - Source reduction through (1) use of materials that are more durable and easier to repair and maintain, (2) design to generate less scrap material through dimensional planning, (3) increased recycled content, (4) use of reclaimed materials, and (5) use of structural materials in a dual role as finish material (e.g. stained concrete flooring, unfinished ceilings, etc.).
 - Reuse of existing structure and shell in renovation projects.
 - Design for deconstruction without compromising safety.
 - Design for flexibility through the use of moveable walls, raised floors, modular furniture, moveable task lighting and other reusable building components.
 - Development of indoor recycling program and space.
- PS30:*** Local jurisdictions and waste management agencies ~~can and should~~ may discourage the siting of new landfills unless all other waste reduction and prevention actions have been fully explored. If landfill siting or expansion is necessary, landfills ~~can and should~~ may be sited with an adequate landfill-owned, undeveloped land buffer to minimize the potential adverse impacts of the landfill in neighboring communities.
- PS31:** Project sponsors ~~can and should~~ may discourage exporting of locally generated waste outside of the SCAG region during the construction and implementation of a project. Disposal within the county where the waste originates ~~can and should~~ may be encouraged as much as possible. Green technologies for long-distance transport of waste (e.g., clean engines and clean locomotives or electric rail for waste-by-rail disposal systems) and consistency with SCAQMD and 2012-2035 RTP/SCS policies ~~can and should~~ may be required.
- PS32:** Project sponsors ~~can and should~~ may encourage waste reduction goals and practices and look for opportunities for voluntary actions to exceed the 50 percent waste diversion target.

- PS33:** Project sponsors and local jurisdictions ~~can and should~~ may encourage the development of local markets for waste prevention, reduction, and recycling practices by supporting recycled content and green procurement policies, as well as other waste prevention, reduction and recycling practices.
- PS34:** Local jurisdictions ~~can and should~~ may develop ordinances that promote waste prevention and recycling activities such as: requiring waste prevention and recycling efforts at all large events and venues; implementing recycled content procurement programs; and developing opportunities to divert food waste away from landfills and toward food banks and composting facilities.
- PS35:*** Local jurisdictions and waste management agencies ~~can and should~~ may develop alternative waste management strategies such as composting, recycling, and conversion technologies.
- PS36:*** Project sponsors, local jurisdictions and waste management agencies, where practical and feasible, ~~can and should~~ may develop and site composting, recycling, and conversion technology facilities that have minimum environmental and health impacts.
- PS37:** Local jurisdictions ~~can and should~~ may require the reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).
- PS38:** Project sponsors ~~can and should~~ may integrate reuse and recycling into residential industrial, institutional and commercial projects.
- PS39:** Local jurisdictions ~~can and should~~ may provide easy and convenient recycling opportunities for residents, the public, and tenant businesses.
- PS40:** Local jurisdictions ~~can and should~~ may provide education and publicity about reducing waste and available recycling services.
- PS41:*** The California Integrated Waste Management Board ~~can and should~~ may continue to enforce solid waste diversion mandates that are enacted by the Legislature.
- PS42:** Local jurisdictions ~~can and should~~ may continue to adopt programs to comply with state solid waste diversion rate mandates and, where possible, ~~can and should~~ may encourage further recycling to exceed these rates.
- PS43:** Local jurisdictions ~~can and should~~ may implement or expand city or county-wide recycling and composting programs for residents and businesses. This could include extending the types of recycling services offered (e.g., to include food and green waste recycling) and providing public education and publicity about recycling services.
- PS44:** Local jurisdictions, waste management agencies and SCAG ~~can and should~~ may coordinate regional approaches and strategic siting of waste management facilities.
- PS45:** Local jurisdictions and waste management agencies ~~can and should~~ may encourage and, where practical and feasible, facilitate the creation of synergistic linkages between community businesses and the development of eco-industrial parks and materials exchange centers where one entity's waste stream becomes another entity's raw material.
- PS46:** Local jurisdictions and waste management agencies ~~can and should~~ may prioritize siting of new solid waste management facilities including recycling, composting, and conversion technology facilities in conjunction with existing waste management or material recovery facilities.
- PS47:** Local jurisdictions and waste management agencies ~~can and should~~ may increase programs to educate the public and increase awareness of reuse, recycling, composting, and green building benefits and raise consumer education issues at the county and city level, as well as at local school districts and education facilities.
- PS48:*** For projects identified in the 2012-2035 RTP/SCS that require solid waste collection, project sponsors may ~~will~~ coordinate with the local public works department to ensure that the existing public services and utilities would be able to handle the increase. If the current infrastructure servicing the project site is found to be inadequate, infrastructure improvements for the appropriate public service or utility ~~can and should~~ may be identified in each project's CEQA documentation.

- PS49:*** The growth inducing potential of individual projects ~~can and should~~ may be carefully evaluated so that the full implications of the projects are understood. Individual environmental documents ~~should~~ may quantify indirect impacts (growth that could be facilitated or induced) on public services and utilities to the extent feasible. Lead and responsible agencies then ~~will~~ may make any necessary adjustments to the applicable General Plan. Any such identified adjustment ~~should~~ may be communicated to SCAG.
- PS50:*** Prior to construction, the project implementation agency ~~can and should~~ may identify the locations of existing utility lines. The contractor ~~should~~ may ~~shall~~ avoid all known utility lines during construction.
- PS51:** In reviewing projects Lead Agencies and project sponsors ~~can and should~~ may consider energy implications of construction processes. In general the most energy efficient construction process and long-term operational design ~~can and should~~ may be selected unless there is an overriding reason why not.
- PS52:*** Local jurisdictions ~~can and should~~ may include energy analyses in environmental documentation and general plans with the goal of conserving energy through the wise and efficient use of energy. For any identified energy impacts, appropriate mitigation measures ~~can and should~~ may be developed and monitored. SCAG recommends the use of Appendix F, Energy Conservation, of the *CEQA Guidelines*.
- PS53:** Project sponsors ~~can and should~~ may consider the most cost-effective alternative and renewable energy generation facilities.
- PS54:*** Project sponsors ~~can and should~~ may require that projects use efficient lighting. (Fluorescent lighting uses approximately 75% less energy than incandescent lighting to deliver the same amount of light.)
- PS55:** Project sponsors ~~can and should~~ may require measures that reduce the amount of water sent to the sewer system. (Reduction in water volume sent to the sewer system means less water has to be treated and pumped to the end user, thereby saving energy.)
- PS56:** Project sponsors ~~can and should~~ may pursue incentives to encourage the use of energy efficient equipment and vehicles.
- PS57:** State and federal lawmakers and regulatory agencies ~~can and should~~ may pursue the design of programs to either require or incentivize the expanded availability including the expansion of alternative fuel filling stations and use of alternative-fuel vehicles to reduce the impact of shifts in petroleum fuel supply and price.
- PS58:** Local jurisdictions ~~can and should~~ may consider various best practices and technological improvements that can reduce the consumption of fossil fuels, such as:
- Expanding light-duty vehicle retirement programs
 - Increasing commercial vehicle fleet modernization
 - Implementing driver training module on fuel consumption
 - Replacing gasoline powered mowers with electric mowers
 - Reducing idling from construction equipment
 - Incentivizing alternative fuel vehicles and equipment
 - Developing infrastructure for alternative fueled vehicles
 - Increasing use and mileage of High Occupancy Vehicle (HOV), High Occupancy Toll (HOT) and dedicated Bus Rapid Transit (BRT) lanes
 - Implementing truck idling rule, devices, and truck-stop electrification
 - Requiring electric truck refrigerator units
 - Reducing locomotives fuel use
 - Modernizing older off-road engines and equipment
 - ~~Implementing cold ironing at ports~~
 - ~~Encouraging freight mode shift~~
 - Limit use and develop fleet rules for construction equipment
 - Requiring zero, and/or near zero-emission forklifts
 - ~~Developing landside port strategy with alternative fuels, clean engines, and electrification~~

Above measure edited to recognize that cold ironing is subject to state regulation and to reflect that “Freight mode shift” requires proper understanding of how existing transportation modes serve specific markets for goods movement. The final bullet was deleted to ensure consistency with the 2012 Goods Movement strategy.

- PS59:** Local jurisdictions or agencies with purview over utilities ~~can and should~~ may, as practical and feasible, streamline permitting and provide public information to facilitate accelerated construction of geothermal, solar and wind power generation facilities and transmission line improvements.
- PS60:*** Utilities ~~can and should~~ may increase capacity of existing transmission lines to meet forecast demand that supports sustainable growth, where feasible and appropriate in coordination with local planning agencies.
- PS61:** Project sponsors ~~can and should~~ may support programs to reduce single occupancy vehicle trips such as telecommuting, ridesharing, alternative work schedules, and parking cash-outs.
- PS62:*** Project sponsors ~~can and should~~ may submit projected electricity and natural gas demand calculations to the local electricity or natural gas provider, for any project anticipated to require substantial utility consumption. Any infrastructure improvements necessary for project construction ~~can and should~~ may be completed according to the specifications of the energy provider.
- PS63:** Project sponsors ~~can and should~~ may encourage, to the extent practical and feasible, ensure that new buildings incorporate solar panels in roofing and tap other renewable energy sources to offset new demand on conventional power sources. For example, transit providers ~~can and should~~ may, as feasible, assure that designers of new transit stations incorporate solar panels in roofing.
- PS64:*** Project sponsors ~~can and should~~ may encourage energy efficient design for buildings, potentially including strengthening local building codes for new construction and renovation to achieve a higher level of energy efficiency. This may include strengthening local building codes for new construction and renovation to require a higher level of energy efficiency.
- PS65:** Local jurisdictions ~~can and should~~ may seek funding through utility-sponsored programs to conduct energy efficiency “tune-ups” of existing buildings, as practical and feasible, by checking, repairing, and readjusting heating, ventilation, air conditioning, lighting, hot water equipment, insulation and weatherization.
- PS66:*** Project sponsors ~~can and should~~ may provide individualized energy management services for large energy users.
- PS67:** Local jurisdictions and project sponsors ~~can and should~~ may encourage the use of energy efficient appliances and office equipment.
- PS68:** Project sponsors ~~can and should~~ may pursue incentives and technical assistance for lighting efficiency.
- PS69:** Local jurisdictions ~~can and should~~ may provide public education and publicity about energy efficiency programs and incentives in cooperation with local utility providers.
- PS70:*** If a carbon trading system is established, a lead agency may consider whether carbon offsets would be an appropriate means of project mitigation. The project sponsor could, for example, fund off-site projects (e.g., alternative energy projects) that will reduce carbon emissions, or could purchase “credits” from another entity that will fund such projects. The lead agency ~~can and should~~ may ensure that any mitigation taking the form of carbon offsets is specifically identified and that such mitigation will in fact occur
- PS71:** Local jurisdictions ~~can and should~~ may encourage the integration of green building measures into project design and zoning such as those identified in the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED), Energy Star Homes, Green Point Rated Homes, and the California Green Builder Program. Energy saving measures for new and remodeled buildings include:
- Using energy efficient materials in building design, construction, rehabilitation, and retrofit
 - Encouraging new development to exceed Title 24 energy efficiency requirements
 - Developing Cool Communities measures including tree planting and light-colored roofs. These measures focus on reducing ambient heat, which reduces energy consumption related to air conditioning and other cooling equipment.
 - Utilizing efficient commercial/residential space and water heaters: This could include the advertisement of existing and/or development of additional incentives for energy efficient appliance purchases to reduce excess energy use and save money. Federal tax incentives are provided online at http://www.energystar.gov/index.cfm?c=Productspr_tax_credits

- Encouraging landscaping that requires no additional irrigation: utilizing native, drought tolerant plants can reduce water usage up to 60 percent compared to traditional lawns.
 - Encouraging combined heating and cooling (CHP), also known as cogeneration, in all buildings.
 - Encouraging neighborhood energy systems, which allow communities to generate their own electricity
 - Orienting streets and buildings for best solar access
 - Encouraging buildings to obtain at least 20% of their electric load from renewable energy
- PS72:** Project sponsors ~~can and should~~ may install energy efficient lighting (e.g., light emitting diodes (LEDs)), heating and cooling systems, appliances, equipment, and control systems.
- PS73:** Project sponsors ~~can and should~~ may use passive solar design, e.g., orient buildings and incorporate landscaping to maximize passive solar heating during cool seasons, minimize solar heat gain during hot seasons, and enhance natural ventilation.
- PS74:** Project sponsors ~~can and should~~ may design buildings to take advantage of sunlight.
- PS75:** Project sponsors ~~can and should~~ may install light colored “cool” roofs and cool pavements.
- PS76:** Install efficient lighting (including LEDs) for traffic, street and other outdoor lighting.
- PS77:** Project sponsors ~~can and should~~ may reduce unnecessary outdoor lighting.
- PS78:** Project sponsors ~~can and should~~ may use automatic covers, efficient pumps and motors, and solar heating for pools and spas.
- PS79:** Project sponsors ~~can and should~~ may provide education on energy efficiency to residents, customers and/or tenants.
- PS80:** Project sponsors ~~can and should~~ may use paving materials with a Solar Reflective Index (SRI) of at least 29, or open grid paving systems.
- PS81:** Project sponsors ~~can and should~~ may use roofing material with SRI of at least 29 on covered parking (underground, beneath decking or roofs, or beneath a building).
- PS81*:** Local jurisdictions ~~can and should~~ may adopt a Heat Island Mitigation Plan that requires cool roofs, cool pavements, and strategically placed shade trees, and actively inspect and enforce state requirements for cool roofs on non-residential re-roofing projects.
- PS82:** Local jurisdictions ~~can and should~~ may pursue policies and programs to improve energy efficiency of existing buildings.
- PS83:** Local jurisdictions ~~can and should~~ may require the performance of energy audits for residential and commercial buildings prior to completion of sale, and that audit results and information about opportunities for energy efficiency improvements be presented to the buyer.
- PS84*:** Local jurisdictions ~~can and should~~ may create an outreach and incentive program to promote energy efficiency and conservation in the community, including:
- Launching an “energy efficiency challenge” campaign for community residents;
 - Implementing a low-income weatherization assistance program;
 - Implementing conservation campaigns specifically targeted to residents, and separately to businesses;
 - Promoting the purchase of Energy Star® appliances, including, where feasible, incentive grants and vouchers;
 - Promoting participation in the local “Green Business” program;
 - Distributing free CFL bulbs or other efficiency fixtures to community members;
 - Offering exchange programs for high-energy-use items, such as halogen torchiere lamps;
 - Adopting an ordinance requiring energy upgrades at time of property sale.
- PS85:** Project sponsors ~~can and should~~ may install solar, wind, and geothermal power systems and solar hot water heaters.

- PS86:** Project sponsors ~~can and should~~ may install solar panels on unused roof and ground space and over carports and parking areas.
- PS87:** Project sponsors ~~can and should~~ may include energy storage where appropriate to optimize renewable energy generation systems and avoid peak energy use.
- PS88:** Project sponsors ~~can and should~~ may use combined heat and power (CHP) in appropriate applications.
- PS89:*** Local jurisdictions ~~can and should~~ may identify possible sites for production of renewable energy (such as solar, wind, small hydro, and biogas), as compatible with surrounding uses, and protect and promote that use, including:
- Designating suitable sites to prioritize their development for renewable energy generation;
 - Evaluating potential land use, environmental, economic, and other constraints on that use, and mitigate such constraints, as feasible;
 - Adopting measures to protect the renewable energy use of the sites and their resources, such as utility easements, rights-of-way, and land set-a-sides.
- PS90:** Local jurisdictions ~~can and should~~ may allow renewable energy projects in areas zoned for open space, where consistent with the Open Space element, and other uses and values.
- PS91:** Local jurisdictions ~~can and should~~ may promote and require renewable energy generation, and co-generation projects where feasible and appropriate.
- PS92:** Local jurisdictions ~~can and should~~ may require that new office/retail/commercial or industrial development, or major rehabilitation (e.g., additions of 25,000 square feet commercial, or 100,000 square feet industrial) incorporate renewable energy generation either on- or off-site to provide 15 percent or more of the project’s energy needs.
- PS92:** Local jurisdictions ~~can and should~~ may promote and encourage cogeneration projects for commercial and industrial facilities, provided they meet all applicable air quality standards and provide a net reduction in GHG emissions associated with energy production.
- PS93:** Local jurisdictions ~~can and should~~ may require that, where feasible, all new buildings be constructed to allow for easy, cost-effective installation of solar energy systems in the future, using such “solar-ready” features as:
- Designing the building to include optimal roof orientation (between 20 to 55 degrees from the horizontal), with sufficient south-sloped roof surface;
 - Clear access without obstructions (chimneys, heating and plumbing vents, etc.) on the south sloped roof;
 - Designing the roof framing to support the addition of solar panels;
 - Installation of electrical conduit to accept solar electric system wiring;
 - Installation of plumbing to support a solar hot water system and provision of space for a solar hot water storage tank.
- PS94:** Local jurisdictions ~~can and should~~ may require that residential projects of 6 units or more participate in the California Energy Commission’s New Solar Homes Partnership, which provides rebates to developers who offer solar power in at least 50 percent of new units, or a program with similar provisions.
- PS95:** Local jurisdictions ~~can and should~~ may require that any building constructed in whole or in part with local jurisdiction funds incorporate passive solar design features, such as daylighting and passive solar heating, where feasible.
- PS96:** Local jurisdictions ~~can and should~~ may protect active and passive solar design elements and systems from shading by neighboring structures and trees, as consistent with existing tree shading requirements.
- PS97:** Local jurisdictions ~~can and should~~ may provide, where feasible, creative financing for renewable energy projects, including subsidized or other low-interest loans, and the option to pay for system installation through long-term assessments on individual property tax bills.
- PS98:*** Local jurisdictions ~~can and should~~ may pursue partnerships with other governmental entities and with private companies and utilities to establish incentive programs for renewable energy.

- PS99:** Local jurisdictions ~~can and should~~ may establish and maintain a clearinghouse of information on available funding alternatives for renewable energy projects, rates of return, and other information to support developers and community members interested in pursuing renewable energy projects.
- PS100:** Local jurisdictions ~~can and should~~ may establish targets for the purchase of renewable energy, in excess of the state Renewable Portfolio Standards, using such mechanisms as green tags or renewable energy certificates.
- PS101:** Local jurisdictions ~~can and should~~ may evaluate the feasibility and effectiveness of using Community Choice Aggregation as a model for providing renewable energy to meet the community’s electricity needs, including potential partnerships with other jurisdictions.
- PS102:** Local jurisdictions ~~can and should~~ may prepare and implement a comprehensive plan to improve energy efficiency of municipal facilities, including:
- Conduct energy audits for all municipal facilities;
 - Retrofit facilities for energy efficiency where feasible and when remodeling or replacing components, including increased insulation, installing green or reflective roofs and low-emissive window glass;
 - Implement an energy tracking and management system;
 - Install energy-efficient exit signs, street signs, and traffic lighting;
 - Install energy-efficient lighting retrofits and occupancy sensors, and institute a “lights out at night” policy;
 - Retrofit heating and cooling systems to optimize efficiency (e.g., replace chillers, boilers, fans, pumps, belts, etc.);
 - Install Energy Star® appliances and energy-efficient vending machines;
 - Improve efficiency of water pumping and use at municipal facilities, including a schedule to replace or retrofit system components with high-efficiency units (i.e., ultra-low-flow toilets, fixtures, etc.);
 - Provide chilled, filtered water at water fountains and taps in lieu of bottled water;
 - Install a central irrigation control system and time its operation for off-peak use;
 - Adopt an accelerated replacement schedule for energy inefficient systems and components.
- PS103:** Local jurisdictions ~~can and should~~ may require that any newly constructed, purchased, or leased municipal space meet minimum standards as appropriate, such as:
- Requirements for new commercial buildings to meet LEED criteria established by the U.S. Green Building Council;
 - Requirements for new residential buildings to meet criteria of the Energy Star® New Homes Program established by U.S. EPA;
 - Incorporation of passive solar design features in new buildings, including daylighting and passive solar heating;
 - Retrofitting of existing buildings to meet standards under Title 24 of the California Building Energy Code, or to achieve a higher performance standard as established by the local jurisdiction;
 - Retrofitting of existing buildings to decrease heat gain from non-roof impervious surfaces with cool paving, landscaping, and other techniques.
 - Training & Support: Local jurisdictions or agencies ~~can and should~~ may ensure that staff receives appropriate training and support to implement objectives and policies to reduce GHG emissions, including:
 - Providing energy efficiency training to design, engineering, building operations, and maintenance staff;
 - Providing information on energy use and management, including data from the tracking and management system, to managers and others making decisions that influence energy use;
 - Providing energy design review services to departments undertaking new construction or renovation projects, to facilitate compliance with LEED standards.
- MM-PS104:*** Local jurisdictions ~~can and should~~ may collaborate with local energy suppliers and distributors to establish energy conservation programs, Energy Star® appliance change-out programs, rebates, vouchers, and other incentives to install energy-efficient technology and products and to cooperate on advertising.

TRANSPORTATION, TRAFFIC & SECURITY

- TR-1** Project-specific workshops on Sustainability Planning and Development ~~Smart Growth should~~ may be held by local agencies.

Above measure is clarified.

- TR-2** Transit operators ~~should~~may incorporate ITS technologies as part of their security and emergency preparedness and share that information with other operators. Aside from deploying ITS technologies for advanced customer information, transit agencies ~~should~~may work intensely with ethnic, local and disenfranchised communities through public information / outreach sessions ensuring public participation is utilized to its fullest. In case of evacuation, these transit dependent persons may need additional assistance to evacuate to safety.
- TR3:** SCAG ~~shall (for its employees) and~~ Local jurisdictions ~~can and should~~may institute teleconferencing, telecommute and/or flexible work hour programs to reduce unnecessary employee transportation.
- TR4:** Local jurisdictions ~~can and should~~may create a ride-sharing program, including promoting existing ride sharing programs e.g., by designating a certain percentage of parking spaces for ride sharing vehicles, designating adequate passenger loading and unloading for ride sharing vehicles, and providing a web site or message board for coordinating rides.
- TR5:** SCAG ~~shall and~~ Local jurisdictions ~~can and should~~may create or accommodate car sharing programs, e.g., provide parking spaces for car share vehicles at convenient locations accessible by public transportation.
- TR6:** SCAG ~~shall and~~ Local jurisdictions ~~can and should~~may provide a vanpool for employees for commute trips.

Above measure is clarified.

- TR7:** Transportation Planning: SCAG ~~shall and~~ Local jurisdictions ~~can and should~~may ensure encourage that new developments incorporate both local and regional transit measures into the project design that promote the use of alternative modes of transportation.

Above measure is clarified.

- TR8:** As may be appropriate, project sponsors ~~can and should~~may submit fair share traffic payments to the local agency for funding capital improvement projects to accommodate future traffic demand in the area.
- TR9:** Local jurisdictions ~~can and should~~may coordinate controlled intersections so that traffic passes more efficiently through congested areas. Where traffic signals or streetlights are installed, may require the use of Light Emitting Diode (LED) technology.
- TR10:** Local jurisdictions ~~can and should~~may promote ride sharing programs e.g., by designating a certain percentage of parking spaces for high-occupancy vehicles, providing larger parking spaces to accommodate vans used for ride-sharing, and designating adequate passenger loading and unloading and waiting areas.
- TR11:** Local jurisdictions ~~can and should~~may encourage the use of car-sharing programs such as ZipCar. Accommodations for such programs include providing parking spaces for the car-share vehicles at convenient locations accessible by public transportation.
- TR12:** Project sponsors of a commercial use ~~can and should~~may submit to the Lead Agency (or other appropriate government agency) a Transportation Demand Management (TDM) plan containing strategies to reduce on-site parking demand and single occupancy vehicle travel. The sponsor ~~should~~may implement the approved TDM plan. The TDM ~~should~~may include strategies to increase bicycle, pedestrian, transit, and carpools/vanpool use. All four modes of travel ~~should~~may be considered. Strategies to consider include the following:
- Inclusion of additional bicycle parking, shower, and locker facilities that exceed the requirement
 - Construction of bike lanes per the prevailing Bicycle Master Plan (or other similar document)
 - Signage and striping onsite to encourage bike safety
 - Installation of pedestrian safety elements (such as cross walk striping, curb ramps, countdown signals, bulb outs, etc.) to encourage convenient crossing at arterials
 - Installation of amenities such as lighting, street trees, trash and any applicable streetscape plan.
 - Direct transit sales or subsidized transit passes
 - Guaranteed ride home program
 - Pre-tax commuter benefits (checks)

- On-site car-sharing program (such as City Car Share, Zip Car, etc.)
- On-site carpooling program
- Distribution of information concerning alternative transportation options
- Parking spaces sold/leased separately
- Parking management strategies; including attendant/valet parking and shared parking spaces

TR13:* Project sponsors and construction contractors ~~can and should~~ may meet with the appropriate Lead Agency (or other government agency) to determine traffic management strategies to reduce, to the maximum extent feasible, traffic congestion and the effects of parking demand by construction workers during construction of this project and other nearby projects that could be simultaneously under construction. The project sponsor ~~should~~ may develop a construction management plan for review and approval by the Lead Agency (or other government agency as appropriate). The plan ~~should~~ may include at least the following items and requirements:

- A set of comprehensive traffic control measures, including scheduling of major truck trips and deliveries to avoid peak traffic hours, detour signs if required, lane closure procedures, signs, cones for drivers, and designated construction access routes.
- Notification procedures for adjacent property owners and public safety personnel regarding when major deliveries, detours, and lane closures will occur.
- Location of construction staging areas for materials, equipment, and vehicles at an approved location.
- A process for responding to, and tracking, complaints pertaining to construction activity, including identification of an onsite complaint manager. The manager ~~should~~ may determine the cause of the complaints and ~~should~~ may take prompt action to correct the problem. The Lead Agency ~~should~~ may be informed who the Manager is prior to the issuance of the first permit.
- Provision for accommodation of pedestrian flow.
- As necessary, provision for parking management and spaces for all construction workers to ensure that construction workers do not park in on street spaces.
- Any damage to the street caused by heavy equipment, or as a result of this construction, ~~should~~ may be repaired, at the project sponsor's expense, within one week of the occurrence of the damage (or excessive wear), unless further damage/excessive wear may continue; in such case, repair ~~should~~ may occur prior to issuance of a final inspection of the building permit. All damage that is a threat to public health or safety ~~should~~ may be repaired immediately. The street ~~should~~ may be restored to its condition prior to the new construction as established by the Lead Agency (or other appropriate government agency) and/or photo documentation, at the sponsor's expense, before the issuance of a Certificate of Occupancy.
- Any heavy equipment brought to the construction site ~~should~~ may be transported by truck, where feasible.
- No materials or equipment ~~should~~ may be stored on the traveled roadway at any time.
- Prior to construction, a portable toilet facility and a debris box ~~should~~ may be installed on the site, and properly maintained through project completion.
- All equipment ~~should~~ may be equipped with mufflers.
- Prior to the end of each work-day during construction, the contractor or contractors ~~should~~ may pick up and properly dispose of all litter resulting from or related to the project, whether located on the property, within the public rights-of-way, or properties of adjacent or nearby neighbors.

TR14: Local jurisdictions ~~can and should~~ may encourage the use of public transit systems by enhancing safety and cleanliness on vehicles and in and around stations, providing shuttle service to public transit, offering public transit incentives and providing public education and publicity about public transportation services.

TR15: Local jurisdictions ~~can and should~~ may encourage bicycling and walking by incorporating bicycle lanes into street systems in regional transportation plans, new subdivisions, and large developments, creating bicycle lanes and walking paths directed to the location of schools and other logical points of destination and provide adequate bicycle parking, and encouraging commercial projects to include facilities on-site to encourage employees to bicycle or walk to work.

TR16: Transit agencies ~~can and should~~ may encourage bicycling to transit facilities by providing additional bicycle parking, locker facilities, and bike lane access to transit facilities when feasible.

TR17:* Project sponsors ~~can and should~~ may ensure that prior to construction all necessary local and State road and railroad encroachment permits are obtained. As deemed necessary by the governing jurisdiction, the road encroachment permits may require the contractor to prepare a traffic control plan in accordance with professional engineering standards prior to construction. Traffic control plans ~~should~~ may include the following requirements:

- Identification of all roadway locations where special construction techniques (e.g., directional drilling or night construction) would be used to minimize impacts to traffic flow.
- Development of circulation and detour plans to minimize impacts to local street circulation. This may include the use of signing and flagging to guide vehicles through and/or around the construction zone.
- Scheduling of truck trips outside of peak morning and evening commute hours.
- Limiting of lane closures during peak hours to the extent possible.
- Usage of haul routes to minimize truck traffic on local roadways to the extent possible.
- Inclusion of detours for bicycles and pedestrians in all areas potentially affected by project construction.
- Installation of traffic control devices as specified in the California Department of Transportation Manual of Traffic Controls for Construction and Maintenance Work Zones.
- Development and implementation of access plans for highly sensitive land uses such as police and fire stations, transit stations, hospitals, and schools. The access plans would be developed with the facility owner or administrator. To minimize disruption of emergency vehicle access, affected jurisdictions ~~should~~ may be asked to identify detours for emergency vehicles, which will then be posted by the contractor. Notify in advance the facility owner or operator of the timing, location, and duration of construction activities and the locations of detours and lane closures.
- Storage of construction materials only in designated areas
- Coordination with local transit agencies for temporary relocation of routes or bus stops in work zones, as necessary.

TR18: Local jurisdictions ~~can and should~~ may meet an identified transportation-related benchmark.

TR19: Local jurisdictions ~~can and should~~ may adopt a comprehensive parking policy that discourages private vehicle use and encourages the use of alternative transportation.

TR20: Project sponsors ~~can and should~~ may build or fund a major transit stop within or near the development.

TR21: Local jurisdictions and transit agencies ~~can and should~~ may provide public transit incentives such as free or low-cost monthly transit passes to employees, or free ride areas to residents and customers.

TR22: Local jurisdictions and project sponsors ~~can and should~~ may promote “least polluting” ways to connect people and goods to their destinations.

TR23: Local jurisdictions and project sponsors ~~can and should~~ may incorporate bicycle lanes, routes and facilities into street systems, new subdivisions, and large developments.

TR24: Local jurisdictions ~~can and should~~ may require amenities for non-motorized transportation, such as secure and convenient bicycle parking.

TR25: Local jurisdictions ~~can and should~~ may ensure that the project enhances, and does not disrupt or create barriers to, non-motorized transportation.

TR26: Local jurisdictions ~~can and should~~ may connect parks and open space through shared pedestrian/bike paths and trails to encourage walking and bicycling.

TR27: Local jurisdictions ~~can and should~~ may create bicycle lanes and walking paths directed to the location of schools, parks and other destination points.

TR28: Local jurisdictions ~~can and should~~ may work with the school districts to improve pedestrian and bike access to schools and to restore or expand school bus service using lower-emitting vehicles.

TR29: Local jurisdictions and transit agencies ~~can and should~~ may provide information on alternative transportation options for consumers, residents, tenants and employees to reduce transportation-related emissions.

- TR30:** Local jurisdictions ~~can and should~~ may educate consumers, residents, tenants and the public about options for reducing motor vehicle-related greenhouse gas emissions. Include information on trip reduction; trip linking; vehicle performance and efficiency (e.g., keeping tires inflated); and low-, and/or near zero- and/or zero-emission vehicles.
- TR31:** Local jurisdictions ~~can and should~~ may purchase, or create incentives for purchasing, low-, and/or near zero and/or zero-emission vehicles.
- TR32:** Local jurisdictions ~~can and should~~ may create local “light vehicle” networks, such as neighborhood electric vehicle systems.
- TR33:** * Local jurisdictions ~~can and should~~ may enforce and follow limits idling time for commercial vehicles, including delivery and construction vehicles.
- TR34:** Local jurisdictions ~~can and should~~ may provide the necessary facilities and infrastructure to encourage the use of low-, and/or near zero- and/or zero-emission vehicles.
- TR35:** Local jurisdictions ~~can and should~~ may reduce GHG emissions by reducing vehicle miles traveled and by increasing or encouraging the use of alternative fuels and transportation technologies.
- TR36:** Local jurisdictions ~~can and should~~ may reduce VMT-related emissions by encouraging the use of public transit through adoption of new development standards that would require improvements to the transit system and infrastructure, increase safety and accessibility, and provide other incentives.
- TR37:** Project Selection: Local jurisdictions ~~can and should~~ may give priority to transportation projects that would contribute to a reduction in vehicle miles traveled per capita, while maintaining economic vitality and sustainability.
- TR38:** Equal Pedestrian Access Local jurisdictions ~~can and should~~ may include separated sidewalks whenever possible, on both sides of all new street improvement projects, except where there are severe topographic or natural resource constraints.
- TR39:*** Public Involvement: Local jurisdictions ~~can and should~~ may carry out a comprehensive public involvement and input process that provides information about transportation issues, projects, and processes to community members and other stakeholders, especially to those traditionally underserved by transportation services.
- TR40:** System Interconnectivity: Local jurisdictions ~~can and should~~ may create an interconnected transportation system that allows a shift in travel from private passenger vehicles to alternative modes, including public transit, ride sharing, car sharing, bicycling and walking, by incorporating the following:
- Ensuring transportation centers are multi-modal to allow transportation modes to intersect;
 - Providing adequate and affordable public transportation choices, including expanded bus routes and service, as well as other transit choices such as shuttles, light rail, and rail;
 - To the extent feasible, extending service and hours of operation to underserved arterials and population centers or destinations such as colleges;
 - Focusing transit resources on high-volume corridors and high-boarding destinations such as colleges, employment centers and regional destinations;
 - Coordinating schedules and routes across service lines with neighboring transit authorities;
 - Supporting programs to provide “station cars” for short trips to and from transit nodes (e.g., neighborhood electric vehicles);
 - Studying the feasibility of providing free transit to areas with residential densities of 15 dwelling units per acre or more, including options such as removing service from less dense, underutilized areas to do so;
 - Employing transit-preferential measures, such as signal priority and bypass lanes. Where compatible with adjacent land use designations, right-of-way acquisition or parking removal may occur to accommodate transit-preferential measures or improve access to transit. The use of access management ~~should~~ may be considered where needed to reduce conflicts between transit vehicles and other vehicles;
 - Providing safe and convenient access for pedestrians and bicyclists to, across, and along major transit priority streets;
 - Using park-and-ride facilities to access transit stations only at ends of regional transitways or where adequate feeder bus service is not feasible.

- TR41:** Transit System Infrastructure: Local jurisdictions ~~can and should~~ may upgrade and maintain transit system infrastructure to enhance public use, including:
- Ensuring transit stops and bus lanes are safe, convenient, clean and efficient;
 - Ensuring transit stops have clearly marked street-level designation, and are accessible;
 - Ensuring transit stops are safe, sheltered, benches are clean, and lighting is adequate;
 - Placing transit stations along transit corridors within mixed-use or transit-oriented development areas at intervals of three to four blocks, or no less than one-half mile.
- TR42:** Customer Service: Transit agencies ~~can and should~~ may enhance customer service and system ease-of-use, including:
- Developing a Regional Pass system to reduce the number of different passes and tickets required of system users;
 - Implementing “Smart Bus” technology, using GPS and electronic displays at transit stops to provide customers with “real-time” arrival and departure time information (and to allow the system operator to respond more quickly and effectively to disruptions in service);
 - Investigating the feasibility of an on-line trip-planning program.
- TR43:** Transit Funding: Local jurisdictions ~~can and should~~ may prioritize transportation funding to support a shift from private passenger vehicles to transit and other modes of transportation, including:
- Give funding preference to improvements in public transit over other new infrastructure for private automobile traffic;
 - Before funding transportation improvements that increase roadway capacity and VMT, evaluate the feasibility and effectiveness of funding projects that support alternative modes of transportation and reduce VMT, including transit, and bicycle and pedestrian access.
- TR44:** Transit and Multimodal Impact Fees: Local jurisdictions ~~can and should~~ may ~~consider the use of assess~~ transit and multimodal impact fees on new developments to fund public transportation infrastructure, bicycle infrastructure, pedestrian infrastructure and other multimodal accommodations.

Above measure revised to clarify intent and emphasize local discretion for revenue programs.

- TR45:** Local jurisdictions ~~can and should~~ may implement traffic and roadway management strategies to improve mobility and efficiency, and reduce associated emissions.
- TR46:** System Monitoring: Local jurisdictions ~~can and should~~ may monitor traffic and congestion to determine when and where new transportation facilities are needed in order to increase access and efficiency.
- TR47:** Arterial Traffic Management: Local jurisdictions ~~can and should~~ may modify arterial roadways to allow more efficient bus operation, including bus lanes and signal priority/preemption where necessary.
- TR48:** Signal Synchronization: Local jurisdictions ~~can and should~~ may expand signal timing programs where emissions reduction benefits can be demonstrated, including maintenance of the synchronization system, and ~~will~~ will ~~coordination~~ with adjoining jurisdictions as needed to optimize transit operation while maintaining a free flow of traffic.
- TR49:** HOV Lanes: Local jurisdictions ~~can and should~~ may encourage the construction of high-occupancy vehicle (HOV) lanes or similar mechanisms whenever necessary to relieve congestion and reduce emissions.
- TR50:** Delivery Schedules: Where operationally feasible, local jurisdictions ~~can and should~~ may establish ordinances or land use permit conditions limiting the hours when deliveries can be made to off-peak hours in high traffic areas.

Above measure revised so that changes to delivery hours consider operational feasibility.

- TR51:** Local jurisdictions ~~can and should~~ may reduce VMT related-emissions by implementing and supporting trip reduction programs.

TR52: Ride-Share Programs: Local jurisdictions ~~can and should~~ may promote ride-sharing programs, including:

- Designate a certain percentage of parking spaces for ride-sharing vehicles;
- Designate adequate passenger loading, unloading, and waiting areas for ride-sharing vehicles;
- Provide a web site or message board for coordinating shared rides;
- Encourage private, for-profit community car-sharing, including parking spaces for car share vehicles at convenient locations accessible by public transit;
- Hire or designate a rideshare coordinator to develop and implement ridesharing programs.

TR53: Employer-based Trip Reduction: Local jurisdictions ~~can and should~~ may support voluntary, employer-based trip reduction programs, including:

- Provide assistance to regional and local ridesharing organizations;
- Advocate for legislation to maintain and expand incentives for employer ridesharing programs;
- Require the development of Transportation Management Associations for large employers and commercial/ industrial complexes;
- Provide public recognition of effective programs through awards, top ten lists, and other mechanisms.

TR54: Ride Home Programs: Local jurisdictions ~~can and should~~ may implement a “guaranteed ride home” program for those who commute by public transit, ride-sharing, or other modes of transportation, and encourage employers to subscribe to or support the program.

TR55: Local Area Shuttles: Transit agencies ~~can and should~~ may encourage and utilize shuttles to serve neighborhoods, employment centers and major destinations.

TR56: Local jurisdictions and transit agencies ~~can and should~~ may create a free or low-cost local area shuttle system that includes a fixed route to popular tourist destinations or shopping and business centers.

TR57: Local jurisdictions ~~can and should~~ may work with existing shuttle service providers to coordinate their services.

TR58: Low- and No-Travel Employment Opportunities: Local jurisdictions ~~can and should~~ may facilitate employment opportunities that minimize the need for private vehicle trips, including:

- Amend zoning ordinances and the Development Code to include live/work sites and satellite work centers in appropriate locations;
- Encourage telecommuting options with new and existing employers, through project review and incentives, as appropriate.

TR59:* Local jurisdictions ~~can and should~~ may support bicycle use as a mode of transportation by enhancing infrastructure to accommodate bicycles and riders, and providing incentives.

TR60: Development Standards for Bicycles: Local jurisdictions ~~can and should~~ may establish standards for new development and redevelopment projects to support bicycle use, including:

- Amending the Development Code to include standards for safe pedestrian and bicyclist accommodations, by incorporating the following:
 - “Complete Streets” policies that foster equal access by all users in the roadway design;
 - Bicycle and pedestrian access internally and in connection to other areas through easements;
 - Safe access to public transportation and other non-motorized uses through construction of dedicated paths;
 - Safe road crossings at major intersections, especially for school children and seniors;
 - Adequate, convenient and secure bike parking at public and private facilities and destinations in all urban areas;
 - Street standards ~~will~~ may include provisions for bicycle parking within the public right of way.

TR61: Local jurisdictions ~~can and should~~ may require new development and redevelopment projects to include bicycle facilities, as appropriate with the new land use, including:

- Construction of weatherproof bicycle facilities where feasible, and at a minimum, bicycle racks or covered, secure parking near the building entrances;

- Provision and maintenance of changing rooms, lockers, and showers at large employers or employment centers.
 - Prohibit projects that impede bicycle and pedestrian access, such as large parking areas that cannot be safely crossed by non-motorized vehicles, and developments that block through access on existing or potential bicycle and pedestrian routes;
 - Encourage the development of bicycle stations at intermodal hubs, with attended or “valet” bicycle parking, and other amenities such as bicycle rental and repair, and changing areas with lockers and showers;
 - Conduct a connectivity analysis of the existing bikeway network to identify gaps, and prioritize bikeway development where gaps exist.
- TR62:** Bicycle and Pedestrian Trails: Local jurisdictions ~~can and should~~ may establish a network of multi-use trails to facilitate safe and direct off-street bicycle and pedestrian travel, and ~~will~~ provide bike racks along these trails at secure, lighted locations
- TR63:** Bicycle Safety Program: Local jurisdictions ~~can and should~~ may develop and implement a bicycle safety educational program to teach drivers and riders the laws, riding protocols, routes, safety tips, and emergency maneuvers.
- TR64:** Bicycle and Pedestrian Project Funding: Local jurisdictions ~~can and should~~ may pursue and provide enhanced funding for bicycle and pedestrian facilities and access projects, including, as appropriate:
- Apply for regional, State, and federal grants for bicycle and pedestrian infrastructure projects;
 - Establish development exactions and impact fees to fund bicycle and pedestrian facilities;
 - Use existing revenues, such as State gas tax subventions, sales tax funds, and general fund monies for projects to enhance bicycle use and walking for transportation.
- TR65:** Bicycle Parking: Local jurisdictions ~~can and should~~ may adopt bicycle parking standards that ensure bicycle parking sufficient to accommodate 5 to 10 percent of projected use at all public and commercial facilities, and at a rate of at least one per residential unit in multiple-family developments (suggestion: check language with League of American Bicyclists).
- TR66:** Local jurisdictions ~~can and should~~ may establish parking policies and requirements that capture the true cost of private vehicle use and support alternative modes of transportation.
- TR67:** Parking Policy: Local jurisdictions ~~can and should~~ may adopt a comprehensive parking policy to discourage private vehicle use and encourage the use of alternative transportation by incorporating the following:
- Reduce the available parking spaces for private vehicles while increasing parking spaces for shared vehicles, bicycles, and other alternative modes of transportation;
 - Eliminate or reduce minimum parking requirements for new buildings;
 - “Unbundle” parking (require that parking is paid for separately and is not included in the base rent for residential and commercial space);
 - Use parking pricing to discourage private vehicle use, especially at peak times;
 - Create parking benefit districts, which invest meter revenues in pedestrian infrastructure and other public amenities;
 - Establish performance pricing of street parking, so that it is expensive enough to promote frequent turnover and keep 15 percent of spaces empty at all times;
 - Encourage shared parking programs in mixed-use and transit-oriented development areas.
- TR68:** Event Parking Policies: Local jurisdictions ~~can and should~~ may establish policies and programs to reduce onsite parking demand and promote ride-sharing and public transit at large events, including:
- Promote the use of peripheral parking by increasing on-site parking rates and offering reduced rates for peripheral parking;
 - Encourage special event center operators to advertise and offer discounted transit passes with event tickets;
 - Encourage special event center operators to advertise and offer discount parking incentives to carpooling patrons, with four or more persons per vehicle for on-site parking;
 - Promote the use of bicycles by providing space for the operation of valet bicycle parking service.

- TR69:** Parking “Cash-out” Program: Local jurisdictions ~~can and should~~ may require new office developments with more than 50 employees to offer a Parking “Cash-out” Program to discourage private vehicle use.
- TR70:** Electric/Alternative Fuel Vehicle Parking: Local jurisdictions ~~can and should~~ may require new commercial and retail developments to provide prioritized parking for electric vehicles and vehicles using alternative fuels.
- TR71:** Local jurisdictions ~~can and should~~ may support and promote the use of low-, and/or near zero- and/or zero-emission vehicles, and alternative fuels, and other measures to directly reduce emissions from motor vehicles.
- TR72:** Low-, and/or near zero and/or Zero Emission Vehicles: Local jurisdictions ~~can and should~~ may support and promote the use of low-, and/or near zero- and/or zero-emission vehicles, by doing the following:
- Develop the necessary infrastructure to encourage the use of low-, and/or near zero- and/or zero-emission vehicles and clean alternative fuels, such as development of electric vehicle charging facilities and conveniently located alternative fueling stations;
 - Encourage new construction to include vehicle access to properly wired outdoor receptacles to accommodate ZEV and/or plug in electric hybrids (PHEV);
 - Encourage transportation fleet standards to achieve the lowest emissions possible, using a mix of alternate fuels, PZEV or better fleet mixes;
 - Establish incentives, as appropriate, to taxicab owners to use alternative fuel or gas-electric hybrid vehicles.

Measure made consistent.

- TR73:*** Vehicle Idling: Local jurisdictions ~~can and should~~ may enforce State idling laws for commercial vehicles, including delivery and construction vehicles.
- TR74:** Pedestrian and Bicycle Promotion: Local jurisdictions ~~can and should~~ may work with local community groups and downtown business associations to organize and publicize walking tours and bicycle events, and to encourage pedestrian and bicycle modes of transportation.
- TR75:** Local jurisdictions ~~can and should~~ may organize events and workshops to promote GHG-reducing activities.
- TR76:** Fleet Replacement: Local jurisdictions and agencies ~~can and should~~ may establish a replacement policy and schedule to replace fleet vehicles and equipment with the most fuel efficient vehicles practical, including gasoline hybrid and alternative fuel or electric models.
- TR77:** Local jurisdictions ~~can and should~~ may implement measures to reduce employee vehicle trips and to mitigate emissions impacts from municipal travel.
- TR78:** Trip Reduction Program: Local jurisdictions ~~can and should~~ may implement a program to reduce vehicle trips by employees, including:
- Providing incentives and infrastructure for vanpooling and carpooling, such as pool vehicles, preferred parking, and a website or bulletin board to facilitate ride-sharing;
 - Providing subsidized passes for mass transit;
 - Offering compressed work hours, off-peak work hours, and telecommuting, where appropriate;
 - Offer a guaranteed ride home for employees who use alternative modes of transportation to commute.
- TR79:** Bicycle Transportation Support: Local jurisdictions ~~can and should~~ may promote and support the use of bicycles as transportation, including:
- Providing bicycle stations with secure, covered parking, changing areas with storage lockers and showers, as well as a central facility where minor repairs can be made;
 - Providing bicycles, including electric bikes, for employees to use for short trips during business hours;
 - Implementing a police-on-bicycles program;
 - Providing a bicycle safety program, and information about safe routes to work.
- TR80:** Municipal Parking Management: Local jurisdictions ~~can and should~~ may implement a Parking Management Program to discourage private vehicle use, including:
- Encouraging carpools and vanpools with preferential parking and a reduced parking fee;

- Institute a parking cash-out program;
- Renegotiate employee contracts, where possible, to eliminate parking subsidies;
- Install on-street parking meters with fee structures designed to discourage private vehicle use;
- Establish a parking fee for all single-occupant vehicles.

TR81: Travel Mitigation: Local jurisdictions ~~can and should~~ may mitigate business-related travel, especially air travel, through the annual purchase of verified carbon offsets.

TR82: Transit Access to Municipal Facilities: Local jurisdiction and agency facilities ~~can and should~~ may be located on major transit corridors, unless their use is plainly incompatible with other uses located along major transit corridors.

TR83: Local jurisdictions and development project sponsors may and are encouraged to coordinate and consult early with the Caltrans District Planning offices of Local Development Intergovernmental Review on any land use proposal that would be located within 500 feet of state transportation facilities to enable consideration of the site specific access and operational safety impacts.

Above measure added in response to a comment from Caltrans.

WATER RESOURCES

W1: Local jurisdictions ~~can and should~~ may encourage new development and industry to locate in those service areas with existing wastewater infrastructure and treatment capacity, making greater use of those facilities prior to incurring new infrastructure costs.

W2: Local jurisdictions ~~can and should~~ may promote reduced wastewater system demand by: designing wastewater systems to minimize inflow and increase upstream treatment and infiltration to the extent feasible, reducing overall source water generation by domestic and industrial users, deferring development approvals for industries that generate high volumes of wastewater until wastewater agencies have expanded capacity.

W3: Wastewater treatment agencies are encouraged to have expansion plans, approvals and financing in place once their facilities are operating at 80 percent of capacity.

W4: Project sponsors ~~can and should~~ may coordinate with the local wastewater provider in order to ensure that existing and/or planned sewer conveyance and treatment facilities are capable of meeting wastewater flow capacity requirements. Each project sponsor ~~can and should~~ may identify specific on- and off-site improvements needed to ensure that impacts related to wastewater conveyance capacity are addressed prior to issuance of plans. Sewer capacity clearance from the local wastewater provider ~~will~~ may be required at the time that a sewer connection permit application is submitted.

W5:* As appropriate, confirmation of the capacity of the surrounding stormwater and sanitary sewer system and state of repair ~~can and should~~ may be completed by a qualified civil engineer with funding from the project sponsor. The project sponsor ~~can and should~~ may be responsible for the necessary stormwater and sanitary sewer infrastructure improvements to accommodate the proposed project. In addition, the sponsor ~~can and should~~ may be required to pay any fees to improve sanitary sewer infrastructure as may be required by the applicable local agencies. Improvements to the existing sanitary sewer collection system ~~can and should~~ may specifically include, but are not limited to, mechanisms to control or minimize increases in infiltration/inflow to offset sanitary sewer increases associated with the proposed project. To the maximum extent practicable, the sponsor ~~will~~ may be required to implement Best Management Practices to reduce the peak stormwater runoff from the project site. Additionally, the project sponsor ~~can and should~~ may be responsible for payment of any required installation or hook-up fees to the affected service providers.

W6: Wastewater treatment agencies ~~can and should~~ may maximize efficiency of wastewater treatment and pumping equipment.

W7:* Project sponsors with projects requiring the discharge of dredged or fill materials into U.S. waters, including wetlands, ~~can and should~~ may comply with sections 404 and 401 of the Clean Water Act including the requirement to obtain a permit from the U.S. Army Corps of Engineers and the governing Regional Water Quality Control Board.

W8:* Project sponsor ~~can and should~~ may ensure that natural riparian conditions near projects are maintained, wherever feasible, to minimize the effects of stormwater flows at stream crossings. Where feasible, riparian areas ~~can and should~~ may be restored or expanded to mitigate additional impervious surface and associated runoff.

W9:* Prior to construction within the vicinity of a watercourse, the project sponsor ~~can and should~~ may obtain all necessary regulatory permits and authorizations from the U.S. Army Corps of Engineers (Corps), Regional Water Quality Control Board (RWQCB), California Department of Fish and Game, California Coastal Commission, and local jurisdictions, and ~~should~~ may comply with all conditions issued by applicable agencies. Required permit approvals and certifications may include, but not be limited to the following:

- U.S. Army Corps of Engineers (Corps): Section 404. Permit approval from the Corps ~~should~~ may be obtained for the placement of dredge or fill material in Waters of the U.S., if any, within the interior of the project site, pursuant to Section 404 of the federal Clean Water Act.
- Regional Water Quality Control Board (RWQCB): Section 401 Water Quality Certification. Certification that the project will not violate state water quality standards is required before the Corps can issue a 404 permit, above.
- California Department of Fish and Game (CDFG): Section 1602 Lake and Streambed Alteration Agreement. Work that will alter the bed or bank of a stream requires authorization from CDFG.

A qualified environmental consultant ~~can and should~~ may be retained and paid for by the project sponsor to make site visits as necessary; and as a follow-up, submit to the Lead Agency a letter certifying that all required conditions have been instituted during the grading activities.

W10:* Prior to issuance of a demolition, grading, or building permit within vicinity of a watercourse project sponsors ~~can and should~~ may develop a final detailed landscaping and irrigation plan for review and approval by the appropriate local jurisdiction prepared by a licensed landscape architect or other qualified person. Such a plan ~~should~~ may include a planting schedule, detailing plant types and locations, and a system for temporary irrigation of plantings.

- Plant and maintain only drought-tolerant plants on the site where appropriate, as well as native and riparian plants in and adjacent to riparian corridors. Along the riparian corridor, native plants ~~should~~ may not be disturbed to the maximum extent feasible. Any areas disturbed along the riparian corridor ~~should~~ may be replanted with mature native riparian vegetation and be maintained to ensure survival.
- All landscaping indicated on the approved landscape plan ~~should~~ may be installed prior to the issuance of a Final inspection of the building permit, otherwise permitted.

All landscaping areas shown on the approved plans ~~should~~ may be maintained in neat and safe conditions, and all plants ~~should~~ may be maintained in good growing condition and, whenever necessary replaced with new plant materials to ensure continued compliance with all applicable landscaping requirements. All paving or impervious surfaces ~~should~~ may occur only on approved areas.

W11:* Project sponsors ~~can and should~~ may comply with the State-wide construction storm water discharge permit requirements including preparation of Storm Water Pollution Prevention Plans for transportation improvement construction projects. Roadway construction projects ~~can and should~~ may comply with the Caltrans storm water discharge permit. Best Management Practices ~~can and should~~ may be identified and implemented to manage site erosion, wash water runoff, and spill control.

W12:* Project sponsors ~~can and should~~ may comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) to address stormwater runoff. Detailed examples of potential mitigation activities that may be required by the Lead Agency are described below.

ADDITIONAL ACTIVITY

The Project sponsors ~~can and should~~ may submit with the application for a building permit (or other construction-related permit) a completed Construction-Permit-Phase Stormwater Supplemental Form. The project drawings submitted for the building permit (or other construction-related permit) ~~should~~ may contain a stormwater management plan, for review and approval by the appropriate agency, to manage stormwater run-off and to limit the discharge of pollutants in stormwater after construction of the project to the maximum extent practicable. The post-construction stormwater management plan ~~should~~ may include and identify the following:

- All proposed impervious surface on the site;

- Anticipated directional flows of on-site stormwater runoff; and
- Site design measures to reduce the amount of impervious surface area and directly connected impervious surfaces; and
- Source control measures to limit the potential for stormwater pollution;
- Stormwater treatment measures to remove pollutants from stormwater runoff; and
- Hydromodification management measures so that post-project stormwater runoff does not exceed the flow and duration of pre-project runoff, if required under the NPDES permit.

The following additional information ~~should~~may be submitted with the post-construction stormwater management plan:

- Detailed hydraulic sizing calculations for each stormwater treatment measure proposed; and
- Pollutant removal information demonstrating that any proposed manufactured/mechanical (i.e. non-landscape-based) stormwater treatment measure, when not used in combination with a landscape-based treatment measure, is capable of removing the range of pollutants typically removed by landscape-based treatment measures and/or the range of pollutants expected to be generated by the project.

All proposed stormwater treatment measures ~~can and should~~may incorporate appropriate planting materials for stormwater treatment (for landscape-based treatment measures) and ~~should~~may be designed with considerations for vector/mosquito control. Proposed planting materials for all proposed landscape-based stormwater treatment measures ~~should~~may be included on the landscape and irrigation plan for the project. The sponsor is not required to include on-site stormwater treatment measures in the post-construction stormwater management plan if he or she secures approval from an appropriate agency that an alternate approach is appropriate. The project sponsor ~~can and should~~may implement the approved stormwater management plan.

Above measure revised to emphasize detailed information cited as examples.

- W13:*** Project sponsors ~~can and should~~may consult with the RWQCB and Storm Water Management Plan permit holders as projects are designed to ensure that projects protect the goals of the Clean Water Act and comply with federal storm water NPDES permits.
- W14:*** Project sponsors ~~can and should~~may ensure that new facilities include structural water quality control features such as drainage channels, detention basins, oil and grease traps, filter systems, and vegetated buffers to prevent pollution of adjacent water resources by polluted runoff where required by applicable urban storm water runoff discharge permits.
- W15:*** Structural storm water runoff treatment ~~can and should~~may be provided according to the applicable urban storm water runoff permit where facilities will be operated by a permitted municipality or county. Where Caltrans is the operator, the statewide permit applies.
- W16:*** Project sponsors ~~can and should~~may ensure that operational best management practices for street cleaning, litter control, and catch basin cleaning are implemented to prevent water quality degradation in compliance with applicable storm water runoff discharge permits. Efforts ~~can and should~~may be made to assure treatment controls are in place as early as possible, such as during the acquisition process for rights-of-way, not just later during the facilities design and construction phase.
- W17:*** In compliance with applicable municipal separate storm sewer system discharge permits as well as Caltrans' storm water discharge permit, long-term sediment control ~~can and should~~may be affected through erosion control and revegetation programs designed to allow reestablishment of native vegetation on slopes and undeveloped areas.
- W18:*** Drainage of roadway runoff ~~can and should~~may comply with Caltrans' storm water discharge permit. Wherever possible, roadways ~~can and should~~may be designed to convey storm water through vegetated median strips that provide detention capacity and allow for infiltration before reaching culverts.
- W19:*** Treatment and control features such as detention basins, infiltration strips, and porous paving, other features to control surface runoff and facilitate groundwater recharge ~~can and should~~may be incorporated into the design of new transportation projects early on in the process to ensure that adequate acreage and elevation contours are provided during the right-of-way acquisition process.

- W20:*** Project sponsors ~~can and should~~ may assure projects mitigate for changes to the volume of runoff, where any downstream receiving water body has not been designed and maintained to accommodate the increase in flow velocity, rate, and volume without impacting the water's beneficial uses. Pre-project flow velocities, rates, and volumes must not be exceeded. This applies not only to increases in storm water runoff from the project site, but also to hydrologic changes induced by flood plain encroachment. Projects ~~should~~ may not cause or contribute to conditions that degrade the physical integrity or ecological function of any downstream receiving waters.
- W21:*** Impacts ~~can and should~~ may be reduced to the extent possible by providing culverts and facilities that do not increase the flow velocity, rate, or volume and/or acquiring sufficient storm drain easements that accommodate an appropriately vegetated earthen drainage channel.
- W22:*** Project sponsors of improvement projects on existing facilities ~~can and should~~ may include upgrades to stormwater drainage facilities to accommodate any increased runoff volumes. These upgrades may include the construction of detention basins or structures that will delay peak flows and reduce flow velocities, including expansion and restoration of wetlands and riparian buffer areas. System designs ~~can and should~~ may be completed to eliminate increases in peak flow rates from current levels.
- W23:*** Local jurisdictions ~~can and should~~ may encourage Low Impact Development and incorporation of natural spaces that reduce, treat, infiltrate and manage stormwater runoff flows in all new developments, where practical and feasible.
- W24:*** Project sponsor ~~can and should~~ may ensure that for sites less than one acre, project drawings submitted for a building permit (or other construction-related permit) contain a final site plan to be reviewed and approved by the appropriate local agency. The final site plan ~~should~~ may incorporate appropriate site design measures to manage stormwater runoff and minimize impacts to water quality after the construction of the project. These measures may include, but are not limited to, the following:

- Minimize impervious surfaces, especially directly connected impervious surfaces;
- Utilize permeable paving in place of impervious paving where appropriate;
- Cluster buildings;
- Preserve quality open space; and
- Establish vegetated buffer areas.

The approved plan ~~should~~ may be implemented and the site design measures shown on the plan ~~should~~ may be permanently maintained.

- W25:*** Project sponsors ~~can and should~~ may implement BMPs to reduce erosion, sedimentation, and water quality impacts during construction to the maximum extent practicable. Plans demonstrating BMPs ~~should~~ may be submitted for review and approval by the Lead Agency. At a minimum, the project sponsor ~~can and should~~ may provide filter materials deemed acceptable to the Lead Agency at nearby catch basins to prevent any debris and dirt from flowing into the local storm drain system and creeks.
- W26:*** Project sponsors for sites over one acre, ~~must~~ may obtain coverage under the General Construction Activity Storm Water Permit (General Construction Permit) issued by the State Water Resources Control Board (SWRCB). The project sponsor ~~must~~ may file a notice of intent (NOI) with the SWRCB. The project sponsor ~~will~~ may be required to prepare a stormwater pollution prevention plan (SWPPP) and submit the plan for review and approval by the Lead Agency. At a minimum, the SWPPP ~~should~~ may include a description of construction materials, practices, and equipment storage and maintenance; a list of pollutants likely to contact stormwater; site-specific erosion and sedimentation control practices; a list of provisions to eliminate or reduce discharge of materials to stormwater; BMPs, and an inspection and monitoring program. Prior to the issuance of any construction-related permits, the project sponsor ~~should~~ may submit to the lead agency a copy of the SWPPP and evidence of submittal of the NOI to the SWRCB. Implementation of the SWPPP ~~should~~ may start with the commencement of construction and continue through the completion of the project. After construction is completed, the project sponsor ~~can and should~~ may submit a notice of termination to the SWRCB.
- W27:*** Project sponsors ~~can and should~~ may ensure that project drawings submitted for a building permit (or other construction-related permit) contain a drainage plan to be reviewed and approved by the appropriate agency. The drainage plan ~~should~~ may include measures to reduce the post-construction volume and velocity of

stormwater runoff to the maximum extent practicable. Stormwater runoff ~~should~~may not be augmented to adjacent properties or creeks. The drainage plan ~~should~~may include and identify the following:

- All proposed impervious surface on the site;
- Anticipated directional flows of on-site stormwater runoff;
- Site design measures to reduce the amount of impervious surface area and directly connected impervious surfaces;
- Source control measures to limit the potential for stormwater pollution; and
- Stormwater treatment measures to remove pollutants from stormwater runoff.

W28:* Project sponsors ~~can and should~~may submit an erosion and sedimentation control plan for review and approval by the appropriate government agency. All work ~~should~~may incorporate all applicable BMPs for the construction industry, including BMP's for dust, erosion and water quality. The measures ~~should~~may include, but are not limited to, the following:

- On sloped properties, the downhill end of the construction area must be protected with silt fencing (such as sandbags, filter fabric, silt curtains, etc.) and hay bales oriented parallel to the contours of the slope (at a constant elevation) to prevent erosion into the street, gutters, stormdrains.
- In accordance with an approved erosion control plan, the project sponsor ~~should~~may implement mechanical and vegetative measures to reduce erosion and sedimentation, including appropriate seasonal maintenance. One hundred (100) percent degradable erosion control fabric ~~should~~may be installed on all graded slopes to protect and stabilize the slopes during construction and before permanent vegetation gets established. All graded areas ~~should~~may be temporarily protected from erosion by seeding with fast growing annual species. All bare slopes ~~must~~may be covered with staked tarps when rain is occurring or is expected.
- Minimize the removal of natural vegetation or ground cover from the site in order to minimize the potential for erosion and sedimentation problems. Maximize the replanting of the area with native vegetation as soon as possible.
- Install filter materials acceptable to the appropriate agency at the storm drain inlets nearest to the project site prior to the start of the wet weather season (October 15); site dewatering activities; street washing activities; saw cutting asphalt or concrete; and in order to retain any debris flowing into the storm drain system. Filter materials ~~should~~may be maintained and/or replaced as necessary to ensure effectiveness and prevent street flooding.
- Ensure that concrete/granite supply trucks or concrete/plaster finishing operations do not discharge wash water into water courses, street gutters, or storm drains.
- Direct and locate tool and equipment cleaning so that wash water does not discharge into the street, gutters, or stormdrains.
- Create a contained and covered area on the site for storage of bags of cement, paints, flammables, oils, fertilizers, pesticides, or any other materials used on the project site that have the potential for being discharged to the storm drain system by the wind or in the event of a material spill. No hazardous waste material ~~should~~may be stored on-site.
- Gather all construction debris on a regular basis and place them in a dumpster or other container which is emptied or removed on a weekly (or other interval approved by the Lead Agency) basis. When appropriate, use tarps on the ground to collect fallen debris or splatters that could contribute to stormwater pollution.
- Remove all dirt, gravel, refuse, and green waste from the sidewalk, street pavement, and storm drain system adjoining the project site. During wet weather, avoid driving vehicles off paved areas and other outdoor work.
- As appropriate, broom sweep the street pavement adjoining the project site on a daily basis. Caked-on mud or dirt ~~should~~may be scraped from these areas before sweeping. At the end of each workday, the entire site ~~must~~may be cleaned and secured against potential erosion, dumping, or discharge to the street, gutter, and/or stormdrains.
- All erosion and sedimentation control measures implemented during construction activities, as well as construction site and materials management ~~should~~may be in strict accordance with the control standards listed in the latest edition of the Erosion and Sediment Control Field Manual published by the RWQB.

All erosion and sedimentation control measures ~~should~~may be monitored regularly by the project sponsor. If measures are insufficient to control sedimentation and erosion then the project sponsor ~~should~~may develop and implement additional and more effective measures immediately.

- W29:*** Project sponsors ~~can and should~~ may ensure that projects requiring continual dewatering facilities implement monitoring systems and long-term administrative procedures to ensure proper water management that prevents degrading of surface water and minimizes, to the greatest extent possible, adverse impacts on groundwater for the life of the project. Construction designs ~~can and should~~ may comply with appropriate building codes and standard practices including the Uniform Building Code.
- W30:*** Project sponsors, lead agencies, and local jurisdictions ~~can and should~~ may maximize, where practical and feasible, permeable surface area in existing urbanized areas to protect water quality, reduce flooding, allow for groundwater recharge, and preserve wildlife habitat. New impervious surfaces ~~can and should~~ may be minimized to the greatest extent possible, including the use of in-lieu fees and off-site mitigation.
- W31:** Project sponsors ~~can and should~~ may avoid designs that require continual dewatering where feasible.
- W32:** Where feasible, transportation facilities ~~can and should~~ may not be sited ~~in~~ away from groundwater recharge areas, to prevent conversion of those areas to impervious surface.
- W33:** Project sponsors ~~can and should~~ may reduce hardscape to the extent feasible to facilitate groundwater recharge as appropriate.
- W34:*** Project sponsor ~~can and should~~ may ensure that all roadbeds for new highway and rail facilities be elevated at least one foot above the 100-year base flood elevation. Since alluvial fan flooding is not often identified on FEMA flood maps, the risk of alluvial fan flooding ~~should~~ may be evaluated and projects ~~should~~ may be sited to avoid alluvial fan flooding. Delineation of floodplains and alluvial fan boundaries ~~should~~ may attempt to account for future hydrologic changes caused by global climate change.
- W35:*** Project sponsors of transportation improvements ~~can and should~~ may comply with local, state, and federal floodplain regulations. Projects requiring federal approval or funding ~~should~~ may comply with Executive Order 11988 on Floodplain Management, which requires avoidance of incompatible floodplain development, restoration and preservation of the natural and beneficial floodplain values, and maintenance of consistency with the standards and criteria of the National Flood Insurance Program.
- W36:*** Local jurisdictions ~~can and should~~ may, to the extent feasible and appropriate, prevent development in flood hazard areas that do not have appropriate protections, especially in alluvial fan areas of the region.
- W37:*** Local water agencies ~~can and should~~ may continue to evaluate future water demands and establish the necessary supply and infrastructure to meet that demand, as documented in their Urban Water Management Plans.
- W38:** Project sponsors, local jurisdictions, and water agencies ~~can and should~~ may include conjunctive use as a water management strategy when feasible.
- W39:*** Regional water agencies ~~can and should~~ may consider, to the greatest extent feasible, potential climate change hydrology and attendant impacts on available water supplies and reliability in the process of creating or modifying systems to manage water resources for both year-round use and ecosystem health. As the methodology and base data for such decisions is still developing, agencies ~~can and should~~ may use the best currently available science in decision-making. Local jurisdictions and water agencies ~~can and should~~ may rely on current regional analyses when making local decisions regarding future water supply and reliability.
- W40:** Project sponsors and local jurisdictions ~~can and should~~ may reduce exterior uses of water in public areas, and ~~should~~ may promote reductions in private homes and businesses, by shifting to drought-tolerant native landscape plantings (~~xeriscaping~~), using weather-based irrigation systems, educating other public agencies about water use, and installing related water pricing incentives. Local jurisdictions ~~can and should~~ may also work with local retailers and vendors to promote the availability of drought resistant landscaping options and provide information on where these can be purchased. Use of ~~reclaimed~~ recycled water especially in median landscaping and hillside landscaping ~~can and should~~ may be implemented where feasible.

Above measure edited in response to a comment by Metropolitan Water District (MWD).

- W41:*** Project sponsors ~~can and should~~ may coordinate with the local water provider to ensure that existing and/or planned water supply and water conveyance facilities are capable of meeting water demand/pressure

requirements. In accordance with State Law, a Water Supply Assessment ~~can and should~~ may be required for projects that meet the size requirements specified in the regulations. In coordination with the local water provider, each project sponsor ~~will~~ may identify specific on- and off-site improvements needed to ensure that impacts related to water supply and conveyance demand/pressure requirements are addressed prior to issuance of a certificate of occupancy. Water supply and conveyance demand/pressure clearance from the local water provider ~~will~~ may be required at the time that a water connection permit application is submitted.

W42:* Project sponsors ~~can and should~~ may coordinate with the local fire service provider in order to ensure that existing and/or planned fire hydrants are capable of meeting fire flow demand/pressure requirements. The issuance of building permits ~~will~~ may be dependent upon submission, review, approval, and testing of fire flow demand and pressure requirements, as established by the local fire service provider prior to occupancy.

W43:* Project sponsors ~~can and should~~ may implement water conservation measures in new development that ~~should~~ may include but not be limited to the following:

- Installation of high-efficiency toilets (1.28 gallons per flush or less, includes dual flush).
- High-efficiency urinals (0.125 gallons per flush or less, includes waterless)
- Restroom faucet flow rate of 1.5 gallons per minute or less
- Public restroom faucet flow rate of 0.5 gallons per minute or less and self-closing
- Showerhead flow rate of 2.0 gallons per minute or less
- Limit of one showerhead per shower stall
- High efficiency clothes washers (water factor of 4.0 or less)
- High efficiency dishwashers (Energy Star rated)
- Domestic water heating system located in close proximity to point(s) of use, as feasible; use of tankless and on-demand water heaters as feasible
- Cooling towers must be operated at a minimum of 5.5 cycles of concentration
- Install on-site water recycling as feasible
- Use of recycled water (if available) for appropriate end uses (irrigation, cooling towers, sanitary)
- Single pass cooling ~~should~~ may be prohibited (e.g. any vacuum pumps or ice machines)
- Irrigation ~~should~~ may include:
 - Weather-based irrigation controller with rain shutoff
 - Flow sensor and master valve shutoff (for large landscaped areas)
 - Matched precipitation (flow) rates for sprinkler heads
 - Drip/microspray/subsurface irrigation where appropriate
 - Minimum irrigation system distribution uniformity of 75%
 - Proper hydro-zoning, turf minimization and use of native/drought tolerant plant materials
 - Use of landscape contouring to minimize precipitation runoff

W44:* Project sponsors ~~can and should~~ may consult with the local water provider to identify feasible and reasonable measures to reduce water consumption, including, but not limited to, systems to use ~~reclaimed~~ recycled water for landscaping, drip irrigation, re-circulating hot water systems, water conserving landscape techniques (such as mulching, installation of drip irrigation systems, landscape design to group plants of similar water demand, soil moisture sensors, automatic irrigation systems, clustered landscaped areas to maximize the efficiency of the irrigation system), water conserving kitchen and bathroom fixtures and appliances, thermostatically controlled mixing valves for baths and showers, and insulated hot water lines.

Above measure edited in response to a comment from MWD.

W45:* Project sponsors ~~can and should~~ may incorporate compliance with local drought measures as appropriate including prohibiting hose watering of driveways and associated walkways; requiring decorative fountains to use recycled water, and repairing water leaks in a timely manner.

W46:* Project sponsors ~~can and should~~ may incorporate automatic sprinkler systems that irrigate landscaping during morning hours or during the evening to reduce water losses from evaporation. Sprinklers ~~should~~ may be required to reset to water less often in cooler months and during the rainfall season, so that water is not wasted in excessive landscape irrigation.

W47:* Prior to issuance of building permits, project sponsors ~~can and should~~ may pay any appropriate fees imposed by local water providers to off-set any fair share project costs as identified by the local water provider.

- W48:** As part of the general plan update process, local jurisdictions ~~can and should~~ may coordinate with water providers to identify water budgets for development within their jurisdiction. Local water providers may provide for new water supply through a combination of water conservation (on and potentially off-site) and recycled water, such that the net increase in water demand (not including demand for recycled water) does not exceed the calculated demand anticipated in the most recent Urban Water Management Plan or other similar document.
- W49:*** Project sponsors ~~can and should~~ may create water-efficient landscapes.
- W50:*** Project sponsors ~~can and should~~ may install water-efficient irrigation systems and devices, such as soil moisture-based irrigation controls and use water-efficient irrigation methods.
- W51:*** Project sponsors ~~can and should~~ may incorporate water-reducing features into building and landscape design.
- W52:** Project sponsors ~~should~~ may make effective use of graywater for landscape irrigation. (Graywater is untreated household wastewater from bathtubs, showers, bathroom wash basins, and water from clothes washing machines.)
- W53:*** Project sponsors ~~can and should~~ may implement low-impact development practices that maintain the existing hydrology of the site to manage storm water and protect the environment by doing the following:
- Devise a comprehensive water conservation strategy appropriate for the project and location.
 - Design buildings to be water-efficient. Install water-efficient fixtures and appliances.
 - Offset water demand from new projects so that there is no net increase in water use.
 - Provide education about water conservation and available programs and incentives.
- W54:** Local jurisdictions ~~can and should~~ may adopt and implement a comprehensive strategy to increase water conservation and the use of recycled water that includes similar measure to the following:
- **Water Consumption Reduction Target:** Regional water agencies ~~should~~ may work together to set a target for to reduce per capita water consumption by 2020.
 - **Water Conservation Plan:** Regional water agencies ~~should~~ may establish a water conservation plan that may include such policies and actions as:
 - Tiered rate structures for water use;
 - Restrictions on time of use for landscape watering, and other demand management strategies;
 - Performance standards for irrigation equipment and water fixtures;
 - Requirements that increased demand from new construction be offset with reductions so that there is no net increase in water use.
 - **Recycled Water Use:** Local jurisdictions and regional water agencies ~~should~~ may establish programs and policies to increase the use of recycled water, including:
 - Create an inventory of non-potable water uses within the jurisdiction that could be served with recycled water;
 - Produce and promote the use of recycled water for agricultural, industrial, and irrigation purposes, including grey water systems for residential irrigation;
 - Produce and promote the use of treated, recycled water for potable uses where GHG emissions from producing such water are lower than from other potable sources.
 - **Water Conservation Outreach:** Local jurisdictions and regional water agencies ~~should~~ may implement a public education and outreach campaign to promote water conservation, and highlights specific water-wasting activities to discourage, such as the watering of non-vegetated surfaces and using water to clean sidewalks and driveways.
- W55:** Local jurisdictions ~~can and should~~ may ensure that building standards and permit approval processes promote and support water conservation.
- W56:*** Local jurisdictions ~~can and should~~ may establish building design guidelines and criteria to promote water-efficient building design, including minimizing the amount of non-roof impervious surfaces around the building(s).

- W57:*** Local jurisdictions ~~can and should~~ may establish menus and check-lists for developers and contractors to ensure water-efficient infrastructure and technology are used in new construction, including low-flow toilets and shower heads, moisture-sensing irrigation, and other such advances.
- W58:*** Local jurisdictions ~~can and should~~ may establish criteria and standards to permit the safe and effective use of gray water (on-site water recycling), and review and appropriately revise, without compromising health and safety, other building code requirements that may prevent the use of such systems.
- W59:** Local jurisdictions ~~can and should~~ may establish programs and policies to ensure landscaping and forests are installed and managed to optimize their climate benefits.
- W60:*** Project sponsors ~~can and should~~ may install water efficient landscapes and irrigation, including:
- Planting drought-tolerant and native species, and covering exposed dirt with moisture-retaining mulch;
 - Installing water-efficient irrigation systems and devices, including advanced technology such as moisture-sensing irrigation controls; and/or
 - Installing edible landscapes that provide local food.
- W61:*** Regional water agencies ~~can and should~~ may maximize efficiency at drinking water treatment, pumping, and distribution facilities, ~~including development of off peak demand schedules for heavy commercial and industrial users.~~

Above measure edited in response to a comment from MWD.

W62: Impacts to waters of the state (i.e., water bodies, drainages, and the beneficial uses they support) from proposed transportation (and/or development) projects -- or loss of beneficial uses from cumulative projects and their impacts, may be mitigated by enhancing or restoring water quality attributes and environmental values of water bodies impacted by previous transportation (and/or development) projects. For example, a new project could examine where an earlier project (preferably in close proximity to the new project area), created impairment to a riparian wildlife corridor, and then plan to remove this impairment as mitigation. Alternatively a new project could remove an obstruction to sediment transport, or remove a check dam currently preventing fish (for example, steelhead trout) migration.

Above measure added in response to a comment from RWQCB, Santa Ana Region.

ATTACHMENT: Relevant Passages from the Community Marin 2013 Document.

The following are recommendations that are supported by the most prominent environmental organizations in Marin County and which have the potential to meet the same goals as PBA.

These recommendations establish a context of alternatives that should be considered relative to any PBA proposals for Marin County.

- Conversion of market- rate units to below-market-rate or assisted living units, second units, and inclusionary units.
- Restoration and expansion of north bay bus services.
- Locate affordable housing near existing jobs and services, as in-fill development and conversion of market-rate units to affordable housing.

4.1 Establish a maximum size of 3,500 square feet for new and remodeled homes, plus another 500 square feet for accessory buildings, unless a lower maximum is specified in adopted city or community plans. Allow a size larger than the maximum only if the unit is subject to design review, meets all planning standards, has no adverse impacts on sensitive habitat and service capacities, does not exceed the energy use of a typical 3,500 square foot floor area house, conforms to the average size of houses in the neighborhood, and the developer makes a compensatory contribution to a trust fund for support of environmental protection. Establish strict standards for floor area ratio, lot coverage, conformance with community character, bulk, mass, slope, height, accessory structures, and design review. The house size calculation should include all enclosed or partially enclosed space that is attached to the living space. Accessory structures include garages. Make it clear that a maximum is not an entitlement.

4.4 Encourage infill and mixed use development where it is consistent with height limits and community character, and reuse of existing non-residential buildings for housing.

4.5 Locate housing near transit and other services, without impairing natural resources, in order to encourage walking and bicycle use, discourage use of the private automobile and reduce vehicle miles traveled.

4.7 Retain existing below market rate housing.

This may be done through zoning, tax incentives, permanent deed restrictions, permitting of second units, and technical assistance. Work with state and local jurisdictions to establish procedures for retaining below market rate housing.

Support housing trust funds to pay for conversion of existing single-family units to create affordable housing. A possible mechanism for accomplishing this would be the use of the real estate transfer tax.

4.10 Prioritize placement of affordable housing in mixed-income neighborhoods. Avoid overconcentration of affordable units in any one area.

Increase the percentage requirements for below-market-rate units, with a minimum requirement of 20 percent, and reduce the project size threshold in inclusionary zoning ordinances. Require provision of below market rate housing on site rather than allowing in lieu fees, where appropriate. If in lieu fees are permitted, they should be adequate to cover the actual cost of developing affordable units. The county currently has a 20 percent inclusionary requirement for two units or more and city standards should match or exceed county requirements.

4.13 Require developers of commercial properties to provide or fully fund an appropriate amount of below-market-rate housing within the county. San Rafael and the county have jobs/housing linkage fees. Other cities and towns should adopt similar requirements.

4.14 Consider increasing density in infill locations, consistent with community character, availability of resources and environmental constraints, to provide less expensive housing. Outlying areas should be reduced in density to offset increases.

4.18 Require point-of-sale inspections for all property sales. These should ensure that the property meets all public health and safety requirements and environmental protection measures, and that required permit fees are paid and inspections completed for work that occurred on the property.

- 4.19 Conduct a point-of-sale energy audit program to convey upgrade recommendations and disclose areas of energy inefficiencies to buyers as part of the pre-sale inspection.
- 5.3 Incorporate into general plans economic policies and programs to reduce Marin County's carbon footprint, including promoting local food production and market supplies.
- 5.4 Ensure that the net public costs and impacts of all commercial development are understood, and require the development to contribute its fair share to a fund that will provide affordable housing and support city services. Require that commercial development fully meet those costs and mitigate impacts as part of the planning and approval process.
- 5.7 Support expansion and funding of the county's Green Business Certification Program, and support businesses that implement program requirements.
- 5.8 Incorporate economic policies that support reducing greenhouse gas emissions, including promoting local food production and market supplies, incentives for use of fuel efficient vehicles, and expansion of energy efficient public transit in the City Centered Corridor.
- 6.1 Reduce the total amount of additional growth, especially commercial development, allowed by current plans; do not just mitigate its impacts. Future growth should be planned in accordance with standards for protection of environmental resources and goals for protection and enhancement of the county's existing character, and should take into account the potential availability of services and resources.
- 6.2 Recognize that there is an ultimate limit to growth based on environmental and service constraints, and all land use designations should be based on these constraints. City and county general plans should limit projected buildout to levels that can exist reliably and continue into the future on local natural resources, including existing developed water sources.
- 6.3 Offset density increases at infill sites with reductions in development potential at outlying locations.
- 6.4 Focus new development on existing community centers, through infill and reuse. Maintain the existing scale and enhance the historic, community-centered character of Marin.
- 6.6 Balance parking requirements with the need to reduce car use, through such means as zip cars, loaner bikes, and other innovative techniques, to minimize spillover into adjacent neighborhoods.
- 6.7 Provide for a range of activities and opportunities for interaction within town centers, such as housing, shopping, services, jobs and outdoor public spaces, along with easy access to transportation.
- 6.9 Make more efficient and/or aesthetic use of parking areas and public garages by adding solar panels on roofs, water retention areas, planted areas, and shade trees.
- 6.11 Require new development, both residential and commercial, to incorporate energy efficiency and other resource conserving measures in all aspects of siting, infrastructure, construction techniques and materials, and landscaping, such as those listed below:
- Encourage compact development patterns that promote efficient use of resources.
 - Maintain natural landforms and habitats by prohibiting massive grading, encroachment into or filling of floodplains and wetlands, and removal of native vegetation.
 - Optimize microclimate orientation to reduce building energy demands in the siting of buildings, and use resource-conserving materials and construction technologies.
 - Minimize conversion of water absorbent ground surfaces to impervious materials. Cluster development to preserve the maximum amount of the property as natural habitat, for agricultural use or open space, prioritizing habitat protection.
 - Assure that donation of open space by a property owner is not at the expense of inappropriate development.
 - Where feasible, use on-site renewable energy technologies, including active and passive solar, to reduce demands for grid-delivered electricity.
 - Use recycled or renewable materials for roads and structures, including materials from sustainable-certified sources and materials that can be recycled in the future.
 - Conserve water use through installation of locally adapted and drought-tolerant landscaping; use recycled (waste) or reclaimed water or gray water wherever possible. Make recycling facilities and services, including dual piping, readily available.
- 6.12 Determine the effectiveness and cost of green building techniques, including the total energy

cost of materials, operation and maintenance, and environmental impacts or costs, before relying on them.

6.13 Prohibit use of green building techniques as a substitute for compliance with all other planning and zoning requirements and protection of natural resources.

6.14 Anticipate the effects of sea level rise and other consequences of a changing climate. Establish adaptive strategies and legal mechanisms to regulate new development or redevelopment in areas projected to be inundated or flooded in the future, including prohibition of new development and requirements for special design standards, and make plans to minimize damage to habitat and existing infrastructure and facilities as inundation proceeds.

7.25 Develop and maintain an effective telecommunication infrastructure in Marin, in accordance with existing law, that avoids adverse impacts on humans, wildlife, and the natural environment.

8.1 Reduce vehicle trips by expanding flextime, walking and biking, ridesharing, telecommuting, compressed work week, traffic information, subsidized bus pass, guaranteed ride, and similar transportation demand techniques.

8.3 Implement Intelligent Transportation Systems (ITS) that will include the following measures: (a) better traffic surveillance and faster removal of disabled vehicles when they are located in a highway or arterial bottleneck; (b) selectively applying ramp metering at on-ramps to enhance freeway traffic flow; and (c) improving real time information about "Next Bus" and travel times to allow people to schedule their travel more efficiently.

8.4 Expand shuttle bus services and satellite parking to serve popular tourist sites such as Sausalito, Fort Baker, Muir Woods, Stinson Beach, and Point Reyes National Seashore. Consider placing tourist-based shuttle bus service parking lots at the Presidio, Fisherman's Wharf, and other locations such as the Larkspur and Sausalito ferry terminals.

8.5 Transit systems and employers should provide satellite parking and shuttle service to and from transit stations and work places as appropriate.

8.6 Expand the Safe Routes to School program and related infrastructure with the objective of reducing vehicle trips and improving safety while protecting environmental resources. Operate more school buses so as to reduce VMT during periods of peak congestion.

8.8 Wherever possible, public agencies should utilize low emission, fuel-efficient vehicles and encourage the development of new technologies and necessary infrastructure support.

8.10 Encourage construction and use of bicycle/pedestrian pathways in already-developed areas and transit centers to support non-motorized commuter travel while not negatively impacting natural resources. Construct Class I bicycle/pedestrian pathways for improved safety where possible.

8.14 Improve traffic flow design of Highway 101 interchanges with the specific purpose of promoting auto, bicycle, pedestrian, and public transit safety without impacting sensitive environmental resources, including views.

8.15 Provide well maintained bus stop facilities with safe access to park-and-ride lots and connections to other modes of transit. Landscape interchanges with drought tolerant native plantings for aesthetic and air quality purposes.

8.17 Confine aviation to the existing Gnoss Field operations for general aviation only. Any runway extension should be for safety only and not for accommodation of larger craft. Do not approve the movement of larger jets. San Rafael (Smith Ranch) Airport and the Richardson Bay Heliport and sea plane base operations should not be expanded.

8.18 Provide transit hubs that offer convenient and timely transfers among all transit modes: auto, bus, bike, pedestrian, and rail.

8.20 Intra-county transit is the most likely means of increasing transit capacity of the east-west arterials and should be expanded. Buses work well on fixed routes; shuttles and vans have flexibility and capability to be reconfigured in response to land use changes and population shifts.

8.21 Plan and integrate local transit systems and transit modes to the greatest extent possible.

8.22 San Rafael Transit Center should be designed to minimize congestion on adjoining streets and sidewalks, and insure safety of pedestrians while they are changing transit modes.

8.23 All transit vehicles should have maximum fuel efficiency and minimum GHG emissions.

8.25 Establish and expand bus routes that are responsive to the needs of workers, students, the elderly, and other transit-dependent population sectors and/or communities. Maintain service to West Marin.

8.26 Expand the ability of buses to accommodate bicycles, and encourage employers to provide secure bicycle storage, showers, and financial incentives to non-motorized commuters.

8.27 Expand paratransit services to meet the needs of seniors and the disabled.

8.29 Telecommuting should be regarded as a form of transportation and public and/or privately-owned telecommunications infrastructure to serve Marin residents should be developed.

8.30 Ensure that local traffic congestion and poor Level of Service (LOS) intersections do not negatively impact local residents as a consequence of high density housing.

8.34 Fully consider the relative effects on greenhouse gas emission of increases in the use of alternative fuel vehicles.

8.35 Encourage use of high efficiency vehicles and the infrastructure to support them.

Attachment A – GHG Emission Reduction Targets

Regulation	Sectors Covered	2010 Actual	2020 Target	2035 Target	2040 Target	2050 Target
S-3-05	All		1990 levels			-80% Re: 1990
AB 32	All		1990 levels			
SB 375	Light-duty motor vehicles		-7% per capita Re: 2005	-15% per capita Re: 2005		
B-16-2012	Transportation					-80% Re: 1990
EIR Criterion #						
1	Light-duty motor vehicles		-7% per capita Re: 2005	-15% per capita Re: 2005		
2	Mobile sources, waste, electricity, natural gas				-0% Re: 2010	
3	Mobile sources, waste, electricity, natural gas					Not impede - 80%
4	Mobile sources, waste, electricity, natural gas		No Conflict with other plans			

Attachment B – SCS Performance re: Targets

EIR Criterion DEIR pg. #	Sectors Covered	2010 Actual	2020 Projection	2035 Projection	2040 Projection	2050 Projection
1 2.5-50	Light-duty motor vehicles		-10.3% per capita <input checked="" type="checkbox"/> Re: 2005	-16.4% per capita <input checked="" type="checkbox"/> Re: 2005	-18.0% per capita Re: 2005	
2 2.5-56 & 59	Mobile sources, waste, electricity, natural gas	48.8 MMTCO ₂ e			41.3 MMTCO ₂ e <input checked="" type="checkbox"/> -15% Re: 2010	
3 2.5-59	Mobile sources, waste, electricity, natural gas					38.8 MMTCO ₂ e <input checked="" type="checkbox"/> -20.5% Re: 2010
4 2.5-59	Mobile sources, waste, electricity, natural gas		46.4 MMTCO ₂ e <input checked="" type="checkbox"/> -4.9% Re: 2010			<input checked="" type="checkbox"/>

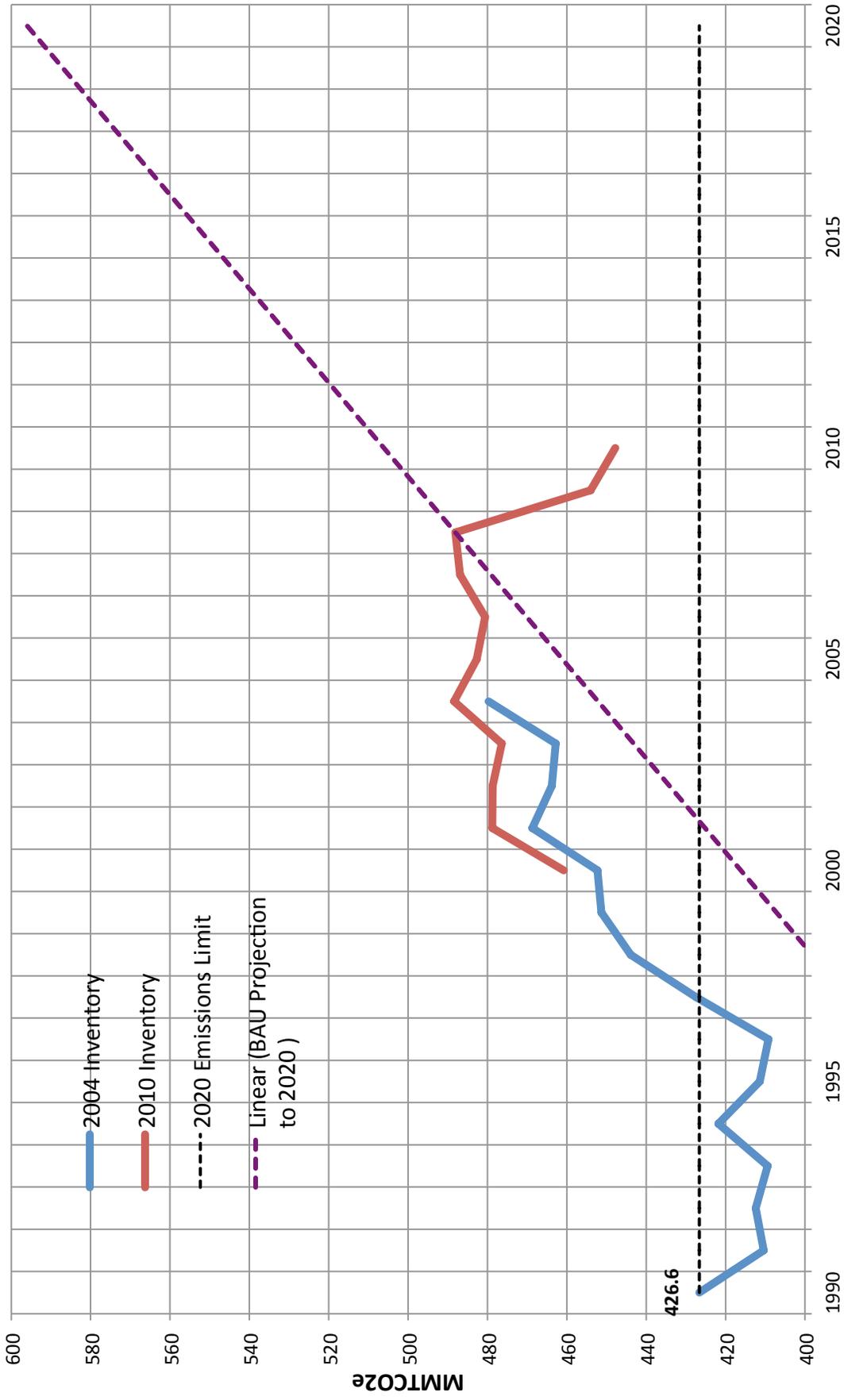
Attachment C—Scoping Plan Targets

	2010 Actual	2020 Target	2035	2040	2050
Scoping Plan		-174 MMTCO ₂ e			
Scoping Plan Reductions	Total Reductions				
	Mobile sources, waste, electricity, natural gas sectors only	-97.4 MMTCO ₂ e			
Scoping Plan Reductions	Mobile sources, waste, electricity, natural gas sectors only	56% of Total Reductions			
Statewide	Emissions Inventory	427 MMTCO ₂ e (1990 Level)			85 MMTCO ₂ e
Statewide	Emissions Reductions for AB 32 Compliance	-21 MMTCO ₂ e			
Statewide	Emissions Reductions from mobile sources, waste, electricity, natural gas sectors only	-11.8 MMTCO ₂ e (56% of 21. See Attachment D)			
Statewide Reduction	Mobile sources, waste, electricity, natural gas sectors only	-2.6% Re: 2010			-81.0% Re: 2010

Attachment D—Scoping Plan Measures Not Included in Regional Totals

Scoping Plan Measures Not Included	MMTCO ₂ e
Vehicle Efficiency	4.5
Medium/HD Vehicles	1.4
Industrial Measures	1.4
Forests	5
Regional Transportation-Related GHG Targets	5
Goods Movement	3.7
High GWP Gases	20.27
High-Speed Rail	1
Additional Reductions	34.4
Total Measures Not Included	76.67
Total Measures	174
Total Measures Included (174-77)	97.4
Percent of Scoping Plan Included in Regional Totals	56%

Attachment E--CA GHG Emissions



Appendix G: Examples of Measures that Could Reduce Impacts from Planning, Development and Transportation Projects

The following list of example measures is intended to function as a resource for lead agencies to consider in identifying mitigation measures to reduce impacts anticipated to result from future projects, as deemed applicable and feasible by such agencies. Some example measures are oriented to planning projects, while some measures are oriented to development and/or transportation projects. Some example measures are oriented to all types of projects. The list is non-exclusive and will not be used by SCAG in any way in reviewing regionally significant projects or project EIRs as part of SCAG's intergovernmental review (IGR) process. Nor are the example measures intended to serve as any kind of checklist to be used on a project-specific basis. Since every project and project setting is different, project specific analysis is needed to identify applicable and feasible mitigation. The following measures may be too generic to be applied on a project-by-project basis and therefore they are presented as examples of measures rather than templates to be followed.

Some of the example mitigation measures include legal requirements that may overlap with federal, state, and/or local regulation. Such legal requirements that incorporate or reference existing regulations are mandatory and any mitigation imposed as a result of a project-specific CEQA process cannot supersede these existing regulations. Nevertheless, SCAG has included these regulations for informational purposes only and to help the reader understand the existing regulatory framework that would assist in mitigating potential environmental impacts.

In addition, the inclusion of these measures that may overlap with existing regulation is not intended to supplant current law. While potential impacts are normally assessed assuming implementation of applicable legal requirements, here, many of the legal requirements are flexible and may require further interpretation or consultation with resource agencies. As such, the resulting reduction in impacts may be difficult to quantify. Thus, in the interest of providing information to the public, SCAG has included these measures containing legal requirements among the example measures.

As part of the CEQA process for each planning, development or transportation project, the Lead Agency is required to identify significant and potentially significant impacts and then mitigate them to the extent feasible. All mitigation measures below are phrased as "may" to allow for tailoring to project and agency-specific conditions as may be applicable and feasible. Use of the word "may" in measures that include legal requirements, or requirements that are otherwise committed, should not be construed to mean that compliance with legal requirements and existing commitments is optional. Furthermore, the text boxes below set forth additional details for the example measures which may apply should agencies choose to implement those measures.

Changes to the measures as compared to the measures presented in the Draft PEIR are shown with new text underlined and deleted text shown in strike-out font. Measures have been renumbered to be continuous.

AESTHETICS

AV1: Prior to the issuance of permits, project sponsors ~~can and should~~ may ~~require and projects should to the extent feasible,~~ construct noise barriers of materials whose color and texture complements the surrounding landscape and development. Noise barriers ~~should~~ may be graffiti resistant and landscaped with plants that screen the barrier, preferably with either native vegetation or landscaping that complements the dominant landscaping of surrounding areas. Natural landscaping ~~should~~ may be used to minimize contrasts between the project and surrounding areas. Wherever possible, interchanges and transit lines at the grade of the surrounding land ~~should~~ may limit view blockage.

Above measure is clarified.

- AV2:** Project sponsors ~~can and should~~ may use natural landscaping to minimize contrasts between the project and surrounding areas. Wherever possible, structures ~~should~~ may be designed to limit view blockage. Edges of major cut-and-fill slopes ~~should~~ may be contoured to provide a more natural looking finished profile. Project sponsors ~~should~~ may replace and renew landscaping along corridors with road widenings, interchange projects, and related improvements. New corridor landscaping ~~should~~ may be designed to respect existing natural and man-made features and to complement the dominant landscaping of surrounding areas.
- AV3:*** Prior to project approval, project sponsors ~~can and should~~ may implement design guidelines, local policies, and programs aimed at protecting views of scenic corridors and avoiding visual intrusions. Projects ~~should~~ may be designed to minimize contrasts in scale and massing between the project and surrounding natural forms and developments. Avoid, if possible, large cuts and fills when the visual environment (natural or urban) would be substantially disrupted. Site or design of projects ~~should~~ may minimize their intrusion into important viewsheds and use contour grading to better match surrounding terrain.
- AV4:** Project sponsors ~~can and should~~ may construct sound walls of materials whose color and texture complements the surrounding landscape and development and use color, texture, and alternating facades to “break up” large facades and provide visual interest. Where there is room, project sponsors ~~should~~ may landscape the sound walls with plants that screen the sound wall, preferably with either native vegetation or landscaping that complements the dominant landscaping of surrounding areas.
- AV5** Project sponsors ~~can and should~~ may avoid construction of transportation facilities in state and locally designated scenic highways and/or vista points. When avoidance is not possible, project sponsors ~~should~~ may minimize visual quality intrusions to the maximum extent feasible.
- AV6:*** For projects in designated or eligible Scenic Highway corridors, prior to project approval, project sponsors ~~can and should~~ may complete design studies and develop site-specific mitigation measures to minimize impacts on the quality of the views or visual experience that originally qualified the highway for scenic designation.
- AV7:** If projects are constructed in state- and locally-designated scenic highways and/or vista points, design, construction, and operation of the transportation facility ~~can and should~~ may be consistent with applicable guidelines and regulations for the preservation of scenic resources along the designated scenic highway.
- AV8:** Project sponsors ~~can and should~~ may design projects to minimize contrasts in scale and massing between the project and surrounding natural forms and development. Project sponsors ~~should~~ may design projects to minimize their intrusion into important viewsheds and use contour grading to better match surrounding terrain. To the maximum extent feasible, landscaping along highway corridors ~~should~~ may be designed to add significant natural elements and visual interest to soften the hard-edged, linear travel experience that would otherwise occur.
- AV9:** Project sponsors ~~can and should~~ may develop design guidelines projects that make elements of proposed buildings/facilities visually compatible with surrounding areas. Visual design guidelines ~~should~~ may, at a minimum, include setback buffers, landscaping, color, texture, signage, and lighting criteria. The following methods ~~should~~ may be employed whenever possible:
- Transportation systems ~~should~~ may be developed to be compatible with the surrounding environment (i.e., colors and materials of construction material).
 - Vegetation used as screening and landscaping ~~should~~ may blend in and complement the natural landscape.
 - Trees bordering highways ~~should~~ may remain or be replaced so that clear-cutting is not evident.
 - Grading ~~should~~ may blend with the adjacent landforms and topography.
- AV10:** In visually sensitive areas and prior to project approval, local land use agencies ~~can and should~~ may apply development standards and guidelines to maintain compatibility with surrounding natural areas, including site coverage, building height and massing, building materials and color, landscaping, site grading, etc
- AV11:*** Project sponsors ~~can and should~~ may ensure that sites ~~should~~ may be kept in a blight/nuisance-free condition. Any existing blight or nuisance ~~should~~ may be abated within 60-90 days of approval, unless an earlier date is specified elsewhere.

AV12:* Project sponsors ~~can and should~~ may ensure that proposed lighting fixtures are adequately shielded to a point below the light bulb and reflector and that prevent unnecessary glare onto adjacent properties. Plans ~~should~~ may be submitted to the Lead Agency (or other government agency as appropriate) for review and approval. All lighting ~~should~~ may be architecturally integrated into the site.

AIR QUALITY

AQ1:* Transportation Control Measures (TCMs) ~~shall be implemented as appropriate by SCAG and can and should~~ may be implemented by local agencies and project sponsors as appropriate. TCMs included in the Plan are identified in the Transportation Conformity Appendix to the 2012-2035 RTP/SCS (starting on page 26). CAA Section 108(f)(1)(A) lists ~~the following~~ sixteen measures as illustrative of TCMs:

AQ2:* Local air districts, local jurisdictions and project sponsors ~~can and should~~ may implement measures adopted by ARB designed to attain federal air quality standards for PM2.5 and 8-hour ozone. ARB’s strategy includes the following elements:

- Set technology forcing new engine standards;
- Reduce emissions from the in-use fleet;
- Require clean fuels, and reduce petroleum dependency;
- Work with USEPA to reduce emissions from federal and state sources; and
- Pursue long-term advanced technology measures.
- Proposed new transportation-related SIP measures include:

On-road and off-road Sources

- ✓ Improvements and Enhancements to California’s Smog Check Program
 - ✓ Expanded Passenger Vehicle Retirement
 - ✓ Modifications to Reformulated Gasoline Program
 - ✓ Cleaner In-Use Heavy-Duty Trucks
 - ✓ Ship Auxiliary Engine Cold Ironing and Other Clean Technology
 - ✓ Cleaner Ship Main Engines and Fuel
 - ✓ Port Truck Modernization
 - ~~✓ Accelerated Introduction of Cleaner Line Haul Locomotives~~
 - ✓ Clean Up Existing Commercial Harbor Craft
- Off-road Sources
- ✓ Cleaner Construction and Other Equipment
 - ✓ Cleaner In-Use Off-Road Equipment
 - ✓ Agricultural Equipment Fleet Modernization
 - ✓ New Emission Standards for Recreational Boats
 - ✓ Off-Road Recreational Vehicle Expanded Emission Standards

Above measure revised to provide further clarification of vehicle classifications and ensure consistency with 2012 RTP Goods Movement Strategies.

AQ3:* Project sponsors ~~can and should~~ may ensure that water or “toxic free” dust suppressants are applied to exposed earth surfaces to control emissions as necessary to control dust and comply with applicable regulations.

AQ4:* Project sponsors ~~can and should~~ may ensure that all excavating and grading activities ~~should~~ may cease during second stage smog alerts and periods of high winds.

AQ5:* Project sponsors ~~can and should~~ may ensure that all trucks hauling dirt, sand, soil, or other loose materials off-site ~~should~~ may be covered or wetted or ~~should~~ may maintain at least two feet of freeboard (i.e., minimum vertical distance between the top of the load and the top of the trailer).

AQ6:* Project sponsors ~~can and should~~ may ensure that all construction roads that have high traffic volumes, ~~should~~ may be surfaced with base material or decomposed granite, or ~~should~~ may be paved or otherwise be stabilized.

AQ7:* Project sponsors ~~can and should~~ may ensure that public streets ~~should~~ may be cleaned, swept or scraped at frequent intervals or at least three times a week if visible soil material has been carried onto adjacent public roads.

AQ8:* Project sponsors ~~can and should~~ may ensure that construction equipment ~~should~~ be visually inspected prior to leaving the site and loose dirt ~~should~~ be washed off with wheel washers as necessary.

AQ9:* Project sponsors ~~can and should~~ may ensure that water, hydroseed, or non-toxic soil stabilizers are applied to inactive construction areas as needed to reduce off-site transport of fugitive dust.

AQ10:* Project sponsors ~~can and should~~ may ensure that traffic speeds on all unpaved surfaces ~~should~~ may not exceed 25 mph.

AQ11:* ~~Project sponsors can and should ensure that low sulfur or other alternative fuels or diesel powered vehicles with Tier 3 or better engines or retrofitted/repowered to meet equivalent emissions standards as Tier 3 engines should be used in construction equipment where feasible. Project sponsors may ensure that all construction diesel engines with a rating of 50 horsepower or higher meet, at a minimum, the USEPA Tier 3 standards for non-road engines. From January 1, 2015 onward, project sponsors may ensure that all construction equipment meets or exceeds equivalent emissions performance to that of USEPA Tier 4 standards for non-road engines. In the event that Tier 3 or 4 engines are not available for any off-road equipment larger than 100 hp, that equipment be equipped with a Tier 2 engine, or an engine that is equipped with retrofit controls to reduce exhaust emissions of nitrogen oxides and diesel particulate matter to no more than Tier 2 levels unless certified by engine manufacturers or the on-site air quality construction mitigation manager that the use of such devices is not practical for specific engine types. For purposes of this condition, the use of such devices is "not practical" for the following, as well as other reasons.~~

1. There is no available retrofit control device that has been verified by either the ARB or USEPA to control the engine in question to Tier 2 equivalent emission levels and the highest level of available control using retrofit or Tier 1 engines is being used for the engine in question; or
2. The construction equipment is intended to be on site for five days or less.
3. Relief may be granted from this requirement if a good faith effort has been made to comply with this requirement and that compliance is not practical.

The use of a retrofit control device may be terminated immediately, provided that a replacement for the equipment item in question meeting the required controls occurs within ten days of termination of the use, if the equipment would be needed to continue working at this site for more than 15 days after the use of the retrofit control device is terminated, if one of the following conditions exists:

1. The use of the retrofit control device is excessively reducing the normal availability of the construction equipment due to increased down time for maintenance, and/or reduced power output due to an excessive increase in back pressure.
2. The retrofit control device is causing or is reasonably expected to cause engine damage.
3. The retrofit control device is causing or is reasonably expected to cause a substantial risk to workers or the public.
4. Any other seriously detrimental cause which has the approval of the project manager prior to implementation of the termination.

Above measure revised in response to comments from the US Environmental protection Agency (EPA).

AQ12:* Project sponsors ~~can and should~~ may ensure that deliveries related to construction activities that affect traffic flow ~~should~~ may be scheduled during off-peak hours (e.g., 10:00 a.m. and 3:00 p.m.) and coordinated to achieve consolidated truck trips, where feasible. When the movement of construction materials and/or equipment impacts traffic flow, temporary traffic control ~~should~~ may be provided to improve traffic flow (e.g., flag person).

Above measure edited to reflect that delivery hours should consider operational feasibility.

AQ13:* Project sponsors ~~can and should~~ may ensure that to the extent possible, that construction activity ~~should~~ utilize electricity from power poles rather than temporary diesel power generators and/or gasoline power generators.

AQ14:* Local jurisdictions or agencies ~~can and should~~ may, as practical and feasible, revegetate exposed earth surfaces following construction. Application of xeriscape principles, including such techniques and materials as native or low water use plants and low precipitation sprinklers heads, bubblers, drip irrigation systems and timing devices, ~~should~~ may also be considered.

AQ15: Local jurisdictions ~~can and should~~ may set, and enforce, specific limits on idling time for commercial vehicles, including delivery and construction vehicles, which prohibit vehicle and engine idling in excess of five minutes, where conditions allow.

Above measure revised in response to a comments from the EPA and revised to reflect that idling policies should consider operational feasibility.

AQ16:* Project sponsors ~~can and should~~ may ensure that sandbags or other erosion control measures are installed to prevent silt runoff to public roadways as needed.

AQ17:* Project sponsors ~~can and should~~ may designate a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust offsite. Their duties ~~should~~ may include holidays and weekend periods when work may not be in progress. The name and telephone number of such persons ~~should~~ may be provided to the local air district prior to the start of construction as well as posted on-site over the duration of construction.

AQ18:* Project sponsors ~~can and should~~ may ensure that appropriate wind-breaks are installed at the construction site to minimize windblown dust.

AQ19: In order to ~~comply with~~ address the California Air Resources Board Air Quality and Land Use Handbook (June 2005) and achieve an acceptable interior air quality level for sensitive receptors, project sponsors ~~can and should~~ may identify appropriate measures, to be incorporated into project building design for residential, school and other sensitive uses located within 500 feet of freeways, heavily travelled arterials, railways and other sources of Diesel Particulate Matter and other known carcinogens. The appropriate measures ~~should~~ may include one or more of the following methods as may be appropriate:

- a. The project sponsor ~~should~~ may retain a qualified air quality consultant to prepare a health risk assessment (HRA) in accordance with the California Air Resources Board and the Office of Environmental Health and Hazard Assessment requirements to determine the exposure of project residents/occupants/users to stationary and mobile (e.g., cars and trucks) sources of air pollution ~~air quality polluters~~ prior to issuance of a demolition, grading, or building permit. The HRA ~~should~~ may be submitted to the Lead Agency for review and approval. The sponsor ~~should~~ may implement the approved HRA recommendations, if any. If the HRA concludes that the air quality risks from nearby sources are at or below acceptable levels, then additional measures are not required.
- b. The project sponsor ~~should~~ may implement the following features that have been found to reduce the air quality risk to sensitive receptors and ~~should~~ may be included in the project construction plans. These ~~should~~ may be submitted to the appropriate agency for review and approval prior to the issuance of a demolition, grading, or building permit and ongoing.
 - i. Do not locate sensitive receptors near distribution center's entry and exit points.
 - ii. Do not locate sensitive receptors in the same building as a perchloroethylene dry cleaning facility.
 - iii. Maintain a 50-foot buffer from a typical gas dispensing facility (under 3.6 million gallons of gas per year).
 - iv. Install, operate and maintain in good working order a central heating and ventilation (HV) system or other air take system in the building, or in each individual residential unit, that meets the efficiency standard of the MERV 13. The HV system ~~should~~ may include the following features: Installation of a high efficiency filter and/or carbon filter-to-filter particulates and other chemical matter from entering the building. Either HEPA filters or ASHRAE 85% supply filters ~~should~~ may be used.
 - v. Retain a qualified HV consultant or HERS rater during the design phase of the project to locate the HV system based on exposure modeling from the mobile and/or stationary pollutant sources.
 - vi. Maintain positive pressure within the building.
 - vii. Achieve a performance standard of at least one air exchange per hour of fresh outside filtered air.
 - viii. Achieve a performance standard of at least 4 air exchanges per hour of recirculation
 - ix. Achieve a performance standard of .25 air exchanges per hour of unfiltered infiltration if the building is not positively pressurized.
- c. Project sponsor ~~should~~ may maintain, repair and/or replace HV system or prepare an Operation and Maintenance Manual for the HV system and the filter. The manual ~~should~~ may include the operating

instructions and maintenance and replacement schedule. This manual ~~should~~ may be included in the CC&R's for residential projects and distributed to the building maintenance staff. In addition, the sponsor ~~should~~ may prepare a separate Homeowners Manual. The manual ~~should~~ may contain the operating instructions and maintenance and replacement schedule for the HV system and the filters. It ~~should~~ may also include a disclosure to the buyers of the air quality analysis findings.

MM-AQ20: To the maximum extent practicable the Lead Agency ~~can and should~~ may ensure that private (individual and common) exterior open space, including playgrounds, patios, and decks, ~~should~~ may either be shielded from ~~stationary~~ sources of air pollution by buildings or otherwise buffered to further reduce air pollution for project occupants.

AQ21: As applicable and feasible, local jurisdictions may investigate (using for example procedures and guidelines for PM hotspot analysis consistent with USEPA (2010) PM guidance) the relationship between 1) any increases in PM10 and PM2.5 within 500 feet of freeways in their jurisdiction, and 2) existing sensitive receptors in that area that do not have adequate air filtration to reduce such impacts to a less than significant level. To the extent that existing sensitive receptors are identified that do not have adequate air filtration, local jurisdictions may establish a program by which project sponsors can mitigate significant increases in PM10 and PM2.5 (e.g., by providing a retrofit program for older higher emitting vehicles, anti-idling requirements or policies, controlling fugitive dust, routing traffic away from populated zones, replacing older buses with cleaner buses, and paying in to a fund established to retrofit sensitive receptors with HEPA filters when sensitive receptors are located within 500 feet of freeways and high-traffic volume roadways that generate substantial diesel particulate emissions).

AQ22: As applicable and feasible, project sponsors may plant appropriate vegetation to reduce PM10/PM2.5 when constructing a sensitive receptor within 500 feet of freeways and high-traffic volume roadways generating substantial diesel particulate emissions.

AQ23: As applicable and feasible, for major transportation projects (especially those that generate substantial diesel particulate emissions) in the region, if health risks are shown to increase significantly at sensitive receptors within 500 feet of a transportation facility, project sponsors are required under CEQA to consider applicable mitigation. Examples include planting appropriate vegetation and retrofitting existing sensitive uses with air filtration to reduce potential health risk impacts to a less than significant level.

Above measures added to provide additional examples of mitigation to address health risk within 500 feet of transportation facilities with potential health impacts.

BIOLOGICAL RESOURCES AND OPEN SPACE

Ecosystems in the SCAG Region

BIO/OS1:* Project sponsors ~~can and should~~ may assess displacement of habitat due to removal of native vegetation during route planning/project location planning. Routes/project sites ~~can and should~~ may be planned in coordination with state and local resources agencies and ~~should~~ may consider inventories of natural resources, such as CDFG and CNDDDB. Routes ~~can and should~~ may be planned in order to avoid and/or minimize removal of native vegetation, by comparing proposed infrastructure with state and local conservation plans and by creating maps of resource habitat overlaid with the transportation network. Projects located in or adjacent to habitat areas ~~can and should~~ may incorporate buffers to minimize lighting, noise, and other project impacts that can severely disrupt wildlife. Vegetation buffers ~~can and should~~ may be appropriate to the adjacent vegetation association and protect the genetic integrity of the adjacent habitat. If avoidance is not possible, agencies/project sponsors ~~can and should~~ may consult with the appropriate resource agencies to develop mitigation activities.

BIO/OS2: When avoidance of native vegetation removal is not possible, project sponsors ~~can and should~~ may replant disturbed areas with commensurate native vegetation of high habitat value adjacent to the project that will result in a net environmental benefit (i.e., as opposed to ornamental vegetation with relatively less habitat value). When possible, habitat rehabilitation ~~can and should~~ may use recycled material from rehabilitated infrastructure.

Above measure edited in response to a comment from the California Department of Fish and Game (CDFG).

BIO/OS3:* Project sponsors ~~can and should~~ may include on-site habitat enhancement as a first priority and offsite habitat enhancement or restoration to compensate for unavoidable habitat losses from each project site as appropriate and necessary.

Special Status Species and Natural Communities

BIO/OS4:* Pre-construction special status species surveys ~~can and should~~ may be conducted by a qualified biologist to verify presence or absence of species at risk. For rare plants, surveys may be conducted when: 1) natural vegetation occurs on the site; 2) it is unknown if rare, threatened, or endangered plants or habitats occur on the site; and 3) the project has the potential for direct or indirect effects on vegetation. Species surveys ~~can and should~~ may occur during the portion of the species' life cycle where the species is most likely to be identified within the appropriate habitat. In all cases, impacts on special status species and/or their habitat ~~can and should~~ may be avoided during construction to the maximum extent feasible.

Above measure edited in response to a comment from CDFG.

BIO/OS5: For projects located in sensitive habitat areas, project sponsors ~~can and should~~ may develop and implement a Worker Awareness Program (environmental education) to inform project workers of their responsibilities in regards to avoiding and minimizing impacts on sensitive biological resources.

BIO/OS6: Project sponsors ~~can and should~~ may appoint an Environmental Inspector to serve as a contact for issues that may arise concerning implementation of mitigation measures, and to document and report on adherence to these measures.

BIO/OS7:* Project sponsors ~~can and should~~ may schedule construction activities to avoid sensitive times for biological resources (e.g. steelhead spawning periods during the winter and spring) and to avoid the rainy season when erosion and sediment transport is increased.

BIO/OS8:* Project sponsors ~~can and should~~ may schedule projects to avoid construction during critical life stages or sensitive seasons (e.g. the nesting season; see Mitigation Measures **BIO/OS25**, and **BIO/OS15** through **BIO/OS35**).

BIO/OS9: Project sponsors ~~can and should~~ may precede construction, as appropriate, by pre-construction monitoring to ensure no sensitive species' habitat would be unnecessarily destroyed (also see Mitigation Measures **BIO/OS4** through **BIO/OS13**). All discovered sensitive species habitat ~~can and should~~ may be avoided where feasible, or disturbance ~~should~~ may be minimized.

BIO/OS10:* Project sponsors ~~can and should~~ may fence and/or mark sensitive habitat to prevent unnecessary machinery or foot traffic during construction activities.

BIO/OS11:* Project sponsors ~~can and should~~ may ensure that sensitive habitats (native vegetative communities identified as rare and/or sensitive by the CDFG) and special-status plant species (including vernal pools) impacted by projects ~~can and should~~ may be restored and augmented. Project sponsors may consult with CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. The Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

If impacts are temporary, mitigation may be at a 1:1 ratio (compensation acres to impacted acres). Permanent impacts ~~can and should~~ may be compensated for by creating or restoring habitats at a **3:1** ratio as close as possible to the site of the impact. The CDFG may recommend mitigation ratios that vary on a project-by-project basis. ~~and may exceed those recommended in Mitigation Measure MM-BIO/OS17.~~

This measure is revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS12: When work is conducted in or adjacent to identified sensitive habitat areas, and/or areas of intact native vegetation, construction protocols ~~can and should~~ may require the salvage of perennial plants and the salvage

and stockpile of topsoil (the surface material from 6 to 12 inches deep) and ~~can and should~~ may be used in restoring native vegetation to all areas of temporary disturbance within the project area.

BIO/OS13: When removal and/or damage to sensitive species habitat are unavoidable during construction, project sponsors ~~can and should~~ may ensure that any disturbed natural areas are replanted with appropriate native vegetation following the completion of construction activities. In the case of permanent losses to sensitive species habitat, mitigation ~~can and should~~ may follow the offsite habitat compensation guidance.

BIO/OS14:* A qualified wetland scientist ~~can and should~~ may review construction drawings as part of each project-specific environmental analysis to determine whether wetlands will be impacted, and if necessary, perform a formal wetland delineation. Appropriate state and federal permits ~~can and should~~ may be obtained, ~~but~~ and each project EIR ~~will~~ may contain language clearly stating the provisions of such permits, including avoidance measures, restoration procedures, and in the case of permanent impacts compensatory creation or enhancement measures to ensure a no net loss of wetland extent or function and values.

BIO/OS15: Suitable habitat for listed vernal pool crustaceans ~~can and should~~ may be avoided to the extent feasible. If infeasible, impacts ~~should~~ may be mitigated in accordance with the Programmatic Biological Opinion (PBO) for vernal pool invertebrates, issued by the USFWS Sacramento Field Office in 1995. Surveys ~~should~~ may be conducted, with USFWS approval, in accordance with the 1996 *Interim Survey Guidelines to Permittees for Recovery Permits under Section 10(a)(1)(A) of the Endangered Species Act for the Listed Vernal Pool Branchiopods*, to establish whether or not listed invertebrates are present.

BIO/OS16: Project sponsors ~~can and should~~ may avoid removal of wetland or riparian vegetation. Specific vegetation that is not to be removed ~~should~~ may be so marked during construction. Wetland and riparian vegetation removal ~~should~~ may be minimized as much as possible.

BIO/OS17:* Project sponsors ~~can and should~~ may replace any disturbed wetland, riparian or aquatic habitat, either on-site or at a suitable off-site location at ratios to ensure no net loss. See Mitigation Measures **BIO/OS1** through **BIO/OS14**.

BIO/OS18:* Project sponsors ~~can and should~~ may ensure that when individual projects include unavoidable losses of riparian or aquatic habitat, adjacent or nearby riparian or aquatic habitat ~~should~~ be enhanced (e.g., through removal of non-native invasive wetland species and replacement with more ecologically valuable native species).

BIO/OS19:* For projects near water resources project sponsors ~~can and should~~ may implement Best Management Practices (BMPs) at construction sites to minimize erosion and sediment transport from the area. BMPs include encouraging growth of vegetation in disturbed areas, using straw bales or other silt-catching devices, and using settling basins to minimize soil transport. (See also Water Resources Mitigation Measures.)

~~Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS.~~

BIO/OS20:* If specific project area trees are designated as “Landmark Trees” or “Heritage Trees”, then approval for removals ~~can and should~~ may be obtained through the appropriate entity, and appropriate mitigation measures ~~can and should~~ may be developed at that time, to ensure that the trees are replaced. Mitigation trees ~~can and should~~ may be locally-collected native species.

BIO/OS21:* Project sponsors may prioritize retention of trees on-site ~~can and should~~ be prioritized consistent with local regulations. ~~For example, the Lead Agency may require additional adequate protection can and should be provided during the construction period for any trees that are to remain standing, including the following, plus any recommendations of an arborist~~ actions described below.

ACTIONS AS MAY BE RECOMMENDED BY AN ARBORIST.

- a. Before the start of any clearing, excavation, construction or other work on the site, every protected tree deemed to be potentially endangered by said site work, ~~can and should~~ may be securely fenced off. Such fences ~~can and should~~ may remain in place for duration of all such work. All trees to be removed ~~can and should~~ may be clearly marked. A scheme ~~can and should~~ may be established for the removal and disposal of logs, brush, earth and other debris that will avoid injury to any protected tree.

- b. Where proposed development or other site work could encroach upon the protected perimeter of any protected tree, special measures can habitat for listed vernal pool crustaceans ~~can and should~~ may be avoided to the extent feasible. If infeasible, impacts ~~should~~ may be mitigated in accordance with the Programmatic Biological Opinion (PBO) for vernal pool invertebrates, issued by the USFWS Sacramento Field Office in 1995. Surveys ~~should~~ may be conducted, with USFWS approval, in accordance with the 1996 *Interim* and ~~should~~ may be incorporated to allow the roots to breathe and obtain water and nutrients. Any excavation, cutting, filing, or compaction of the existing ground surface within the protected perimeter ~~should~~ may be minimized. No change in existing ground level ~~should~~ may occur from the base of any protected tree at any time. No burning or use of equipment with an open flame ~~should~~ may occur near or within the protected perimeter of any protected tree.
- c. No storage or dumping of oil, gas, chemicals, or other substances that may be harmful to trees ~~should~~ may occur from the base of any protected trees, or any other location on the site from which such substances may enter the protected perimeter. No heavy construction equipment or construction materials ~~should~~ may be operated or stored within a distance from the base of any protected trees. Wires, ropes, or other devices ~~should~~ may not be attached to any protected tree, except as needed for support of the tree. No sign, other than a tag showing the botanical classification, ~~should~~ may be attached to any protected tree.
- d. Periodically during construction, the leaves of protected trees ~~can and should~~ may be thoroughly sprayed with water to prevent buildup of dust and other pollution that would inhibit leaf transpiration.
- e. If any damage to a protected tree ~~should~~ occurs during or as a result of work on the site, the project sponsor ~~can and should~~ may immediately notify the appropriate local agency of such damage. If, such tree cannot be preserved in a healthy state, the local agency ~~can and should~~ may require replacement of any tree removed with another tree or trees on the same site deemed adequate by the local agency to compensate for the loss of the tree that is removed.
- f. All debris created as a result of any tree removal work ~~can and should~~ may be removed by the project sponsor from the property within two weeks of debris creation, and such debris ~~can and should~~ may be properly disposed of by the project sponsor in accordance with all applicable laws, ordinances, and regulations.

Above measure is revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS22:* Project sponsors with projects within the range and within suitable habitat for species listed as threatened or endangered under California Endangered Species Act (such as the Mohave ground squirrel) or the Federal Endangered Species Act (such as the Arroyo toad) ~~can and should~~ may conduct surveys, with CDFG and/or USFWS approval, in accordance with established and approved survey methods appropriate for the species of interest, such as the 1999 USFWS *Survey Protocol for the Arroyo Toad*, to establish whether or not the species is present. If species is determined present ~~then the following applies~~, project sponsors may consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. Project sponsors should obtain an Incidental Take Permit under Section 2081 of the Fish and Game Code before proceeding with authorization of any project subject to CESA. Additional authorization may be required by the USFWS for take of federal-listed species or their occupied habitat. The Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- A pre-construction survey ~~shall should~~ may be conducted by a qualified biologist at each site to identify suitable habitat for the species of interest and to determine what avoidance measures, including relocation, fencing installation, and avoidance of breeding season ~~will~~ may be required.
- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).
- Project sponsors must obtain an Incidental Take Permit under Section 2081 of the Fish and Game Code before proceeding with authorization of any project subject to CESA. Additional authorization may be required by the USFWS for take of federal-listed species or their occupied habitat.

Above measure is revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS23:* Project sponsors with projects within the range and within suitable habitat for the blunt-nosed leopard lizard ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 2004 CDFG *Approved Survey Methodology for the Blunt-Nosed Leopard Lizard*, to establish whether or not the species is present. If species is determined present ~~then the following applies~~ project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or

minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG). No direct taking of the blunt-nosed leopard lizard ~~should~~ may occur as this is a CDFG fully protected species with no regulatory mechanism to authorize direct taking (killing) of individuals.

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS24:* Project sponsors with projects within the range and within suitable habitat for the California red-legged frog ~~can and should~~ may implement the measures detailed in the Programmatic Biological Opinion (PBO) for construction impacts to the red-legged frog that was issued by the USFWS (Federal Register 1999) to the USACE. The measures listed below are taken largely from the PBO and, if applied to the western pond turtle as well as the frog, would be adequate as standard mitigation for both species. A similar level of effort for survey protocol can also be applied to the Mountain yellow-legged frog, with adjustments to its climate, habitat, and breeding requirements.

- The name and credentials of a biologist qualified to act as a construction monitor ~~will~~ may be submitted to USFWS for approval at least 15 days prior to commencement of work;
- The USFWS-approved biologist ~~can and should~~ may survey the site two weeks prior to the onset of work activities and immediately prior to commencing work. If red-legged frog adults, tadpoles, or eggs are found, the approved biologist ~~can and should~~ may contact USFWS to determine whether relocating any life stages is appropriate;
- The USFWS-approved biologist ~~can and should~~ may ensure that the introduction or spread of invasive exotic plant species is avoided to the maximum extent possible, by removing weeds from areas of exposed bare soil within the construction zone where construction occurs in riparian vegetation.
- The number and size of access routes, staging areas, and total area of activity ~~should~~ may be limited to the minimum necessary to achieve the project goal;
- If work sites require dewatering, the intakes ~~can and should~~ may be screened with a maximum mesh sizes of 5 millimeters;
- The USFWS-approved biologist ~~can and should~~ may permanently remove and destroy from within the project area any individuals of exotic species, such as bullfrogs, crayfish, and centrarchid fishes, to the maximum extent practicable.

~~**MM-BIO/OS25:*** Project sponsors with projects within the range and within suitable habitat for the California tiger salamander can and should conduct surveys, with USFWS approval, in accordance with the 2003 USFWS Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander, to establish whether or not the species is present. In addition to measures described for the California red-legged frog, which would also serve to protect the California tiger salamander, the following measures can and should be implemented to further minimize adverse effects to the California tiger salamander:~~

~~A pre construction survey can and should be conducted at each site to identify suitable pond and upland burrow aestivation areas. As feasible within the context of the work area, aestivation areas should be temporarily fenced and avoided:~~

- ~~• At locations where upland aestivation habitat is identified and cannot be avoided, aestivation burrows can and should be excavated by hand prior to construction and individual animals moved to natural burrows or artificial burrows constructed of PVC pipe within 0.25 miles of the construction site as approved by the USFWS.~~
- ~~• To ensure compliance with these measures and minimize California tiger salamander take, a qualified biological monitor can and should be present during all new site disturbance construction activities (vegetation removal, clearing, grubbing, grading) at locations with suitable upland aestivation habitat.~~
- ~~• Impacts on breeding ponds can and should be avoided until the ponds have dried.~~
- ~~• Upon approval by the USFWS, preconstruction surveys to salvage and relocate individual California tiger salamanders can and should include installation of drift fences and pitfall traps within construction sites to identify and relocate animals. Following removal of individuals, construction areas should be fenced with temporary exclusionary silt fencing.~~

- ~~• Temporary impacts on upland aestivation habitat can and should be restored to grassland habitat.~~
- ~~• Mitigation for occupied habitat permanently impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG.~~

Above measure deleted in response to a comment from CDFG.

BIO/OS25:* Project sponsors with projects within the range and within suitable habitat for the Coachella Valley fringe-toed lizard ~~can and should~~ may conduct surveys, with USFWS/CDFG approval, in accordance with the CDFG *Protocol for Determining Coachella Valley Fringe-Toed Lizard (CVFTL) Presence*, to establish whether or not the species is present. ~~The measures listed below are taken largely from the CDFG protocol recommendations and would be adequate as standard mitigation for this species. If the species is determined present then the following applies:~~ If species is determined present, project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS26:* Project sponsors with projects within the range and within suitable habitat for the desert tortoise ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 1992 USFWS *Field Survey Protocol For Any Federal Action That may Occur Within The Range Of The Desert Tortoise*, to establish whether or not the species is present. ~~If the species is determined present, then the following applies:~~ project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

Upon approval by the USFWS, preconstruction surveys of project impact areas ~~can and should~~ may be required to salvage and relocate individual desert tortoise out of harms way. Following removal of individuals, construction areas ~~should~~ may be fenced with temporary exclusionary silt fencing.

Mitigation for occupied habitat impacted is likely to be compensatory acquisition of mitigation credits or off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS27:* California species of special concern (CSC), such as the two-striped garter snake and several bat species are considered special-status species that meet the definition of rare, threatened or endangered species for the purposes of CEQA. Projects within the range and within suitable habitat for California species of special concern ~~can and should~~ may conduct surveys in accordance with the best professional judgment of a qualified biologist. ~~The following measures can and should be implemented to further minimize adverse effects to CSC species:~~ Project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- Preconstruction surveys of project impact areas ~~can and should~~ may be required to salvage and relocate individual two-striped garter snakes out of harm's way. Following removal of individuals, construction areas ~~should~~ may be fenced with temporary exclusionary silt fencing.
- Similarly appropriate survey, salvage, and mitigation measures ~~can and should~~ may be taken with regard to other

CSC classified species. If avoidance of impacts to species is not feasible, on site and/or off site protection of appropriate mitigation lands in perpetuity ~~should~~may be secured for these species.

- Mitigation for occupied habitat is likely to be compensatory acquisition of mitigation credits or off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG. The two-striped garter snake is not formally listed but considered a special-status species worthy of measures to avoid and minimize impacts to the extent feasible.

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS28:* Project sponsors ~~can and should~~ may ensure ~~that to~~ avoiding disrupting nesting Swainson's hawks, by conducting construction activities at known nesting locations ~~can and should occur~~ between September and March, outside the nesting season (nesting typically occurs from March 1 through September 15). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey. Pre-construction surveys may commence in January utilizing approved protocol methods in consultation with CDFG and before the start of construction for any given milepost. no more than two weeks before the start of construction for any given milepost and report whether or not there are nesting Swainson's hawks within 500 feet of any project (assuming available authorized access). If there are nesting Swainson's hawks present within the 500 foot buffer areas, construction will be delayed until the CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active Swainson's hawk nest until the adult and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist. If pre-construction surveys locate a nest site within one-half mile of any project (assuming available authorized access) a Swainson's hawk Monitoring and Mitigation Plan may be prepared in consultation with CDFG. Plans may be prepared by a qualified biologist approved by the CDFG. Plans may include detailed measures to avoid and minimize impacts to Swainson's hawks in and near the construction areas. The Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- If a nest site is found, design the project to allow sufficient foraging and fledging area to maintain the nest site.
- During the nesting season, ensure no new disturbances, habitat conversions, or other project-related activities that may cause nest abandonment or forced fledging occur within one-half mile of an active nest between March 1 and September 15. Buffer zones may be adjusted in consultation with CDFG and the Lead Agency.
- Do not remove Swainson's hawk nest trees unless avoidance measures are determined to be infeasible. Removal of such trees may occur only during the timeframe of October 1 and the last day in February.

Above measure edited in response to a comment from CDFG.

BIO/OS29:* Project sponsors ~~can and should~~ may ensure that no more than two weeks before construction in any given milepost, a survey for burrows and burrowing owls ~~can and should~~ may be conducted by a qualified biologist within 500 feet of the project (assuming available authorized access). The Lead Agency may require subsequent mitigation to be performed in conformance with applicable guidelines as described below.

ADDITIONAL ACTIVITY

The survey ~~will~~ may conform to the protocol described by the California Burrowing Owl Consortium's 1993 Burrowing Owl Protocol and Mitigation Guideline which includes up to four surveys on different dates if there are suitable burrows present as well as the CDFG's 1995 Staff Report on Burrowing Owl Mitigation. Both mitigation guidelines also recommend habitat land acquisition and protection in perpetuity for project-related loss of occupied wintering and breeding habitat for burrowing owls. If occupied burrowing owl dens are found within the survey area, a determination ~~can and should~~ may be made by a qualified biologist in consultation with CDFG whether or not project work will impact the occupied burrows or disrupt reproductive behavior.

- If it is determined that construction will not impact occupied burrows or disrupt breeding behavior, construction ~~will~~ may proceed without any restriction or mitigation measures.
- If it is determined that construction will impact occupied burrows during August through February, the subject owls ~~will~~ may be passively relocated from the occupied burrow(s) using one-way doors. There ~~should~~ may be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow before one-way doors are installed. Artificial burrows ~~should~~ may be in place at least one-week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.

- If it is determined that construction will physically impact occupied burrows or disrupt reproductive behavior during the nesting season (March through July) then avoidance is the only mitigation available. Construction ~~should~~ may be delayed within 300 feet of occupied burrows until it is determined that the subject owls are not nesting or until a qualified biologist determines that juvenile owls are self-sufficient or are no longer reliant on the natal burrow as their primary source of shelter and survival.
- Mitigation for occupied habitat is likely to be compensatory acquisition of mitigation credits or off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG.

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS30:* Project sponsors ~~can and should~~ may ensure that when working within 100 feet of salt or brackish marshland presence for the California black rail, California clapper rail, and Yuma clapper rail ~~should~~ may be assumed for either species during the period February 1- August 31 and construction ~~should~~ may be scheduled to begin no earlier than September 1 and end no later than January 31 to avoid potential impact on reproduction. The Department of Fish and Game and United States Fish and Wildlife Service ~~can and should~~ may be consulted when projects identify occupied habitat or habitat capable of supporting California clapper rail, light-footed clapper rail, and Yuma clapper rail.

BIO/OS31:* Project sponsors with projects within the range and within suitable habitat for the coastal California gnatcatcher ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 1997 USFWS *Coastal California Gnatcatcher Presence/Absence Survey Guidelines*, to establish whether or not the species is present. If the species is determined to be present, then the following applies project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- To avoid disrupting nesting coastal California gnatcatchers, construction activities at known nesting locations ~~should~~ may occur between September and March outside the nesting season (nesting typically occurs from March 1 through September 1). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey no more than two weeks before the start of construction for any given milepost and report whether or not there are nesting coastal California gnatcatchers within 500 feet of any project (assuming available authorized access). If there are nesting coastal California gnatcatchers present within the 500-foot buffer areas, construction may ~~will~~ be delayed until the USFWS and/or CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active coastal California gnatcatchers nest until the adults and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist.
- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS32:* Project sponsors with projects within the range and within suitable habitat for the least Bell's vireo ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 2001 USFWS *Least Bell's Vireo Survey Guidelines*, to establish whether or not the species is present. If the species is determined to be present, then the following applies project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- To avoid disrupting nesting least Bell's vireo, construction activities at known nesting locations ~~can and should~~ may occur between September and March outside the nesting season (nesting typically occurs from March 1 through September 1). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey no more than two weeks before the start of

construction for any given milepost and report whether or not there are nesting least Bell's vireo within 500 feet of any project (assuming available authorized access). If there are nesting least Bell's vireo present within the 500-foot buffer areas, construction ~~will~~ may be delayed until the CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active least Bell's vireo nest until the adults and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist.

- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS33:* Project sponsors with projects within the range and within suitable habitat for the southwestern willow flycatcher ~~can and should~~ may conduct surveys, with USFWS approval, in accordance with the 2000 USFWS *Southwestern Willow Flycatcher Protocol Survey Guidelines (Revision 2000)*, to establish whether or not the species is present. ~~If the species is determined present then the following applies:~~ Project sponsors should consult with the USFWS and/or CDFG, as applicable, to ensure that significant impacts are avoided, mitigated, and/or minimized to the extent feasible. As part of the consultation, the Lead Agency may require other activity as described below.

ADDITIONAL ACTIVITY

- To avoid disrupting nesting southwestern willow flycatcher, construction activities at known nesting locations ~~can and should~~ may occur between September and March outside the nesting season (nesting typically occurs from March 1 through September 15). Alternatively, if construction activities take place during the nesting season, a qualified biologist ~~can and should~~ may conduct a pre-construction survey no more than two weeks before the start of construction for any given milepost and report whether or not there are nesting southwestern willow flycatcher within 500 feet of any project (assuming available authorized access). If there are nesting southwestern willow flycatchers present within the 500-foot buffer areas, construction ~~will~~ may be delayed until the CDFG has been consulted to determine suitable avoidance measures. A potential avoidance measure may include delaying all construction activity within 500 feet of an active southwestern willow flycatcher nest until the adults and/or young of the year are no longer reliant on the nest site for survival as determined by a qualified biologist.
- Mitigation for occupied habitat impacted is likely to be compensatory off-site acquisition or protection of similar habitats at a ratio of 3:1 (compensation acres to that impacted) or other similar ratio with the approval of the USFWS and/or CDFG).

Above measure revised to reduce level of detail and to more clearly defer to local ordinances and other law as a first option.

BIO/OS34:* Project sponsors ~~can and should~~ may ensure that suitable nesting sites for migratory nongame native bird species protected under the Federal Migratory Bird Treaty Act and/or trees with unoccupied raptor nests (large stick nests or cavities) ~~should~~ may only be removed prior to February 1, or following the nesting season.

A survey to identify active raptor and other migratory nongame bird nests ~~can and should~~ may be conducted by a qualified biologist at least two weeks before the start of construction at project sites from February 1st through August 31st. ~~Active raptor nests can and should be re-located within 500 feet of the project to the extent feasible and assuming available authorized access. Suitable nesting habitat for protected native birds can and should be re-located within 300 feet of the project.~~ Any active non-raptor nests identified within the project area or within 300 feet of the project area may be marked with a 300-foot buffer, and the buffer area may need to be avoided by construction activities until a qualified biologist determines that the chicks have fledged. Active raptor nests within the project area or within 500 feet of the project area may be marked with a 500-foot buffer and the buffer avoided until a qualified biologist determines that the chicks have fledged. If the 300-foot buffer for non-raptor nests or 500-foot buffer for raptor nests cannot be avoided during construction of the project, the project sponsor may retain a qualified biologist to monitor the nests on a daily basis during construction to ensure that the nests do not fail as the result of noise generated by the construction. The biological monitor may be authorized to halt construction if the construction activities cause negative effects, such as the adults abandoning the nest or chicks falling from the nest.

- Beginning thirty days prior to the disturbance of suitable nesting habitat, the project sponsor ~~can and should~~ may arrange for weekly bird surveys conducted by a qualified biologist with experience in

conducting breeding bird surveys to detect protected native birds occurring in the habitat that is to be removed and any other such habitat within 300 feet of the construction work area (within 500 feet for raptors) as access to adjacent areas allows. The last survey ~~can and should~~ may be conducted no more than 3 days prior to the initiation of clearance/construction work.

- If an active raptor nest is found within 500 feet of the project or nesting habitat for a protected native bird is found within 300 feet of the project a determination ~~can and should~~ may be made by a qualified biologist in consultation with CDFG whether or not project construction work will impact the active nest or disrupt reproductive behavior.
- If it is determined that construction will not impact an active nest or disrupt breeding behavior, construction will proceed without any restriction or mitigation measure. If it is determined that construction will impact an active raptor nest or disrupt reproductive behavior then avoidance is the only mitigation available. Construction ~~can and should~~ may be delayed within 300 feet of such a nest (within 500 feet for raptor nests), until August 31 or as determined by CDFG, until the adults and/or young of the year are no longer reliant on the nest site for survival and when there is no evidence of a second attempt at nesting as determined by a qualified biologist. Limits of construction to avoid a nest ~~can and should~~ may be established in the field with flagging and stakes or construction fencing marking the protected area 300 feet (or 500 feet) from the nest. Construction personnel ~~can and should~~ may be instructed on the sensitivity of the area.
- Documentation to record compliance with applicable State and Federal laws pertaining to the protection of native birds ~~can and should~~ may be recorded.

Above measure edited in response to a comment from CDFG.

Natural Lands

BIO/OS35: Project sponsors ~~can and should~~ may conduct site-specific analyses of opportunities to preserve or improve habitat linkages with areas on- and off-site before project construction begins. Habitat linkages/wildlife movement corridors ~~can and should~~ may be analyzed on a broader and cumulative impact analysis scale to avoid adverse impacts from linear projects that have potential for impacts on a broader scale or critical narrow choke points that could reduce function of recognized movement corridors on a larger scale. Before construction, a qualified biologist will may review construction drawings and habitat connectivity mapping provided by the CDFG or CNDDDB will may be used to determine the risk of habitat fragmentation. Mitigation banking to preserve habitat linkages and corridors (opportunities to purchase, maintain, and/or restore off-site habitat) is one opportunity that project sponsor and local jurisdictions may pursue.

Above measure edited in response to a comment from CDFG.

BIO/OS36: Project sponsors ~~can and should~~ may evaluate the potential for overpasses, underpasses, and culverts in cases where a roadway or other transportation project may interrupt the flow of species through their habitat. Wildlife crossings/access ~~can and should~~ may be provided in accordance with proven standards, such as FHWA's Critter Crossings or Ventura County Mitigation Guidelines and the Wildlife Crossings Assessment & Mitigation Manual (Meese, et al., 2007.), and in consultation with wildlife corridor authorities with sufficient knowledge of both regional and local wildlife corridors, and at locations useful and appropriate for the species of concern.

Above measure edited in response to a comment from CDFG.

BIO/OS37: Project sponsors ~~can and should~~ may include analysis of wildlife corridors during project planning, in order to minimize or avoid impacts to these corridors. ~~Impacts to these corridors should be avoided and/or minimized.~~ In addition, project sponsors may include analysis to identify where additional linkages and/or culverts/under crossings would be needed that do not exist.

Above measure edited in response to a comment from CDFG.

BIO/OS38: Project sponsors ~~can and should~~ may use wildlife fencing where appropriate to minimize the probability of wildlife injury due to direct interaction between wildlife and roads. Wildlife fencing used ~~can and should~~ may be based on proven designs for impacted species and developed in conjunction with wildlife corridor authorities with sufficient knowledge of both regional and local wildlife corridors. Project sponsors ~~can and should~~ may take advantage of natural environmental buffers (i.e. streams or fields) to protect wildlife habitat from nearby transportation infrastructure. Inclusion of this mitigation measure ~~can and should~~ may be

considered on a case-by-case basis, as use of wildlife fencing could further increase the effects of habitat fragmentation and isolation for many species. Also see **BIO/OS1** through **BIO/OS21**.

BIO/OS39: Project sponsors ~~can and should~~ may avoid siting new 2012-2035 RTP/SCS transportation facilities within areas not presently exposed to impacts from transportation facilities. If avoidance is infeasible, the project ~~should~~ may minimize vehicular accessibility to areas beyond the actual transportation surface. This can be accomplished through fencing and signage. Additionally, the area of native habitats to be lost to proximity to a transportation facility ~~should~~ may be assessed and habitat at a quality of equal or superior value ~~can and should~~ may be secured and protected in perpetuity.

Threats to Biological Resources in the SCAG Region

BIO/OS40: Project sponsors ~~can and should~~ may establish litter control programs in appropriate areas, such as receptacles at road turnouts, rest stops, and viewpoints. All refuse containers ~~can and should~~ may be provided with mechanisms which prevent scavenging animals from gaining access to the contents of such containers.

BIO/OS41: Project sponsors ~~can and should~~ may use road noise minimization methods, such as brush and tree planting, at heavy noise-producing transportation areas that may affect wildlife. Native vegetation ~~can and should~~ may be used.

BIO/OS42: Project sponsors ~~can and should~~ may avoid and/or minimize construction activities that have the potential to expose species to noise, smoke, or other disturbances. Pre-construction surveys ~~can and should~~ may be conducted as appropriate to determine the presence of any species that would need to be protected from such an impact.

Protection of Biological Resources in the SCAG Region

BIO/OS43: Any Conservation opportunity areas identified by SCAG or others may be used by local jurisdictions and project sponsors as priority areas for mitigating impacts to open space resources. SCAG's forthcoming regional conservation planning policy will include additional information on conservation opportunity areas.

Above measure is clarified.

BIO/OS44: Project sponsors ~~can and should~~ may ensure that transportation systems proposed in the 2012-2035 RTP/SCS avoid or mitigate significant impacts to natural lands, community open space and important farmland, including cumulative impacts and open space impacts from the growth associated with transportation projects and improvements.

BIO/OS45: Individual projects ~~submitted for IGR review can and should~~ may either avoid significant impacts to regionally significant open space resources or mitigate the significant impacts ~~through measures consistent with regional open space policies for conserving natural lands, community open space and farmlands~~. All projects submitted for IGR review ~~can and should~~ may demonstrate consideration of alternatives that would avoid or reduce impacts to open space.

Above measure revised to clarify IGR process and to reflect intent to defer to lead agencies' CEQA analysis and mitigation decisions.

BIO/OS46: Project sponsors ~~can and should~~ may include into project design, to the maximum extent practicable, mitigation measures and recommended best practices aimed at minimizing or avoiding impacts to natural lands, including, but not limited to FHWA's Critter Crossings, Ventura County Mitigation Guidelines, CDFG's Wildlife Action Plan and any applicable conservation plans.

BIO/OS47:* For projects adjacent to natural watercourses, project sponsors ~~can and should~~ may submit a vegetation management plan for review and approval by the Lead Agency that includes, as deemed appropriate, the following measures:

- Identify and do not disturb a ~~20-foot~~ buffer distance (to be determined as appropriate on a case-by-case basis) from the top of the natural watercourse. If the top of bank cannot be identified, leave a 50-foot buffer from the centerline of the watercourse or as wide a buffer as possible between the watercourse centerline and the proposed site development.

- Identify and leave "islands" of vegetation in order to prevent erosion and landslides and protect nesting habitat.
- Leave at least 6 inches of vegetation on the site.
- Trim tree branches from the ground up (limbing up) and leave tree canopy intact.
- Leave stumps and roots from cut down trees to prevent erosion.
- Plant fire-appropriate, drought-tolerant, preferably native vegetation.
- Err on the side of caution; if a plant, tree or area is sensitive, obtain a second opinion before cutting.
- Provide erosion and sediment control protection if cutting vegetation on a steep slope.
- Leave tall shrubbery at least 3-feet high.
- Fence off sensitive plant habitats and creek areas to protect from animal grazing as appropriate and necessary.
- Do not clear-cut vegetation. This can lead to erosion and severe water quality problems and destroy important habitat.
- Do not remove vegetation within 20-feet of the top of bank. If the top of bank cannot be identified, do not cut within 50-feet of the centerline of the natural watercourse or as wide a buffer as possible between the natural watercourse centerline and the proposed site development.
- Do not trim/prune branches that are larger than 4 inches in diameter.
- Do not remove tree canopy.
- Do not dump cut vegetation in a creek.
- Do not cut tall shrubbery to less than 3-feet high.
- Do not cut off short vegetation (grasses, ground-cover) to less than 6-inches high.

Above measure edited in response to a comment from CDFG.

BIO/OS48:* As appropriate conduct a biological assessment for any site/corridor where there is the potential for impacts to significant biological resources including threatened or endangered species, sensitive habitats/species and/or protected trees.

BIO/OS49: Shade Tree Planting: Local jurisdictions or agencies ~~can and should~~ may promote the planting of shade trees and establish shade tree guidelines and specifications, including:

- Recommendations for tree planting based on the land use (residential, commercial, parking lots, etc.);
- Recommendations for tree types based on species size, branching patterns, whether deciduous or evergreen, whether roots are invasive, etc.;
- Recommendations for placement, including distance from structures, density of planting, and orientation relative to structures and the sun.

BIO/OS50: Urban Forestry Management: Local jurisdictions or agencies ~~can and should~~ may develop an Urban Forestry Program to consolidate policies and ordinances regarding tree planting, maintenance, and removal, including:

- Establish a tree-planting target and schedule to support the goals of the California Climate Action Team to plant 5 million trees in urban areas by 2020;
- Establish guidelines for tree planting, including criteria for selecting deciduous or evergreen trees low-VOC-producing trees, and emphasizing the use of drought-tolerant native trees and vegetation.

BIO/OS51: Local jurisdictions or agencies ~~can and should~~ may establish policies and programs to restore, protect, manage and preserve conservation areas, including forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas, that remove and sequester carbon from the atmosphere.

BIO/OS52: Conservation Area Development: Local jurisdictions or agencies ~~can and should~~ may consider establishing programs and funding mechanisms to create protected conservation areas, ~~including:~~ For example, local jurisdictions may:

- ~~Imposing~~ Impose mitigation fees for development on lands that would otherwise be conservation areas, and use the funds generated to protect other areas from development;
- ~~Proposing~~ Consider proposals for voters to approve a small tax increment (e.g., a quarter cent sales tax, perhaps for a finite time period that could be renewed) to fund the purchase of development rights in conservation areas, or purchase of the land outright.

Above measure revised to clarify intent to defer to jurisdictional authority on revenue programs.

BIO/OS53: Conservation Area Preservation: Local jurisdictions or agencies ~~can and should~~ may establish policies to preserve existing conservation areas, and to discourage development in those areas.

BIO/OS54: Local jurisdictions or agencies ~~can and should~~ may manage its stock of vegetation to reduce GHG emissions.

BIO/OS55: Local jurisdictions ~~can and should~~ may conduct a comprehensive inventory and analysis of the urban forest, and coordinate tree maintenance responsibilities with all responsible departments, consistent with best management practices.

BIO/OS56: Local jurisdictions or agencies ~~can and should~~ may evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and install or replace vegetation with drought-tolerant, low-maintenance native species or edible landscaping that can also provide shade and reduce heat-island effects.

CULTURAL RESOURCES

CUL1:* As part of the appropriate project/environmental review of individual projects, project sponsors ~~can and should~~ may identify potential impacts to historic resources. A record search at the appropriate Information Center ~~should~~ may be conducted to determine whether the project area has been previously surveyed and whether historic resources were identified.

CUL2:* If indicated as necessary by a records search, prior to construction activities, project sponsors ~~can and should~~ may obtain a qualified architectural historian to conduct historic architectural surveys as recommended by the Information Center. In the event the records indicate that no previous survey has been conducted, the Information Center ~~will~~ may make a recommendation on whether a survey is warranted based on the sensitivity of the project area for historical resources within 1,000 feet of the project.

CUL3:* Project sponsors ~~can and should~~ may comply with Section 106 of the National Historic Preservation Act (NHPA) including, but not limited to, projects for which federal funding or approval is required for the individual project. This law requires federal agencies to evaluate the impact of their actions on resources included in or eligible for listing in the National Register. Federal agencies must coordinate with the State Historic Preservation Officer in evaluating impacts and developing mitigation. These mitigation measures may include, but are not limited to the following:

- Where appropriate, project sponsors ~~should~~ may employ design measures to avoid historical resources and undertake adaptive reuse where appropriate and feasible. If resources are to be preserved, as feasible, project sponsors ~~should~~ may carry out the maintenance, repair, stabilization, rehabilitation, restoration, preservation, conservation or reconstruction in a manner consistent with the Secretary of the Interior's Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings. If resources would be impacted, impacts ~~should~~ may be minimized to the extent feasible.
- Where feasible, noise buffers/walls and/or visual buffers/landscaping ~~should~~ may be constructed to preserve the contextual setting of significant built resources.

CUL4:* Project sponsors ~~can and should~~ may secure a qualified environmental agency and/or architectural historian, or other such qualified person to document any significant historical resource(s), by way of historic narrative, photographs, and architectural drawings, as mitigation for the effects of demolition of a resource. However, such documentation will not mitigate the effects to less than significant.

CUL5:* As part of the appropriate project/environmental review of individual projects, project sponsors ~~can and should~~ may consult with the Native American Heritage Commission (NAHC) to determine whether known sacred sites are in the project area, and identify the Native American(s) to contact to obtain information about the project site. Federal, State, counties, and cities lead agencies may require that a check of the NAHC sacred lands files be undertaken by all projects and that the Native American tribes or individuals identified by the NAHC be contacted by the project proponent for further information and consultation on the project.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL6:* Prior to construction activities, project sponsors ~~can and should~~ may obtain a qualified archaeologist to conduct a record search at the appropriate Information Center of the California Archaeological Inventory to determine whether the project area has been previously surveyed and whether resources were identified. Federal, State, counties, and cities lead agencies may require a qualified archeologist conduct a record search at the appropriate Information Center on the project.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL7:* Prior to construction activities, project sponsors ~~can and should~~ may obtain a qualified archaeologist or architectural historian (depending on applicability) to conduct archaeological and/or historic architectural surveys as recommended by the Information Center. In the event the records indicate that no previous survey has been conducted, the Information Center ~~may~~ may make a recommendation on whether a survey is warranted based on the sensitivity of the project area for archaeological resources. Federal, State, counties, and cities lead agencies may conduct a phase I archeological or historic architectural survey for all project that have not been previously surveyed or have not been surveyed in the past ten years.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL8:* If the record search indicates that the project is located in an area rich with cultural materials, project sponsors ~~can and should~~ may retain a qualified archaeologist to monitor any subsurface operations, including but not limited to grading, excavation, trenching, or removal of existing features of the subject property. Federal, State, counties, and cities lead agencies require that a Native American monitor be employed by the project proponent or tribe to monitor the subsurface operations or any earth movement in all projects. It is also strongly recommended that a pre-excavation agreement be implemented with culturally affiliated tribes.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL9:* Construction activities and excavation ~~can and should~~ may be conducted to avoid cultural resources (if identified). If avoidance is not feasible, further work may be needed to determine the importance of a resource. Project sponsors ~~shall should~~ may obtain a qualified archaeologist familiar with the local archaeology, and/or as appropriate, an architectural historian who ~~should~~ may make recommendations regarding the work necessary to determine importance. If the cultural resource is determined to be important under state or federal guidelines, impacts on the cultural resource ~~will~~ may need to be mitigated. Avoidance is the preferred alternative. If avoidance is not feasible, Federal, State, counties, and cities lead agencies may require that the project sponsor consult with culturally affiliated Native American Tribes in the determination of importance of the resource.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL10:* Project sponsors ~~can and should~~ may stop construction activities and excavation in the area where cultural resources are found until a qualified archaeologist can determine the importance of these resources. Federal, State, counties, and cities lead agencies may require that the project sponsor consult with culturally affiliated Native American Tribes in the determination of importance of the resource.

Above measure edited in response to a comment from San Manuel Band of Mission Indians.

CUL11:* As part of the appropriate project/environmental review of individual projects, project sponsors ~~can and should~~ may obtain a qualified paleontologist to identify and evaluate paleontological resources where potential impacts are considered high; the paleontologist ~~should~~ may also conduct a field survey in these areas.

CUL12:* Project sponsors ~~can and should~~ may ensure that construction activities avoid known paleontological resources, if feasible, especially if the resources in a particular lithic unit formation have been determined through detailed investigation to be unique.

CUL13:* Project sponsors ~~can and should~~ may ensure that when a construction activity could significantly disturb soils or geologic formations in areas identified as having a moderate to high potential to support paleontological resources, a qualified researcher must be stationed on-site to observe during excavation operations and recover scientifically valuable specimens. As part of this mitigation, the following actions ~~should~~ may be taken:

- A certified paleontologist ~~should~~may be retained (or required to be retained) by the project sponsor prior to construction to establish procedures for surveillance and the preconstruction salvage of exposed resources if fossil-bearing sediments have the potential to be impacted.
- The paleontologist ~~should~~may provide preconstruction coordination with contractors, oversee original cutting in previously undisturbed areas of sensitive formations, halt or redirect construction activities as appropriate to allow recovery of newly discovered fossil remains, and oversee fossil salvage operations and reporting.
- This measure ~~should~~may be placed as a condition on all plans where excavation and earthmoving activity is proposed in a geologic unit having a moderate or high potential for containing fossils.
- Excavations of paleontological resources ~~should~~may be overseen by the qualified paleontologist and the paleontological resources given to a local agency, or other applicable institution, where they could be displayed or used for research.

CUL14:* Where practicable, project sponsors ~~can and should~~may avoid routes and project designs that would permanently alter unique features with archaeological and/or paleontological significance.

CUL15:* As part of project oversight of individual projects, project sponsors ~~can and should~~may, in the event of discovery or recognition of any human remains during construction or excavation activities associated with the project, in any location other than a dedicated cemetery, ~~should~~may cease further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until the coroner of the county in which the remains are discovered has been informed and has determined that no investigation of the cause of death is required.

CUL16:* If any discovered remains are of Native American origin:

- The coroner ~~shall~~ ~~should~~may contact the Native American Heritage Commission in order to ascertain the proper descendants from the deceased individual. The coroner ~~should~~may make a recommendation to the landowner or the person responsible for the excavation work, for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods. This may include obtaining a qualified archaeologist or team of archaeologists to properly excavate the human remains; or
- If the Native American Heritage Commission is unable to identify a descendant, or the descendant failed to make a recommendation within 24 hours after being notified by the commission, the landowner or their authorized representative ~~can and should~~may obtain a Native American monitor, and an archaeologist, if recommended by the Native American monitor, and rebury the Native American human remains and any associated grave goods, with appropriate dignity, on the property and in a location that is not subject to further subsurface disturbance where the following conditions occur:
 - The Native American Heritage Commission is unable to identify a descendent;
 - The descendant identified fails to make a recommendation; or
 - The landowner or their authorized representative rejects the recommendation of the descendant, and the mediation by the Native American Heritage Commission fails to provide measures acceptable to the landowner.

GEOLOGY, SOILS AND MINERAL RESOURCES

GEO1:* Project sponsors ~~can and should~~may ensure that projects located within or across Alquist-Priolo Zones comply with design requirements provided in Special Publication 117, published by the California Geological Survey, as well as relevant local, regional, State, and federal design criteria for construction in seismic areas.

GEO2:* Project sponsors ~~can and should~~may ensure that projects are designed in accordance with county and city code requirements for seismic ground shaking. The design of projects ~~should~~may consider seismicity of the site, soil response at the site, and dynamic characteristics of the structure, in compliance with the appropriate California Building Code and State of California design standards for construction in or near fault zones, as well as all standard design, grading, and construction practices in order to avoid or reduce geologic hazards.

GEO3:* Project sponsors ~~can and should~~may ensure that site-specific geotechnical investigations conducted by a qualified geotechnical expert ~~should~~may be required prior to preparation of project designs. These investigations would identify areas of potential failure and recommend remedial geotechnical measures to eliminate any problems.

- GEO4:*** Project sponsors ~~can and should~~ may ensure that site-specific geotechnical investigations conducted by a qualified geotechnical expert are conducted to ascertain soil types and local faulting prior to preparation of project designs. These investigations would identify areas of potential failure and recommend remedial geotechnical measures to eliminate any problems.
- GEO5:*** Project sponsors ~~can and should~~ may ensure that project designs provide adequate slope drainage and appropriate landscaping to minimize the occurrence of slope instability and erosion. Design features ~~should~~ may include measures to reduce erosion caused by stormwater. Road cuts ~~should~~ may be designed to maximize the potential for revegetation.
- GEO6:*** Project sponsors ~~can and should~~ may ensure that, prior to preparing project designs, new and abandoned wells are identified within construction areas to ensure the stability of nearby soils.
- GEO7:** Project sponsors ~~can and should~~ may ensure that projects avoid geologic units or soils that are unstable, expansive soils and soils prone to lateral spreading, subsidence, liquefaction, or collapse wherever feasible.
- GEO8:** Project sponsors ~~can and should~~ may ensure that projects avoid landslide areas and potentially unstable slopes wherever feasible.
- GEO9:** Project sponsors ~~can and should~~ may ensure that site-specific geotechnical investigations conducted by a qualified geotechnical expert ~~should~~ may be required prior to preparation of project designs to identify the potential for subsidence and expansive soils. These investigations would identify areas of potential failure and recommend remedial geotechnical measures to eliminate any problems. Recommended corrective measures, such as structural reinforcement and replacing soil with engineered fill, ~~should~~ may be implemented in project designs.
- GEO10:** Local jurisdictions ~~can and should~~ may review availability of aggregate and mineral resources in their jurisdiction and ~~should~~ may develop a long-range plan to meet demand.

GREENHOUSE GAS EMISSIONS

- GHG1:** SCAG member cities and the county governments ~~can and should~~ may adopt and implement Climate Actions Plans (CAPS, also known as Plans for the Reduction of Greenhouse Gas Emissions as described in CEQA Guidelines Section 15183.5 Tiering and Streamlining the Analysis of Greenhouse Gas Emissions) ~~that contain the following information~~

ADDITIONAL ACTIVITY

Climate Action Plans generally follow the steps and contain components described below.

- a) Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within their respective jurisdictions;
- b) Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;
- c) Identify and analyze the GHG emissions resulting for specific actions or categories of actions anticipated within their respective jurisdictions;
- d) Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
- e) Establish a mechanism to monitor the plan's progress toward achieving that level and to require amendment if the plan is not achieving specified levels; and
- f) Be adopted in a public process following environmental review.

CAPs ~~can and should~~ may, when appropriate, incorporate planning and land use measures from the California Attorney General's latest list of example policies to address climate change at both the plan and project level. Specifically, at the plan level, land use plans ~~can and should~~ may, when appropriate, incorporate planning and land use measures from the California Attorney General's latest list of example policies to address climate change (http://ag.ca.gov/globalwarming/pdf/GP_policies.pdf), including, but not limited to policies from that web page such as:

- Smart growth, jobs/housing balance, transit-oriented development, and infill development through land use designations, incentives and fees, zoning, and public-private partnerships

- Create transit, bicycle, and pedestrian connections through planning, funding, development requirements, incentives and regional cooperation, and create disincentives for auto use
- Energy and water-efficient buildings and landscaping through ordinances, development fees, incentives, project timing, prioritization, and other implementing tools

In addition, member cities and the county governments ~~can and should~~ may incorporate, as appropriate, policies to encourage implementation of the Attorney General’s list of project specific mitigation measures available at the following web site: http://ag.ca.gov/globalwarming/pdf/GW_mitigation_measures.pdf, including, but not limited to measures from the web page such as:

- Adopt a comprehensive parking policy that discourages private vehicle use and encourages the use of alternative transportation
- Build or fund a major transit stop within or near development
- Provide public transit incentives such as free or low-cost monthly transit passes to employees, or free ride areas to residents and customers
- Incorporate bicycle lanes, routes and facilities into street systems, new subdivisions, and large developments
- Require amenities for non-motorized transportation, such as secure and convenient bicycle parking.

They ~~should~~ may also incorporate, when appropriate, planning and land use measures from additional resources listed by the California Attorney General at the following webpage: <http://ag.ca.gov/globalwarming/ceqa/resources.php>.

In addition, CAPs ~~can and should~~ may also incorporate analysis of climate change adaptation, in recognition of the likely and potential effects of climate change in the future regardless of the level of mitigation and in conjunction with Executive Order S-13-08, which seeks to enhance the State’s management of climate impacts including sea level rise, increased temperatures, shifting precipitation, and extreme weather events by facilitating the development of State’s first climate adaptation strategy.

Above measure revised to reduce level of detail and to clearly defer to local policy-making process.

GHG2: Project sponsors ~~can and should~~ may require Best Available Control Technology (BACT) during construction and operation of projects, including:

- a) Solicit bids that include use of energy and fuel efficient fleets;
- b) Solicit preference construction bids that use BACT, particularly those seeking to deploy zero- and/or near zero emission technologies;
- c) Employ use of alternative fueled vehicles;
- d) Use lighting systems that are energy efficient, such as LED technology;
- e) Use CEQA Guidelines Appendix F, Energy Conservation, to create an energy conservation plan;
- f) Streamline permitting process to infill, redevelopment, and energy-efficient projects;
- g) Use an adopted emissions calculator to estimate construction-related emissions;
- h) Use the minimum feasible amount of GHG-emitting construction materials that is feasible;
- i) Use of cement blended with the maximum feasible amount of flash or other materials that reduce GHG emissions from cement production;
- j) Use of lighter-colored pavement where feasible;
- k) Recycle construction debris to maximum extent feasible; and
- l) Plant shade trees in or near construction projects where feasible.

Above measure edited in response to a comment from EPA.

GHG3: ~~SCAG shall in its capacity as a Clean Cities Coalition, and Local jurisdictions can and should~~ may establish a coordinated, creative public outreach activities ~~campaign~~, including publicizing the importance of reducing GHG emissions and steps community members ~~can~~ may take to reduce their individual impacts.

GHG4: Pedestrian and Bicycle Promotion: ~~SCAG shall and Local jurisdictions can and should~~ may work with local community groups and ~~downtown~~ business associations to organize and publicize walking tours and bicycle events, and to encourage pedestrian and bicycle modes of transportation.

GHG5: Waste Reduction: Local jurisdictions ~~can and should~~ may organize workshops on waste reduction activities for the home or business, such as backyard composting, or office paper recycling, and ~~will~~ may schedule recycling drop-off events and neighborhood chipping/mulching days.

GHG6: Water Conservation: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may organize support and/or sponsor workshops on water conservation activities, such as selecting and planting drought tolerant, native plants in landscaping, and installing advanced irrigation systems.

Measure is clarified.

GHG7: Energy Efficiency: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may organize workshops on steps to increase energy efficiency in the home or business, such as weatherizing the home or building envelope, installing smart lighting systems, and how to conduct a self-audit for energy use and efficiency.

GHG8: Schools Programs: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may develop and implement a program to present information to school children about climate change and ways to reduce GHG emissions, and ~~will~~ may support school-based programs for GHG reduction, such as school based trip reduction and the importance of recycling.

HAZARDOUS MATERIALS

HM1:* Project sponsors ~~can and should~~ may comply with all applicable laws, regulations, and health and safety standards set forth by federal, state, and local authorities that regulate the proper handling of such materials and their containers to the routine transport, use, and disposal of hazardous materials does not create a significant hazard to the public or the environment.

HM2:* Project sponsors ~~can and should~~ may consider any known or planned school locations when determining the alignment of new transportation projects and modifications to existing transportation facilities as well as any industrial or other use that could pose a hazard to students.

HM3:* Project sponsors ~~can and should~~ may ensure that Best Management Practices (BMPs) are implemented as part of construction to minimize the potential negative effects to groundwater and soils. These ~~should~~ may include the following:

- Follow manufacturer's recommendations on use, storage, and disposal of chemical products used in construction;
- Avoid overtopping construction equipment fuel gas tanks;
- During routine maintenance of construction equipment, properly contain and remove grease and oils;
- Properly dispose of discarded containers of fuels and other chemicals;
- Ensure that construction would not have a significant impact on the environment or pose a substantial health risk to construction workers and the occupants of the proposed development. Soil sampling and chemical analyses of samples ~~should~~ may be performed to determine the extent of potential contamination beneath all UST's, elevator shafts, clarifiers, and subsurface hydraulic lifts when on-site demolition, or construction activities would potentially affect a particular development or building; and
- If soil, groundwater or other environmental medium with suspected contamination is encountered unexpectedly during construction activities (e.g., identified by odor or visual staining, or if any underground storage tanks, abandoned drums or other hazardous materials or wastes are encountered), the project sponsor ~~should~~ may cease work in the vicinity of the suspect material, the area ~~should~~ may be secured as necessary, and the project sponsor ~~should~~ may take all appropriate measures to protect human health and the environment. Appropriate measures ~~should~~ may include notification of regulatory agency(ies) and implementation of actions as necessary, to identify the nature and extent of contamination. Work ~~should~~ may not resume in the area(s) affected until the measures have been implemented under the oversight of the City or regulatory agency, as appropriate.

HM4:* As appropriate, project sponsors ~~can and should~~ may submit documentation to determine whether radon or vapor intrusion from the groundwater and soil is located on-site as part of the Phase I documents. The Phase I analysis ~~should~~ may be submitted to the appropriate government agency for review and approval, along with a Phase II report if warranted by the Phase I report for the project site. The reports ~~should~~ may make recommendations for remedial action, if appropriate, and ~~should~~ may be signed by a Registered Environmental Assessor, Professional Geologist, or Professional Engineer. The project sponsor ~~should~~ may implement the approved recommendations.

HM5:* As appropriate each project sponsor ~~can and should~~ may submit a Hazardous Materials Business/Operations Plan for review and approval by the appropriate local agency. Once approved, this plan ~~should~~ will then be

kept on file with the Lead Agency (or other appropriate government agency) and may be updated as applicable. The purpose of the Hazardous Materials Business/Operations Plan is to ensure that employees are adequately trained to handle the materials and provides information to the local fire protection agency ~~should~~ may emergency response be required. The Hazardous Materials Business/Operations Plan ~~should~~ may include the following:

- The types of hazardous materials or chemicals stored and/or used on-site, such as petroleum fuel products, lubricants, solvents, and cleaning fluids
- The location of such hazardous materials
- An emergency response plan including employee training information
- A plan that describes the manner in which these materials are handled, transported and disposed

HM6:* Project sponsors ~~can and should~~ may implement all of the following Best Management Practices (BMPs) regarding potential soil and groundwater hazards.

- Soil generated by construction activities ~~should~~ may be stockpiled on-site in a secure and safe manner. All contaminated soils determined to be hazardous or non-hazardous waste must be adequately profiled (sampled) prior to acceptable reuse or disposal at an appropriate off-site facility. Specific sampling and handling and transport procedures for reuse or disposal ~~should~~ may be in accordance with applicable local, State and federal agencies laws.
- Groundwater pumped from the subsurface ~~should~~ may be contained onsite in a secure and safe manner, prior to treatment and disposal, to ensure environmental and health issues are resolved pursuant to applicable laws and policies. Engineering controls ~~should~~ may be utilized, which include impermeable barriers to prohibit groundwater and vapor intrusion into the building.
- Prior to issuance of any demolition, grading, or building permit, the sponsor ~~should~~ may submit for review and approval by the Lead Agency (or other appropriate government agency), written verification that the appropriate federal, State and/or local oversight authorities, including, but not limited to the Regional Water Quality Control Board (RWQCB), have granted all required clearances and confirmed that the all applicable standards, regulations and conditions for all previous contamination at the site.

HM7:* Project sponsors ~~can and should~~ may consult all known databases of contaminated sites and undertake a standard Phase I Environmental Site Assessment in the process of planning, environmental clearance, and construction for projects included in the 2012-2035 RTP/SCS, including development projects.

HM8:* Where contaminated sites are identified, project sponsors ~~can and should~~ may develop appropriate mitigation measures to assure that worker and public exposure is minimized to an acceptable level and to prevent any further environmental contamination as a result of construction.

HM9:* If asbestos-containing materials (ACM) are found to be present in building materials to be removed project sponsors ~~can and should~~ may submit specifications signed by a certified asbestos consultant for the removal, encapsulation, or enclosure of the identified ACM in accordance with all applicable laws and regulations, including but not necessarily limited to: California Code of Regulations, Title 8; Business and Professions Code; Division 3; California Health & Safety Code Section 25915-25919.7; and other local regulations as applicable.

HM10:* Prior to issuance of demolition, grading, or building permits, project sponsors ~~can and should~~ may submit to the appropriate agency responsible for hazardous materials/wastes oversight, a Phase II Environmental Site Assessment report if warranted by a Phase I report for the project site. The reports ~~should~~ may make recommendations for remedial action, if appropriate, and ~~should~~ may be signed by a Registered Environmental Assessor, Professional Geologist, or Professional Engineer.

HM11:* Project sponsors ~~can and should~~ may submit a comprehensive assessment report to the appropriate agency, signed by a qualified environmental professional, documenting the presence or lack thereof of ACM, lead-based paint, and any other building materials or stored materials classified as hazardous waste by State or federal law.

HM12:* If a Phase II Environmental Site Assessment report recommends remedial action, the project sponsor ~~can and should~~ may:

- Consult with the appropriate local, State, and federal environmental regulatory agencies to ensure sufficient minimization of risk to human health and environmental resources, both during and after

construction, posed by soil contamination, groundwater contamination, or other surface hazards including, but not limited to, underground storage tanks, fuel distribution lines, waste pits and sumps;

- Obtain and submit written evidence of approval for any remedial action if required by a local, State, or federal environmental regulatory agency; and
- Submit a copy of all applicable documentation required by local, State, and federal environmental regulatory agencies, including but not limited to: permit applications, Phase I and II environmental site assessments, human health and ecological risk assessments, remedial action plans, risk management plans, soil management plans, and groundwater management plans.

HM13:* If lead-based paint is present, project sponsors ~~can and should~~ may submit specifications to the appropriate agency, signed by a certified Lead Supervisor, Project Monitor, or Project Designer for the stabilization and/or removal of the identified lead paint in accordance with all applicable laws and regulations, including but not necessarily limited to: California Occupational Safety and Health Administration’s (Cal OSHA’s) Construction Lead Standard, Title 8 California Code of Regulations (CCR) Section 1532.1 and Department of Health Services (DHS) Regulation 17 CCR Sections 35001-36100, as may be amended. If other materials classified as hazardous waste by State or federal law are present, the project sponsor ~~should~~ may submit written confirmation to the appropriate local agency that all State and federal laws and regulations ~~should~~ may be followed when profiling, handling, treating, transporting and/or disposing of such materials.

HM14:* If materials classified as hazardous waste by State or federal law are present, project sponsors ~~can and should~~ may submit written confirmation to appropriate local agency that all State and federal laws and regulations ~~should~~ may be followed when profiling, handling, treating, transporting and/or disposing of such materials.

LAND USE AND AGRICULTURAL RESOURCES

LU1:* Local jurisdictions ~~can and should~~ may provide for new housing consistent with the regional Housing Needs Assessment (RHNA) to accommodate their share of the forecasted regional growth.

LU2:* Significant adverse impacts to community cohesion resulting from the displacement of residences or businesses ~~can and should~~ may be mitigated with specific relocation measures as dictated by local, state or federal requirements on a project-by project basis. Such measures include assistance in finding a new location, assistance with moving, or compensation for losses. Where it has been determined that displacement is necessary and displaced individuals are eligible, a relocation assistance program consistent with the State Uniform Location Assistance and Real Properties Acquisition Policies Act provides compensation and assistance in finding new residence for displaced individuals.

LU3: Project sponsors ~~can and should~~ may design new transportation facilities that consider access to existing community facilities. During the design phase of the project, community amenities and facilities ~~can and should~~ may be identified and considered in the design of the project.

LU4: Project sponsors ~~can and should~~ may design roadway improvements that minimize barriers to pedestrians and bicyclists. During the design phase, pedestrian and bicycle routes ~~should~~ may be determined that permit connections to nearby community facilities.

LU5:* For projects that require approval or funding by the USDOT, project sponsors ~~can and should~~ may comply with Section 4(f) U.S. Department of Transportation Act of 1966 (USDOT Act).

LU6: Project sponsors ~~can and should~~ may ensure that at least one acre of unprotected open space is permanently conserved for each acre of open space developed as a result of transportation projects/improvements.

LU6: Local jurisdictions ~~can and should~~ may seek funding to prepare specific plans and related environmental documents to facilitate mixed-use development at selected sites, and to allow these areas to serve as receiver sites for transfer of development rights away from environmentally sensitive lands and rural areas outside established urban growth boundaries.

LU7:* Local jurisdictions ~~can and should~~ may preserve and create open space and parks. Preserve existing trees, and plant replacement trees at a set ratio.

- LU8:** Project sponsors ~~can and should~~ may consider corridor realignment, buffer zones and setbacks, and berms and fencing where feasible, to avoid agricultural lands and to reduce conflicts between transportation uses and agricultural lands.
- LU9:*** Prior to final approval of each project and when feasible and prudent, the project sponsor ~~can and should~~ may establish conservation easement programs to mitigate impacts to prime farmland.
- LU10:*** Prior to final approval of each project, the project sponsor ~~can and should~~ may to the extent practical and feasible, avoid impacts to prime farmlands or farmlands that support crops considered valuable to the local or regional economy.
- LU11:** Local jurisdictions ~~can and should~~ may establish programs to direct growth to less agriculturally valuable lands and ensure, where possible, the continued protection of the most agriculturally valuable land within each county. The following are offered as examples of programs:
- The development or participation in transfer of development rights programs to encourage the preservation of agricultural lands.
 - Tools for the preservation of agricultural lands such as eliminating estates and ranchettes and clustering to retain productive agricultural land.
 - Easing restrictions on farmer's markets and encourage cooperative farming initiatives to increase the availability of locally grown food.
 - Considering partnering with school districts to develop farm-to-school programs.
- LU12:** Local jurisdictions ~~can and should~~ may avoid the premature conversion of farmlands by promoting infill development and the continuation of agricultural uses until urban development is imminent; if development of agricultural lands is necessary, growth ~~can and should~~ may be directed to those lands on which the continued viability of agricultural production has been compromised by surrounding urban development on the loss of local markets.
- LU13:** Local jurisdictions ~~can and should~~ may encourage patterns of urban development and land use, which reduce costs on infrastructure and make better use of existing facilities. Strategies that local jurisdictions ~~can and should~~ may pursue include:
- Increasing the accessibility to natural areas lands for outdoor recreation.
 - Promoting infill development and redevelopment to revitalize existing communities
 - Utilizing "green" development techniques
 - Promoting water-efficient land use and development.
- LU14:** Project sponsors and local jurisdictions ~~can and should~~ may promote infill development and redevelopment to encourage the efficient use of land and minimize the development of agricultural and open space lands.
- LU15:** Local jurisdictions ~~can and should~~ may consider the following land use principles that use resources efficiently, and to the extent practical and feasible minimize pollution and reduce waste generation:
- Mixed-use residential and commercial development that is connected with public transportation and utilizes existing infrastructure.
 - Land use and planning strategies to increase biking and walking trips.
- LU16:*** Individual projects must be consistent with federal, state, and local policies that preserve agricultural lands and support the economic viability of agricultural activities, as well as policies that provide compensation for property owners if preservation is not feasible.
- LU17:** For projects in agricultural areas, project sponsors ~~can and should~~ may contact the California Department of Conservation and each county's Agricultural Commissioner's office to identify the location of prime farmlands and lands that support crops considered valuable to the local or regional economy. Impacts to such lands ~~can and should~~ may be evaluated in project-specific environmental documents. The analysis ~~can and should~~ may use the land evaluation and site assessment (LESA) analysis method (CEQA Guidelines §21095), as appropriate. The project sponsors or local jurisdictions ~~can and should~~ may be responsible for ensuring adherence to the mitigation measures prior to construction. Mitigation measures may include conservation easements or the payment of in-lieu fees.

LU18:* For those projects that require federal funding, the federal agency evaluates the effects of the action to agricultural resources using the criteria set forth in the Farmland Protection Policy Act (FPPA). The FPPA is administered by the NRCS, which determines impacts to farmland that could occur due to the proposed project. The determination is made through coordination between the federal agency proposing or supporting the project and NRCS. The assessment of potential impacts to farmland from corridor type projects, which is typical of transportation projects analyzed in this PEIR, ~~will~~ may require completion of Form NRCS-CPA-106, Farmland Conservation Impact Rating for Corridor Type Projects. NRCS ~~will~~ may make a determination, using set thresholds, as to whether additional project specific mitigation would be required.

LU19: Prior to final approval of each project, the project sponsor ~~can and should~~ may encourage enrollments of agricultural lands for counties that have Williamson Act programs, where applicable.

LU20: Project sponsors and local jurisdictions ~~can and should~~ may submit for IGR review projects with potentially significant impacts to important farmlands. ~~Projects can and should include mitigation measures to reduce impacts and demonstrate project alternatives that avoid or lessen impact to agricultural lands. Mitigation can and should~~ may occur at a 1:1 ratio.

Above measure revised to clarify intent of IGR program, defer to future policy consideration by SCAG, and to defer to local discretion in identifying mitigation.

LU21: Local jurisdictions may consider policies to preserve forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, groundwater recharge areas and other open space that provide carbon sequestration benefits.

Above measure revised to resolve ambiguity.

LU22: Local jurisdictions may require best management practices in agriculture and animal operations to reduce emissions, conserve energy and water, and utilize alternative energy sources, including biogas, wind and solar.

LU23: Local jurisdictions ~~can and should~~ may encourage patterns of urban development and land use, which reduce costs on infrastructure and make better use of existing facilities.

LU24:* Local jurisdictions ~~can and should~~ may adopt and implement General Plan Housing Elements that accommodate the housing need identified through the RHNA process. Affordable housing ~~can and should~~ may be provided consistent with the RHNA income category distribution adopted for each jurisdiction.

LU25: Local jurisdictions ~~can and should~~ may consider shared regional priorities, as outlined in the Compass Blueprint, 2012-2035 RTP/SCS and other ongoing regional planning efforts, in determining their own development goals and drafting local plans.

LU26: Local jurisdictions and subregional organizations ~~can and should~~ may encourage the cleanup and redevelopment of brownfield sites.

LU27: Local jurisdictions or agencies ~~can and should~~ may consider adopting and implement a development pattern that utilizes existing infrastructure; reduces the need for new roads, utilities and other public works in new growth areas; and enhances non-automobile transportation.

Above measure revised to emphasize deference in land use authority.

LU28: Local jurisdictions or agencies ~~can and should~~ may consider ~~establish an urban growth boundary (UGB) with related ordinances or programs to limit suburban sprawl; local jurisdictions or agencies can and should may restrict urban development beyond the UGB and with measures that streamlining~~ streamline entitlement processes ~~within the UGB for consistent~~ projects that are not considered sprawl.

Above measure revised to clarify intent to promote orderly growth and development and to defer to local land use authority.

LU29:* Urban development ~~can and should~~ may occur only where urban public facilities and services exist or can be reasonably made available.

- LU30:*** The improvement and expansion of one urban public facility or service ~~can and should~~ may not stimulate development that significantly precedes the local jurisdiction's ability to provide all other necessary urban public facilities and services at adequate levels.
- LU31:** Local jurisdictions ~~can and should~~ may redirect new growth into existing city/urban reserve areas.
- LU32:** Local jurisdictions ~~can and should~~ may maintain a one dwelling unit per 10-acre minimum lot size or lower density in areas outside designated urban service lines.
- LU33:** Local jurisdictions ~~can and should~~ may consider encouraging high-density, mixed-use, infill development and creative reuse of brownfield, under-utilized and/or defunct properties within the urban core.

Above measure revised to clarify intent to promote orderly growth and development and to defer to local land use authority.

- LU34:*** Local jurisdictions ~~can and should~~ may consider increasing densities in urban core areas to support public transit.

Above measure revised to clarify intent to promote orderly growth and development and to defer to local land use authority.

- LU35:** Local jurisdictions ~~can and should~~ may remove barriers to the development of accessory dwelling units in existing residential neighborhoods as appropriate
- LU36:** Local jurisdictions ~~can and should~~ may reduce required road width standards wherever feasible to calm traffic and encourage alternative modes of transportation.
- LU37:** Local jurisdictions ~~can and should~~ may reduce parking space requirements, unbundle parking from rents and charge for parking in new developments.
- LU38:** Local jurisdictions ~~can and should~~ may add bicycle facilities to streets and public spaces.
- LU39:** Local jurisdictions ~~can and should~~ may plan for and create incentives for mixed-use development.
- LU40:** Local jurisdictions ~~can and should~~ may identify sites suitable for mixed-use development and establish appropriate site-specific standards to accommodate the mixed uses. Site-specific standards could include:
- Increasing allowable building height or allowing height limit bonuses;
 - Allowing flexibility in applying development standards (such as FAR2 and lot coverage) based on the location, type, and size of the units, and the design of the development;
 - Allowing the residential component to be additive rather than within the established FAR for that zone, and eliminating maximum density requirements for residential uses in mixed use zones;
 - Allowing reduced and shared parking based on the use mix, and establishing parking maximums where sites are located within 0.25 miles of a public transit stop;
 - Allowing for tandem parking, shared parking and off-site parking leases;
 - Requiring all property owners in mixed-use areas to unbundle parking from commercial and residential leases;
 - Creating parking benefit districts, which invest meter revenues in pedestrian infrastructure and other public amenities;
 - Establishing performance pricing of street parking, so that it is expensive enough to promote frequent turnover and keep 15 percent of spaces empty at all times.
- LU41:** Local jurisdictions ~~can and should~~ may enable prototype mixed-use structures for use in neighborhood center zones that can be adapted to new uses over time with minimal internal remodeling.
- LU42:** Local jurisdictions ~~can and should~~ may identify and facilitate the inclusion of complementary land uses not already present in local zoning districts, such as supermarkets, parks and recreational fields, schools in neighborhoods, and residential uses in business districts, to reduce the vehicle miles traveled and promote bicycling and walking to these uses.

- LU43:*** Local jurisdictions ~~can and should~~ may work with employers developing larger projects to ensure local housing opportunities for their employees, and engage employers to find ways to provide housing assistance as part of their employee benefits packages; major projects in mixed-use areas ~~can and should~~ may include work-force housing where feasible.
- LU44:** Local jurisdictions ~~can and should~~ may revise zoning ordinance(s) to allow local-serving businesses, such as childcare centers, restaurants, banks, family medical offices, drug stores, and other similar services near employment centers to minimize midday vehicle use.
- LU45:** Local jurisdictions ~~can and should~~ may develop form-based community design standards to be applied to development projects and land use plans, using a comprehensive community outreach, for areas designated mixed-use.
- LU46:** Local jurisdictions ~~can and should~~ may mix affordable housing units with market rate units as opposed to building segregated affordable housing developments.
- LU47:** Where practical and feasible, local jurisdictions ~~can and should~~ may develop programs that enable the reuse of underutilized commercial, office and/or industrial properties for housing or mixed-use housing.
- LU48:** Local jurisdictions ~~can and should~~ may ~~ensure~~ consider consistency with “smart growth” principles – mixed-use, infill, and higher density projects that provide alternatives to individual vehicle travel and promote the efficient delivery of services and goods.

Above measure revised to defer to local land use authority and to emphasize discretion.

- LU49:** Local jurisdictions ~~can and should~~ may meet recognized “smart growth” benchmarks.
- LU50:** Project sponsors ~~can and should~~ may incorporate public transit into the project’s design.
- LU51:** Project sponsors ~~can and should~~ may include pedestrian and bicycle facilities within projects and ensure that existing non-motorized routes are maintained and enhanced.
- LU52:** Local jurisdictions ~~can and should~~ may encourage residential development in High Quality Transit Areas (HQTAs). Such development ~~can and should~~ may include a generally walkable transit village that has a minimum density of 20 dwelling units per acre and is within a ½ mile of a well-serviced transit stop, and includes transit corridors with minimum 15-minute or less service frequency during peak commute hours.
- LU53:** Local jurisdictions ~~can and should~~ may promote greater linkage between land uses and transit, as well as other modes of transportation.
- LU54:** Local jurisdictions ~~can and should~~ may ensure new development is designed to make public transit a viable choice for residents, including:
- Locating medium-high density development near activity centers that can be served efficiently by public transit and alternative transportation modes;
 - Locating medium-high density development near streets served by public transit whenever feasible;
 - Linking neighborhoods to bus stops by continuous sidewalks or pedestrian paths.
- LU55:** Local jurisdictions ~~can and should~~ may establish city-centered corridors, directing development to existing transportation corridors.
- LU56:** Local jurisdictions ~~can and should~~ may develop form-based community design standards to be applied to development projects and land use plans, using a comprehensive community outreach program, for areas designated mixed-use
- LU57:** Local jurisdictions ~~can and should~~ may locate affordable housing in transit-oriented development whenever feasible

- LU58:** Local jurisdictions ~~can and should~~ may consider jobs/housing balance, to the extent practical and feasible, and encourage the development of communities where people live closer to work, bike, walk, and take transit as a substitute for personal auto travel.
- LU59:** Project sponsors ~~can and should~~ may consider community cohesion in designing projects through communities. Transit facilities ~~should~~ may be designed to integrate with the community and encourage walking and bicycling as well as park and ride. New or widened roadways (and freeways) ~~should~~ may be designed to minimize impacts to the extent feasible through landscaping, pedestrian furniture as appropriate. New roadways or freeways ~~should~~ may consider feasible innovative designs such as cap parks that maintain community cohesion.
- LU60:** Local jurisdictions ~~can and should~~ may promote development and preservation of neighborhood characteristics that encourage walking and bicycle riding in lieu of automobile-based travel.
- LU61:** Local jurisdictions ~~can and should~~ may create and preserve distinct, identifiable neighborhoods whose characteristics support pedestrian travel, especially within, but not limited to, mixed-use and transit-oriented development areas, including:
- Designing or maintaining neighborhoods where the neighborhood center can be reached in approximately five minutes of walking;
 - Increasing housing densities from the perimeter to the center of the neighborhood;
 - Directing retail, commercial, and office space to the center of the neighborhood;
 - Encouraging pedestrian-only streets and/or plazas within developments, and destinations that may be reached conveniently by public transportation, walking, or bicycling;
 - Allowing flexible parking strategies in neighborhood activity centers to foster a pedestrian-oriented streetscape;
 - Providing continuous sidewalks with shade trees and landscape strips to separate pedestrians from traffic;
 - Encouraging neighborhood parks and recreational centers near concentrations of residential areas (preferably within one quarter mile) and include pedestrian walkways and bicycle paths that encourage non-motorized travel.
- LU62:** Local jurisdictions ~~can and should~~ may ensure pedestrian access to activities and services, especially within, but not limited to, mixed-use and transit-oriented development areas, including:
- Ensuring new development that provides pedestrian connections in as many locations as possible to adjacent development, arterial streets, thoroughfares;
 - Ensuring a balanced mix of housing, workplaces, shopping, recreational opportunities, and institutional uses, including mixed-use structures;
 - Locating schools in neighborhoods, within safe and easy walking distances of residences served;
 - For new development, primary entrances ~~shall~~ should may be pedestrian entrances, with automobile entrances and parking located to the rear;
 - Support development where automobile access to buildings does not impede pedestrian access, by consolidating driveways between buildings or developing alley access;
 - Street parking provided ~~shall~~ should may be utilized as a buffer between sidewalk pedestrian traffic and the automobile portion of the roadway;
 - Establish pedestrian and bicycle connectivity standards for new development, with block sizes between 1 and 2 acres;
 - For existing areas that do not meet established connectivity standards, prioritize the physical development of pedestrian connectors;
 - Prioritizing grade-separated bicycle / pedestrian crossings where appropriate to enhance connectivity or overcome barriers such as freeways, railways and waterways.
- LU63:** Local jurisdictions ~~can and should~~ may review fee structures and other opportunities to provide financial and administrative incentives to support desired land uses, development patterns, and alternative modes of transportation.
- LU64:** Local jurisdictions ~~can and should~~ may promote desired land uses by considering criteria for scaled scaling developer fees. ~~based on desired criteria, for example~~: Examples include:
- Increasing or reducing fees proportionally with distance from the city center or preferred transit sites;
 - Increasing or reducing fees based on the degree to which mixed uses are incorporated into the project;

- Reducing fees for creative re-use of brownfield sites;
- Increasing fees for the use of greenfield sites.

Above measure revised to defer to local authority on revenue programs.

LU65: Local jurisdictions ~~can and should~~ may consider ~~providing~~ provide fast-track permitting and reductions in processing fees for desired projects. Local jurisdictions ~~can and should~~ may research and implement a program of incentives for development projects that are fully consistent with the 2012-2035 RTP/SCS.

Above measure revised to defer to local authority on revenue programs.

LU66: Local jurisdictions ~~can and should~~ may ~~provide~~ consider providing incentive funding and/or infrastructure loans to support desired projects.

Above measure revised to defer to local authority on revenue programs.

LU67: Local jurisdictions ~~can and should~~ may give preference for infrastructure improvements that support or enhance desired land uses and projects.

LU68: Local jurisdictions ~~can and should~~ may reduce heat gain from pavement and other hardscaping, including:

- Reduce street rights-of-way and pavement widths to pre-World War II widths (typically 22 to 34 feet for local streets, and 30 to 35 feet for collector streets, curb to curb), unless landscape medians or parkway strips are allowed in the center of roadways;
- Reinstate the use of parkway strips to allow shading of streets by trees;
- Include shade trees on south- and west-facing sides of structures;
- Include low-water landscaping in place of hardscaping around transportation infrastructure and in parking areas;
- Install cool roofs, green roofs, and use cool paving for pathways, parking, and other roadway surfaces;
- Establish standards that provide for pervious pavement options;
- Remove obstacles to xeriscaping, edible landscaping and low-water landscaping.

NOISE

NO1:* To reduce noise impacts due to construction, project sponsors ~~can and should~~ may require construction contractors to implement a site-specific noise reduction program, subject to the Lead Agency (or other appropriate government agency) review and approval, which includes the following measures:

- Equipment and trucks used for project construction ~~can and should~~ may utilize the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, wherever feasible).
- Except as may be exempted by the Lead Agency (or other appropriate government agency), impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction ~~can and should~~ may be hydraulically or electrically powered to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust ~~should~~ may be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves ~~should~~ may be used, if such jackets are commercially available and this could achieve a reduction of 5 dBA. Quieter procedures ~~should~~ may be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.
- Stationary noise sources ~~can and should~~ may be located as far from adjacent sensitive receptors as possible and they ~~should~~ may be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures as determined by the Lead Agency (or other appropriate government agency) to provide equivalent noise reduction.

NO2: Prior to the issuance of a building permit, along with the submission of construction documents, each project sponsor ~~can and should~~ may submit to the Lead Agency (or other government agency as appropriate) a list of measures to respond to and track complaints pertaining to construction noise. These measures ~~should~~ may include:

- A procedure and phone numbers for notifying the Lead Agency staff and local Police Department; (during regular construction hours and off-hours);
 - A sign posted on-site pertaining with permitted construction days and hours and complaint procedures and who to notify in the event of a problem. The sign ~~should~~may also include a listing of both the Lead Agency and construction contractor's telephone numbers (during regular construction hours and off-hours);
 - The designation of an on-site construction complaint and enforcement manager for the project;
 - Notification of neighbors and occupants within 300 feet of the project construction area at least 30 days in advance of extreme noise generating activities about the estimated duration of the activity; and
 - A preconstruction meeting ~~can and should~~may be held with the job inspectors and the general contractor/on-site project manager to confirm that noise measures and practices (including construction hours, neighborhood notification, posted signs, etc.) are completed.
- NO3:** Project sponsor ~~can and should~~may implement use of portable barriers in the vicinity of sensitive receptors during construction including construction of subsurface barriers, debris basins, and storm water drainage facilities.
- NO4:*** For projects that require pile driving or other construction noise above 90 dBA in proximity to sensitive receptors, to further reduce potential pier drilling, pile driving and/or other extreme noise generating construction impacts greater than 90dBA, a set of site-specific noise attenuation measures ~~can and should~~may be completed under the supervision of a qualified acoustical consultant. Prior to commencing construction, a plan for such measures ~~should~~may be submitted for review and approval by the Lead Agency (or other appropriate government agency) to ensure that maximum feasible noise attenuation ~~will be~~ is achieved. This plan ~~should~~may be based on the final design of the project. A third-party peer review, paid for by the project sponsor, may be required to assist the Lead Agency in evaluating the feasibility and effectiveness of the noise reduction plan submitted by the project sponsor. The criterion for approving the plan ~~should~~may be a determination that maximum feasible noise attenuation ~~will be~~ is achieved. The noise reduction plan ~~can and should~~may include, but not be limited to, an evaluation of implementing the following measures. These attenuation measures ~~can and should~~may include as many of the following control strategies as applicable to the site and construction activity:
- Erect temporary plywood noise barriers around the construction site, particularly along on sites adjacent to residential buildings;
 - Implement "quiet" pile driving technology (such as pre-drilling of piles, the use of more than one pile driver to shorten the total pile driving duration), where feasible, in consideration of geotechnical and structural requirements and conditions;
 - Utilize noise control blankets on the building structure as the building is erected to reduce noise emission from the site;
 - Evaluate the feasibility of noise control at the receivers by temporarily improving the noise reduction capability of adjacent buildings by the use of sound blankets for example and implement such measure if such measures are feasible and would noticeably reduce noise impacts; and
 - Monitor the effectiveness of noise attenuation measures by taking noise measurements.
- NO5:** Noise generated from any rock-crushing or screening operations performed within 3,000 feet of any occupied residence ~~can and should~~may be mitigated by the project sponsor by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the local jurisdiction.
- NO6:** Where feasible, pile holes ~~can and should~~may be pre-drilled to reduce potential noise and vibration impacts.
- NO7:** As necessary, each project sponsor ~~can and should~~may retain a structural engineer or other appropriate professional to determine threshold levels of vibration and cracking that could damage any adjacent historic or other structure subject to damage, and design means and construction methods to not exceed the thresholds.
- NO8:*** Project sponsors ~~can and should~~may comply with all local sound control and noise level rules, regulations, and ordinances.
- NO9:*** As part of the appropriate environmental review of each project, a project specific noise evaluation ~~can and should~~may be conducted and appropriate mitigation identified and implemented.

- NO10:** Project sponsors ~~can and should~~ may employ, where their jurisdictional authority permits, land use planning measures, such as zoning, restrictions on development, site design, and use of buffers to ensure that future development is compatible with adjacent transportation facilities.
- NO11:** As a last resort, project sponsors ~~can and should~~ may eliminate noise-sensitive receptors by acquiring freeway and rail rights-of-way. This would ensure the effective operation of all transportation modes.
- NO12:** Project sponsors ~~can and should~~ may, to the extent feasible and practicable, maximize the distance between noise-sensitive land uses and new roadway lanes, roadways, rail lines, transit centers, park-and-ride lots, and other new noise-generating facilities.
- NO13:** Project sponsors ~~can and should~~ may construct sound reducing barriers between noise sources and noise-sensitive land uses. Sound barriers can be in the form of earth-berms or soundwalls. Constructing roadways so as appropriate and feasible that they are depressed below-grade of the existing sensitive land uses also creates an effective barrier between the roadway and sensitive receptors.
- NO14:** Project sponsors ~~can and should~~ may, to the extent feasible and practicable, improve the acoustical insulation of dwelling units where setbacks and sound barriers do not sufficiently reduce noise.
- NO15:** The project sponsors ~~can and should~~ may implement, to the extent feasible and practicable, speed limits and limits on hours of operation of rail and transit systems, where such limits may reduce noise impacts.
- NO16:** ~~As applicable and feasible, project sponsors may~~ To reduce noise impacts, by maximizing distance of new route alignments from between sensitive receptors and new transportation projects. For example, if a transit project were constructed along the center of a freeway (as opposed to a new route or along the side of the freeway), operational noise impacts would be reduced by the increase in distance to the noise sensitive sites and the masking effects of the freeway traffic noise.

Above measure is clarified and simplified.

- NO17:** Transit-related passenger stations, central maintenance facilities, decentralized maintenance facilities, and electric substations ~~can and should~~ may be located away from sensitive receptors to the maximum extent feasible.
- NO18:*** Local jurisdictions or agencies ~~can and should~~ may, as practical and feasible, adhere to published local, state and federal guidelines concerning groundborne vibration impacts.

POPULATION, HOUSING, AND EMPLOYMENT

- POP1:*** For projects with the potential to displace homes and/or businesses, project sponsors ~~can and should~~ may evaluate alternate route alignments and transportation facilities that minimize the displacement of homes and businesses. An iterative design and impact analysis would help where impacts to homes or businesses are involved in order to minimize impacts. ~~Potential impacts should be minimized to the extent feasible. If possible, This may include use of existing rights-of-way should be used.~~
- POP2:** Project sponsors ~~can and should~~ may develop a construction schedule that minimizes potential neighborhood deterioration from protracted waiting periods between right-of-way acquisition and construction.
- POP3:*** Project sponsors ~~shall should~~ may mitigate impacts to affordable housing as feasible through construction of affordable units (deed restricted to remain affordable for an appropriate period of time) or payment of any fee established to address loss of affordable housing.

PUBLIC SERVICES AND UTILITIES

- PS1:*** Project implementation agencies ~~can and should~~ may ensure that prior to construction all necessary local and state road and railroad encroachment permits are obtained. The project implementation agency ~~can and should~~ may also comply with all applicable conditions of approval. As deemed necessary by the governing jurisdiction, the road encroachment permits may require the contractor to prepare a traffic control plan in accordance with professional engineering standards prior to construction. Traffic control plans ~~can and should~~ may include the following requirements:

- Identification of all roadway locations where special construction techniques (e.g., directional drilling or night construction) would be used to minimize impacts to traffic flow.
 - Development of circulation and detour plans to minimize impacts to local street circulation. This may include the use of signing and flagging to guide vehicles through and/or around the construction zone.
 - Scheduling of truck trips outside of peak morning and evening commute hours.
 - Limiting of lane closures during peak hours to the extent possible.
 - Usage of haul routes minimizing truck traffic on local roadways to the extent possible.
 - Inclusion of detours for bicycles and pedestrians in all areas potentially affected by project construction.
 - Installation of traffic control devices as specified in the California Department of Transportation Manual of Traffic Controls for Construction and Maintenance Work Zones.
 - Development and implementation of access plans for highly sensitive land uses such as police and fire stations, transit stations, hospitals, and schools. The access plans would be developed with the facility owner or administrator. To minimize disruption of emergency vehicle access, affected jurisdictions ~~can and should~~ may be asked to identify detours for emergency vehicles, which ~~will~~ may then be posted by the contractor. Notify in advance the facility owner or operator of the timing, location, and duration of construction activities and the locations of detours and lane closures.
 - Storage of construction materials only in designated areas.
 - Coordination with local transit agencies for temporary relocation of routes or bus stops in work zones, as necessary.
- PS2:*** Project sponsors ~~can and should~~ may identify projects in the 2012-2035 RTP/SCS that require police protection, fire service, and emergency medical service and ~~can and should~~ may coordinate with local fire and police departments to ensure that the existing public services would be able to handle the increase in demand for their services. If the current levels of services at the project site are found to be inadequate, infrastructure improvements and/or personnel requirements for the appropriate public service ~~can and should~~ may be identified in each project's CEQA documentation.
- PS3:** Project sponsors ~~can and should~~ may ensure that during project construction, all construction vehicles and equipment ~~will~~ may be fitted with spark arrestors to minimize accidental ignition of dry construction debris and surrounding dry vegetation.
- PS4:*** Project sponsors ~~can and should~~ may encourage the use of fire-resistant vegetation native to Southern California and/or to the local microclimate (e.g., vegetation that has high moisture content, low growth habits, ignition-resistant foliage, or evergreen growth), eliminate brush and chaparral, and discourage the use of fire-promoting species especially non-native, invasive species (e.g., pampas grass, fennel, mustard, or the giant reed) in the immediate vicinity of development in areas with high fire threat.
- PS5:** Project sponsors ~~can and should~~ may encourage natural re-vegetation or seeding with local, native species after a fire and discourage re-seeding of non-native, invasive species to promote healthy, natural ecosystem re-growth. Native vegetation is more likely to have deep root systems that prevent slope failure and erosion of burned areas than shallow-rooted non-natives.
- PS6:** Project sponsors ~~can and should~~ may submit a fire safety plan (including phasing) to the Lead Agency and local fire agency for their review and approval. The fire safety plan ~~can and should~~ may include all of the fire safety features incorporated into the project and the schedule for implementation of the features. The local fire protection agency may require changes to the plan or may reject the plan if it does not adequately address fire hazards associated with the project as a whole or the individual phase.
- PS7:** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may discourage development on potentially hazardous developments in hillsides, canyons, areas with steep slopes or that are susceptible to flooding, earthquakes, wildfire and other known hazards, and areas with limited access for emergency equipment.
- PS8:*** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may promote Fire-wise Land Management: by encouraging the use of fire-resistant vegetation and the elimination of brush and chaparral in the immediate vicinity of development in areas with high fire threat.
- PS9:** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may ~~shall~~ promote Fire Management Planning that help reduce fire threats in the region as part of the Compass Blueprint process and other ongoing regional planning efforts.

PS10:* ~~SCAG shall and~~ Local jurisdictions ~~can and should~~ may encourage the use of fire-resistant materials when constructing projects in areas with high fire threat. Local jurisdictions may discourage development in high fire hazard areas and recommend using project design to reduce risk including building with a compact defensible footprint and minimizing perimeter length.

Above measure edited in response to comments from the Natural Resources Agency Department of Parks and Recreation, and the Wildlife Corridor Conservation Authority

PS11: The growth inducing potential of individual RTP projects ~~shall should~~ may be carefully evaluated so that the full implications of the projects are understood. Individual environmental documents ~~shall should~~ may quantify indirect impacts (growth that could be facilitated or induced) on public services and utilities to the extent feasible. Lead and responsible agencies ~~can and should~~ may then make any necessary adjustments to the applicable General Plan. Any such identified adjustment ~~shall should~~ may be communicated to SCAG.

PS12:* Project sponsors ~~can and should~~ may undertake project-specific review of the impacts to educational facilities as part of project specific environmental review. For any identified impacts, project sponsors ~~can and should~~ may ensure that the appropriate school district fees are paid in accordance with State law. The project sponsors or local jurisdiction ~~can and should~~ may be responsible for ensuring adherence to required mitigation. SCAG ~~should~~ may be provided with documentation of compliance with any necessary mitigation measures.

PS13:* Project sponsors ~~can and should~~ may ensure that projects are consistent with federal, state, and local plans that preserve open space.

PS14:* Project sponsors ~~can and should~~ may consider corridor realignment, buffer zones and setbacks, and berms and fencing where feasible, to avoid open space and recreation land and to reduce conflicts between transportation uses and open space and recreation lands.

PS15: Project sponsors ~~can and should~~ may identify open space areas that could be preserved and ~~should~~ may ~~shall~~ include mitigation measures (such as dedication or payment of in-lieu fees) for the loss of open space.

PS16:* Prior to final approval of each project, the project sponsor ~~can and should~~ may conduct the appropriate project-specific environmental review, including consideration of loss of open space. Potential significant impacts to open space ~~shall should~~ may be mitigated, as feasible. The project sponsors or local jurisdiction ~~can and should~~ may be responsible for ensuring adherence to the mitigation measures prior to construction.

PS17: Local jurisdictions ~~can and should~~ may prepare a Needs Assessment to determine the level of adequate community open space level for their areas.

PS18: Local jurisdictions ~~can and should~~ may ~~work with SCAG~~ participate in regional efforts to identify regionally significant open space resources within their jurisdictions as feasible and appropriate.

Above measure revised to broaden applicability to a variety of open space planning efforts.

PS19: Where practical and feasible, project sponsors and local jurisdictions ~~can and should~~ may consider increasing the accessibility to natural areas and lands for outdoor recreation. Such measures ~~can and should~~ may be coordinated with local and regional open space planning or management agencies.

PS20: Local jurisdictions ~~can and should~~ may encourage multiple use spaces and encourage redevelopment in areas where it will provide more opportunities for recreational uses and access to natural areas close to the urban core.

PS21: Project level mitigation for significant cumulative and growth-inducing impacts on open space resources ~~can and should~~ may include the conservation of natural lands, community open space and important farmland through existing projects in the region.

PS22: Local governments ~~can and should~~ may consider the most recent annual report on open space conservation in planning and evaluating projects and programs in areas with regionally significant open space resources.

- PS23:** Local governments ~~can and should~~ may encourage patterns of urban development and land use, which reduce costs on infrastructure and make better use of existing facilities. Strategies local governments ~~can and should~~ may pursue include:
- Increasing the accessibility to natural areas lands for outdoor recreation.
 - Promoting infill development and redevelopment to revitalize existing communities
 - Utilizing "green" development techniques
 - Promoting water-efficient land use and development.
- PS24:** Project sponsors and local governments ~~can and should~~ may encourage multiple use spaces and encourage redevelopment in areas where it will provide more opportunities for recreational uses and access to natural areas close to the urban core.
- PS25:** Future impacts to open space and recreation lands ~~shall~~ should ~~may~~ be avoided through cooperation, information sharing, and program development as part of SCAG's ongoing regional planning efforts.
- PS26:*** Project sponsors for projects identified in the 2012-2035 RTP/SCS ~~can and should~~ may comply with applicable regulations related to solid waste disposal.
- PS27:*** Projects sponsors ~~can and should~~ may work with the respective local jurisdiction's Recycling Coordinator to ensure that source reduction techniques and recycling measures are incorporated into project construction.
- PS28:** Local jurisdictions may estimate the amount of solid waste generated during construction ~~will be estimated~~ prior to construction, and appropriate disposal sites ~~will~~ may be identified and utilized.

Above measure revised for consistency and to clarify who will carry out.

- PS29:** Project sponsors ~~can and should~~ may integrate green building measures into project design such as those identified in the U.S. Green Building Council's Leadership in Energy and Environmental Design, energy Star Homes, Green Point Rated Homes, and the California Green Builder Program. These measures could include the following:
- Reuse and minimization of construction and demolition (C&D) debris and diversion of C&D waste from landfills to recycling facilities.
 - The inclusion of a waste management plan that promotes maximum C&D diversion.
 - Source reduction through (1) use of materials that are more durable and easier to repair and maintain, (2) design to generate less scrap material through dimensional planning, (3) increased recycled content, (4) use of reclaimed materials, and (5) use of structural materials in a dual role as finish material (e.g. stained concrete flooring, unfinished ceilings, etc.).
 - Reuse of existing structure and shell in renovation projects.
 - Design for deconstruction without compromising safety.
 - Design for flexibility through the use of moveable walls, raised floors, modular furniture, moveable task lighting and other reusable building components.
 - Development of indoor recycling program and space.
- PS30:*** Local jurisdictions and waste management agencies ~~can and should~~ may discourage the siting of new landfills unless all other waste reduction and prevention actions have been fully explored. If landfill siting or expansion is necessary, landfills ~~can and should~~ may be sited with an adequate landfill-owned, undeveloped land buffer to minimize the potential adverse impacts of the landfill in neighboring communities.
- PS31:** Project sponsors ~~can and should~~ may discourage exporting of locally generated waste outside of the SCAG region during the construction and implementation of a project. Disposal within the county where the waste originates ~~can and should~~ may be encouraged as much as possible. Green technologies for long-distance transport of waste (e.g., clean engines and clean locomotives or electric rail for waste-by-rail disposal systems) and consistency with SCAQMD and 2012-2035 RTP/SCS policies ~~can and should~~ may be required.
- PS32:** Project sponsors ~~can and should~~ may encourage waste reduction goals and practices and look for opportunities for voluntary actions to exceed the 50 percent waste diversion target.

- PS33:** Project sponsors and local jurisdictions ~~can and should~~ may encourage the development of local markets for waste prevention, reduction, and recycling practices by supporting recycled content and green procurement policies, as well as other waste prevention, reduction and recycling practices.
- PS34:** Local jurisdictions ~~can and should~~ may develop ordinances that promote waste prevention and recycling activities such as: requiring waste prevention and recycling efforts at all large events and venues; implementing recycled content procurement programs; and developing opportunities to divert food waste away from landfills and toward food banks and composting facilities.
- PS35:*** Local jurisdictions and waste management agencies ~~can and should~~ may develop alternative waste management strategies such as composting, recycling, and conversion technologies.
- PS36:*** Project sponsors, local jurisdictions and waste management agencies, where practical and feasible, ~~can and should~~ may develop and site composting, recycling, and conversion technology facilities that have minimum environmental and health impacts.
- PS37:** Local jurisdictions ~~can and should~~ may require the reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).
- PS38:** Project sponsors ~~can and should~~ may integrate reuse and recycling into residential industrial, institutional and commercial projects.
- PS39:** Local jurisdictions ~~can and should~~ may provide easy and convenient recycling opportunities for residents, the public, and tenant businesses.
- PS40:** Local jurisdictions ~~can and should~~ may provide education and publicity about reducing waste and available recycling services.
- PS41:*** The California Integrated Waste Management Board ~~can and should~~ may continue to enforce solid waste diversion mandates that are enacted by the Legislature.
- PS42:** Local jurisdictions ~~can and should~~ may continue to adopt programs to comply with state solid waste diversion rate mandates and, where possible, ~~can and should~~ may encourage further recycling to exceed these rates.
- PS43:** Local jurisdictions ~~can and should~~ may implement or expand city or county-wide recycling and composting programs for residents and businesses. This could include extending the types of recycling services offered (e.g., to include food and green waste recycling) and providing public education and publicity about recycling services.
- PS44:** Local jurisdictions, waste management agencies and SCAG ~~can and should~~ may coordinate regional approaches and strategic siting of waste management facilities.
- PS45:** Local jurisdictions and waste management agencies ~~can and should~~ may encourage and, where practical and feasible, facilitate the creation of synergistic linkages between community businesses and the development of eco-industrial parks and materials exchange centers where one entity's waste stream becomes another entity's raw material.
- PS46:** Local jurisdictions and waste management agencies ~~can and should~~ may prioritize siting of new solid waste management facilities including recycling, composting, and conversion technology facilities in conjunction with existing waste management or material recovery facilities.
- PS47:** Local jurisdictions and waste management agencies ~~can and should~~ may increase programs to educate the public and increase awareness of reuse, recycling, composting, and green building benefits and raise consumer education issues at the county and city level, as well as at local school districts and education facilities.
- PS48:*** For projects identified in the 2012-2035 RTP/SCS that require solid waste collection, project sponsors may ~~will~~ coordinate with the local public works department to ensure that the existing public services and utilities would be able to handle the increase. If the current infrastructure servicing the project site is found to be inadequate, infrastructure improvements for the appropriate public service or utility ~~can and should~~ may be identified in each project's CEQA documentation.

- PS49:*** The growth inducing potential of individual projects ~~can and should~~ may be carefully evaluated so that the full implications of the projects are understood. Individual environmental documents ~~should~~ may quantify indirect impacts (growth that could be facilitated or induced) on public services and utilities to the extent feasible. Lead and responsible agencies then ~~will~~ may make any necessary adjustments to the applicable General Plan. Any such identified adjustment ~~should~~ may be communicated to SCAG.
- PS50:*** Prior to construction, the project implementation agency ~~can and should~~ may identify the locations of existing utility lines. The contractor ~~should~~ may ~~shall~~ avoid all known utility lines during construction.
- PS51:** In reviewing projects Lead Agencies and project sponsors ~~can and should~~ may consider energy implications of construction processes. In general the most energy efficient construction process and long-term operational design ~~can and should~~ may be selected unless there is an overriding reason why not.
- PS52:*** Local jurisdictions ~~can and should~~ may include energy analyses in environmental documentation and general plans with the goal of conserving energy through the wise and efficient use of energy. For any identified energy impacts, appropriate mitigation measures ~~can and should~~ may be developed and monitored. SCAG recommends the use of Appendix F, Energy Conservation, of the *CEQA Guidelines*.
- PS53:** Project sponsors ~~can and should~~ may consider the most cost-effective alternative and renewable energy generation facilities.
- PS54:*** Project sponsors ~~can and should~~ may require that projects use efficient lighting. (Fluorescent lighting uses approximately 75% less energy than incandescent lighting to deliver the same amount of light.)
- PS55:** Project sponsors ~~can and should~~ may require measures that reduce the amount of water sent to the sewer system. (Reduction in water volume sent to the sewer system means less water has to be treated and pumped to the end user, thereby saving energy.)
- PS56:** Project sponsors ~~can and should~~ may pursue incentives to encourage the use of energy efficient equipment and vehicles.
- PS57:** State and federal lawmakers and regulatory agencies ~~can and should~~ may pursue the design of programs to either require or incentivize the expanded availability including the expansion of alternative fuel filling stations and use of alternative-fuel vehicles to reduce the impact of shifts in petroleum fuel supply and price.
- PS58:** Local jurisdictions ~~can and should~~ may consider various best practices and technological improvements that can reduce the consumption of fossil fuels, such as:
- Expanding light-duty vehicle retirement programs
 - Increasing commercial vehicle fleet modernization
 - Implementing driver training module on fuel consumption
 - Replacing gasoline powered mowers with electric mowers
 - Reducing idling from construction equipment
 - Incentivizing alternative fuel vehicles and equipment
 - Developing infrastructure for alternative fueled vehicles
 - Increasing use and mileage of High Occupancy Vehicle (HOV), High Occupancy Toll (HOT) and dedicated Bus Rapid Transit (BRT) lanes
 - Implementing truck idling rule, devices, and truck-stop electrification
 - Requiring electric truck refrigerator units
 - Reducing locomotives fuel use
 - Modernizing older off-road engines and equipment
 - ~~Implementing cold ironing at ports~~
 - ~~Encouraging freight mode shift~~
 - Limit use and develop fleet rules for construction equipment
 - Requiring zero, and/or near zero-emission forklifts
 - ~~Developing landside port strategy with alternative fuels, clean engines, and electrification~~

Above measure edited to recognize that cold ironing is subject to state regulation and to reflect that “Freight mode shift” requires proper understanding of how existing transportation modes serve specific markets for goods movement. The final bullet was deleted to ensure consistency with the 2012 Goods Movement strategy.

- PS59:** Local jurisdictions or agencies with purview over utilities ~~can and should~~ may, as practical and feasible, streamline permitting and provide public information to facilitate accelerated construction of geothermal, solar and wind power generation facilities and transmission line improvements.
- PS60:*** Utilities ~~can and should~~ may increase capacity of existing transmission lines to meet forecast demand that supports sustainable growth, where feasible and appropriate in coordination with local planning agencies.
- PS61:** Project sponsors ~~can and should~~ may support programs to reduce single occupancy vehicle trips such as telecommuting, ridesharing, alternative work schedules, and parking cash-outs.
- PS62:*** Project sponsors ~~can and should~~ may submit projected electricity and natural gas demand calculations to the local electricity or natural gas provider, for any project anticipated to require substantial utility consumption. Any infrastructure improvements necessary for project construction ~~can and should~~ may be completed according to the specifications of the energy provider.
- PS63:** Project sponsors ~~can and should~~ may encourage, to the extent practical and feasible, ensure that new buildings incorporate solar panels in roofing and tap other renewable energy sources to offset new demand on conventional power sources. For example, transit providers ~~can and should~~ may, as feasible, assure that designers of new transit stations incorporate solar panels in roofing.
- PS64:*** Project sponsors ~~can and should~~ may encourage energy efficient design for buildings, potentially including strengthening local building codes for new construction and renovation to achieve a higher level of energy efficiency. This may include strengthening local building codes for new construction and renovation to require a higher level of energy efficiency.
- PS65:** Local jurisdictions ~~can and should~~ may seek funding through utility-sponsored programs to conduct energy efficiency “tune-ups” of existing buildings, as practical and feasible, by checking, repairing, and readjusting heating, ventilation, air conditioning, lighting, hot water equipment, insulation and weatherization.
- PS66:*** Project sponsors ~~can and should~~ may provide individualized energy management services for large energy users.
- PS67:** Local jurisdictions and project sponsors ~~can and should~~ may encourage the use of energy efficient appliances and office equipment.
- PS68:** Project sponsors ~~can and should~~ may pursue incentives and technical assistance for lighting efficiency.
- PS69:** Local jurisdictions ~~can and should~~ may provide public education and publicity about energy efficiency programs and incentives in cooperation with local utility providers.
- PS70:*** If a carbon trading system is established, a lead agency may consider whether carbon offsets would be an appropriate means of project mitigation. The project sponsor could, for example, fund off-site projects (e.g., alternative energy projects) that will reduce carbon emissions, or could purchase “credits” from another entity that will fund such projects. The lead agency ~~can and should~~ may ensure that any mitigation taking the form of carbon offsets is specifically identified and that such mitigation will in fact occur
- PS71:** Local jurisdictions ~~can and should~~ may encourage the integration of green building measures into project design and zoning such as those identified in the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED), Energy Star Homes, Green Point Rated Homes, and the California Green Builder Program. Energy saving measures for new and remodeled buildings include:
- Using energy efficient materials in building design, construction, rehabilitation, and retrofit
 - Encouraging new development to exceed Title 24 energy efficiency requirements
 - Developing Cool Communities measures including tree planting and light-colored roofs. These measures focus on reducing ambient heat, which reduces energy consumption related to air conditioning and other cooling equipment.
 - Utilizing efficient commercial/residential space and water heaters: This could include the advertisement of existing and/or development of additional incentives for energy efficient appliance purchases to reduce excess energy use and save money. Federal tax incentives are provided online at http://www.energystar.gov/index.cfm?c=Productspr_tax_credits

- Encouraging landscaping that requires no additional irrigation: utilizing native, drought tolerant plants can reduce water usage up to 60 percent compared to traditional lawns.
 - Encouraging combined heating and cooling (CHP), also known as cogeneration, in all buildings.
 - Encouraging neighborhood energy systems, which allow communities to generate their own electricity
 - Orienting streets and buildings for best solar access
 - Encouraging buildings to obtain at least 20% of their electric load from renewable energy
- PS72:** Project sponsors ~~can and should~~ may install energy efficient lighting (e.g., light emitting diodes (LEDs)), heating and cooling systems, appliances, equipment, and control systems.
- PS73:** Project sponsors ~~can and should~~ may use passive solar design, e.g., orient buildings and incorporate landscaping to maximize passive solar heating during cool seasons, minimize solar heat gain during hot seasons, and enhance natural ventilation.
- PS74:** Project sponsors ~~can and should~~ may design buildings to take advantage of sunlight.
- PS75:** Project sponsors ~~can and should~~ may install light colored “cool” roofs and cool pavements.
- PS76:** Install efficient lighting (including LEDs) for traffic, street and other outdoor lighting.
- PS77:** Project sponsors ~~can and should~~ may reduce unnecessary outdoor lighting.
- PS78:** Project sponsors ~~can and should~~ may use automatic covers, efficient pumps and motors, and solar heating for pools and spas.
- PS79:** Project sponsors ~~can and should~~ may provide education on energy efficiency to residents, customers and/or tenants.
- PS80:** Project sponsors ~~can and should~~ may use paving materials with a Solar Reflective Index (SRI) of at least 29, or open grid paving systems.
- PS81:** Project sponsors ~~can and should~~ may use roofing material with SRI of at least 29 on covered parking (underground, beneath decking or roofs, or beneath a building).
- PS81:*** Local jurisdictions ~~can and should~~ may adopt a Heat Island Mitigation Plan that requires cool roofs, cool pavements, and strategically placed shade trees, and actively inspect and enforce state requirements for cool roofs on non-residential re-roofing projects.
- PS82:** Local jurisdictions ~~can and should~~ may pursue policies and programs to improve energy efficiency of existing buildings.
- PS83:** Local jurisdictions ~~can and should~~ may require the performance of energy audits for residential and commercial buildings prior to completion of sale, and that audit results and information about opportunities for energy efficiency improvements be presented to the buyer.
- PS84:*** Local jurisdictions ~~can and should~~ may create an outreach and incentive program to promote energy efficiency and conservation in the community, including:
- Launching an “energy efficiency challenge” campaign for community residents;
 - Implementing a low-income weatherization assistance program;
 - Implementing conservation campaigns specifically targeted to residents, and separately to businesses;
 - Promoting the purchase of Energy Star® appliances, including, where feasible, incentive grants and vouchers;
 - Promoting participation in the local “Green Business” program;
 - Distributing free CFL bulbs or other efficiency fixtures to community members;
 - Offering exchange programs for high-energy-use items, such as halogen torchiere lamps;
 - Adopting an ordinance requiring energy upgrades at time of property sale.
- PS85:** Project sponsors ~~can and should~~ may install solar, wind, and geothermal power systems and solar hot water heaters.

- PS86:** Project sponsors ~~can and should~~ may install solar panels on unused roof and ground space and over carports and parking areas.
- PS87:** Project sponsors ~~can and should~~ may include energy storage where appropriate to optimize renewable energy generation systems and avoid peak energy use.
- PS88:** Project sponsors ~~can and should~~ may use combined heat and power (CHP) in appropriate applications.
- PS89:*** Local jurisdictions ~~can and should~~ may identify possible sites for production of renewable energy (such as solar, wind, small hydro, and biogas), as compatible with surrounding uses, and protect and promote that use, including:
- Designating suitable sites to prioritize their development for renewable energy generation;
 - Evaluating potential land use, environmental, economic, and other constraints on that use, and mitigate such constraints, as feasible;
 - Adopting measures to protect the renewable energy use of the sites and their resources, such as utility easements, rights-of-way, and land set-a-sides.
- PS90:** Local jurisdictions ~~can and should~~ may allow renewable energy projects in areas zoned for open space, where consistent with the Open Space element, and other uses and values.
- PS91:** Local jurisdictions ~~can and should~~ may promote and require renewable energy generation, and co-generation projects where feasible and appropriate.
- PS92:** Local jurisdictions ~~can and should~~ may require that new office/retail/commercial or industrial development, or major rehabilitation (e.g., additions of 25,000 square feet commercial, or 100,000 square feet industrial) incorporate renewable energy generation either on- or off-site to provide 15 percent or more of the project’s energy needs.
- PS92:** Local jurisdictions ~~can and should~~ may promote and encourage cogeneration projects for commercial and industrial facilities, provided they meet all applicable air quality standards and provide a net reduction in GHG emissions associated with energy production.
- PS93:** Local jurisdictions ~~can and should~~ may require that, where feasible, all new buildings be constructed to allow for easy, cost-effective installation of solar energy systems in the future, using such “solar-ready” features as:
- Designing the building to include optimal roof orientation (between 20 to 55 degrees from the horizontal), with sufficient south-sloped roof surface;
 - Clear access without obstructions (chimneys, heating and plumbing vents, etc.) on the south sloped roof;
 - Designing the roof framing to support the addition of solar panels;
 - Installation of electrical conduit to accept solar electric system wiring;
 - Installation of plumbing to support a solar hot water system and provision of space for a solar hot water storage tank.
- PS94:** Local jurisdictions ~~can and should~~ may require that residential projects of 6 units or more participate in the California Energy Commission’s New Solar Homes Partnership, which provides rebates to developers who offer solar power in at least 50 percent of new units, or a program with similar provisions.
- PS95:** Local jurisdictions ~~can and should~~ may require that any building constructed in whole or in part with local jurisdiction funds incorporate passive solar design features, such as daylighting and passive solar heating, where feasible.
- PS96:** Local jurisdictions ~~can and should~~ may protect active and passive solar design elements and systems from shading by neighboring structures and trees, as consistent with existing tree shading requirements.
- PS97:** Local jurisdictions ~~can and should~~ may provide, where feasible, creative financing for renewable energy projects, including subsidized or other low-interest loans, and the option to pay for system installation through long-term assessments on individual property tax bills.
- PS98:*** Local jurisdictions ~~can and should~~ may pursue partnerships with other governmental entities and with private companies and utilities to establish incentive programs for renewable energy.

- PS99:** Local jurisdictions ~~can and should~~ may establish and maintain a clearinghouse of information on available funding alternatives for renewable energy projects, rates of return, and other information to support developers and community members interested in pursuing renewable energy projects.
- PS100:** Local jurisdictions ~~can and should~~ may establish targets for the purchase of renewable energy, in excess of the state Renewable Portfolio Standards, using such mechanisms as green tags or renewable energy certificates.
- PS101:** Local jurisdictions ~~can and should~~ may evaluate the feasibility and effectiveness of using Community Choice Aggregation as a model for providing renewable energy to meet the community’s electricity needs, including potential partnerships with other jurisdictions.
- PS102:** Local jurisdictions ~~can and should~~ may prepare and implement a comprehensive plan to improve energy efficiency of municipal facilities, including:
- Conduct energy audits for all municipal facilities;
 - Retrofit facilities for energy efficiency where feasible and when remodeling or replacing components, including increased insulation, installing green or reflective roofs and low-emissive window glass;
 - Implement an energy tracking and management system;
 - Install energy-efficient exit signs, street signs, and traffic lighting;
 - Install energy-efficient lighting retrofits and occupancy sensors, and institute a “lights out at night” policy;
 - Retrofit heating and cooling systems to optimize efficiency (e.g., replace chillers, boilers, fans, pumps, belts, etc.);
 - Install Energy Star® appliances and energy-efficient vending machines;
 - Improve efficiency of water pumping and use at municipal facilities, including a schedule to replace or retrofit system components with high-efficiency units (i.e., ultra-low-flow toilets, fixtures, etc.);
 - Provide chilled, filtered water at water fountains and taps in lieu of bottled water;
 - Install a central irrigation control system and time its operation for off-peak use;
 - Adopt an accelerated replacement schedule for energy inefficient systems and components.
- PS103:** Local jurisdictions ~~can and should~~ may require that any newly constructed, purchased, or leased municipal space meet minimum standards as appropriate, such as:
- Requirements for new commercial buildings to meet LEED criteria established by the U.S. Green Building Council;
 - Requirements for new residential buildings to meet criteria of the Energy Star® New Homes Program established by U.S. EPA;
 - Incorporation of passive solar design features in new buildings, including daylighting and passive solar heating;
 - Retrofitting of existing buildings to meet standards under Title 24 of the California Building Energy Code, or to achieve a higher performance standard as established by the local jurisdiction;
 - Retrofitting of existing buildings to decrease heat gain from non-roof impervious surfaces with cool paving, landscaping, and other techniques.
 - Training & Support: Local jurisdictions or agencies ~~can and should~~ may ensure that staff receives appropriate training and support to implement objectives and policies to reduce GHG emissions, including:
 - Providing energy efficiency training to design, engineering, building operations, and maintenance staff;
 - Providing information on energy use and management, including data from the tracking and management system, to managers and others making decisions that influence energy use;
 - Providing energy design review services to departments undertaking new construction or renovation projects, to facilitate compliance with LEED standards.
- MM-PS104:*** Local jurisdictions ~~can and should~~ may collaborate with local energy suppliers and distributors to establish energy conservation programs, Energy Star® appliance change-out programs, rebates, vouchers, and other incentives to install energy-efficient technology and products and to cooperate on advertising.

TRANSPORTATION, TRAFFIC & SECURITY

- TR-1** Project-specific workshops on Sustainability Planning and Development ~~Smart Growth should~~ may be held by local agencies.

Above measure is clarified.

- TR-2** Transit operators ~~should~~may incorporate ITS technologies as part of their security and emergency preparedness and share that information with other operators. Aside from deploying ITS technologies for advanced customer information, transit agencies ~~should~~may work intensely with ethnic, local and disenfranchised communities through public information / outreach sessions ensuring public participation is utilized to its fullest. In case of evacuation, these transit dependent persons may need additional assistance to evacuate to safety.
- TR3:** ~~SCAG shall (for its employees) and~~ Local jurisdictions ~~can and should~~may institute teleconferencing, telecommute and/or flexible work hour programs to reduce unnecessary employee transportation.
- TR4:** Local jurisdictions ~~can and should~~may create a ride-sharing program, including promoting existing ride sharing programs e.g., by designating a certain percentage of parking spaces for ride sharing vehicles, designating adequate passenger loading and unloading for ride sharing vehicles, and providing a web site or message board for coordinating rides.
- TR5:** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~may create or accommodate car sharing programs, e.g., provide parking spaces for car share vehicles at convenient locations accessible by public transportation.
- TR6:** ~~SCAG shall and~~ Local jurisdictions ~~can and should~~may provide a vanpool for employees for commute trips.

Above measure is clarified.

- TR7:** Transportation Planning: ~~SCAG shall and~~ Local jurisdictions ~~can and should~~may ensure encourage that new developments incorporate both local and regional transit measures into the project design that promote the use of alternative modes of transportation.

Above measure is clarified.

- TR8:** As may be appropriate, project sponsors ~~can and should~~may submit fair share traffic payments to the local agency for funding capital improvement projects to accommodate future traffic demand in the area.
- TR9:** Local jurisdictions ~~can and should~~may coordinate controlled intersections so that traffic passes more efficiently through congested areas. Where traffic signals or streetlights are installed, may require the use of Light Emitting Diode (LED) technology.
- TR10:** Local jurisdictions ~~can and should~~may promote ride sharing programs e.g., by designating a certain percentage of parking spaces for high-occupancy vehicles, providing larger parking spaces to accommodate vans used for ride-sharing, and designating adequate passenger loading and unloading and waiting areas.
- TR11:** Local jurisdictions ~~can and should~~may encourage the use of car-sharing programs such as ZipCar. Accommodations for such programs include providing parking spaces for the car-share vehicles at convenient locations accessible by public transportation.
- TR12:** Project sponsors of a commercial use ~~can and should~~may submit to the Lead Agency (or other appropriate government agency) a Transportation Demand Management (TDM) plan containing strategies to reduce on-site parking demand and single occupancy vehicle travel. The sponsor ~~should~~may implement the approved TDM plan. The TDM ~~should~~may include strategies to increase bicycle, pedestrian, transit, and carpools/vanpool use. All four modes of travel ~~should~~may be considered. Strategies to consider include the following:
- Inclusion of additional bicycle parking, shower, and locker facilities that exceed the requirement
 - Construction of bike lanes per the prevailing Bicycle Master Plan (or other similar document)
 - Signage and striping onsite to encourage bike safety
 - Installation of pedestrian safety elements (such as cross walk striping, curb ramps, countdown signals, bulb outs, etc.) to encourage convenient crossing at arterials
 - Installation of amenities such as lighting, street trees, trash and any applicable streetscape plan.
 - Direct transit sales or subsidized transit passes
 - Guaranteed ride home program
 - Pre-tax commuter benefits (checks)

- On-site car-sharing program (such as City Car Share, Zip Car, etc.)
- On-site carpooling program
- Distribution of information concerning alternative transportation options
- Parking spaces sold/leased separately
- Parking management strategies; including attendant/valet parking and shared parking spaces

TR13:* Project sponsors and construction contractors ~~can and should~~ may meet with the appropriate Lead Agency (or other government agency) to determine traffic management strategies to reduce, to the maximum extent feasible, traffic congestion and the effects of parking demand by construction workers during construction of this project and other nearby projects that could be simultaneously under construction. The project sponsor ~~should~~ may develop a construction management plan for review and approval by the Lead Agency (or other government agency as appropriate). The plan ~~should~~ may include at least the following items and requirements:

- A set of comprehensive traffic control measures, including scheduling of major truck trips and deliveries to avoid peak traffic hours, detour signs if required, lane closure procedures, signs, cones for drivers, and designated construction access routes.
- Notification procedures for adjacent property owners and public safety personnel regarding when major deliveries, detours, and lane closures will occur.
- Location of construction staging areas for materials, equipment, and vehicles at an approved location.
- A process for responding to, and tracking, complaints pertaining to construction activity, including identification of an onsite complaint manager. The manager ~~should~~ may determine the cause of the complaints and ~~should~~ may take prompt action to correct the problem. The Lead Agency ~~should~~ may be informed who the Manager is prior to the issuance of the first permit.
- Provision for accommodation of pedestrian flow.
- As necessary, provision for parking management and spaces for all construction workers to ensure that construction workers do not park in on street spaces.
- Any damage to the street caused by heavy equipment, or as a result of this construction, ~~should~~ may be repaired, at the project sponsor's expense, within one week of the occurrence of the damage (or excessive wear), unless further damage/excessive wear may continue; in such case, repair ~~should~~ may occur prior to issuance of a final inspection of the building permit. All damage that is a threat to public health or safety ~~should~~ may be repaired immediately. The street ~~should~~ may be restored to its condition prior to the new construction as established by the Lead Agency (or other appropriate government agency) and/or photo documentation, at the sponsor's expense, before the issuance of a Certificate of Occupancy.
- Any heavy equipment brought to the construction site ~~should~~ may be transported by truck, where feasible.
- No materials or equipment ~~should~~ may be stored on the traveled roadway at any time.
- Prior to construction, a portable toilet facility and a debris box ~~should~~ may be installed on the site, and properly maintained through project completion.
- All equipment ~~should~~ may be equipped with mufflers.
- Prior to the end of each work-day during construction, the contractor or contractors ~~should~~ may pick up and properly dispose of all litter resulting from or related to the project, whether located on the property, within the public rights-of-way, or properties of adjacent or nearby neighbors.

TR14: Local jurisdictions ~~can and should~~ may encourage the use of public transit systems by enhancing safety and cleanliness on vehicles and in and around stations, providing shuttle service to public transit, offering public transit incentives and providing public education and publicity about public transportation services.

TR15: Local jurisdictions ~~can and should~~ may encourage bicycling and walking by incorporating bicycle lanes into street systems in regional transportation plans, new subdivisions, and large developments, creating bicycle lanes and walking paths directed to the location of schools and other logical points of destination and provide adequate bicycle parking, and encouraging commercial projects to include facilities on-site to encourage employees to bicycle or walk to work.

TR16: Transit agencies ~~can and should~~ may encourage bicycling to transit facilities by providing additional bicycle parking, locker facilities, and bike lane access to transit facilities when feasible.

TR17:* Project sponsors ~~can and should~~ may ensure that prior to construction all necessary local and State road and railroad encroachment permits are obtained. As deemed necessary by the governing jurisdiction, the road encroachment permits may require the contractor to prepare a traffic control plan in accordance with professional engineering standards prior to construction. Traffic control plans ~~should~~ may include the following requirements:

- Identification of all roadway locations where special construction techniques (e.g., directional drilling or night construction) would be used to minimize impacts to traffic flow.
- Development of circulation and detour plans to minimize impacts to local street circulation. This may include the use of signing and flagging to guide vehicles through and/or around the construction zone.
- Scheduling of truck trips outside of peak morning and evening commute hours.
- Limiting of lane closures during peak hours to the extent possible.
- Usage of haul routes to minimize truck traffic on local roadways to the extent possible.
- Inclusion of detours for bicycles and pedestrians in all areas potentially affected by project construction.
- Installation of traffic control devices as specified in the California Department of Transportation Manual of Traffic Controls for Construction and Maintenance Work Zones.
- Development and implementation of access plans for highly sensitive land uses such as police and fire stations, transit stations, hospitals, and schools. The access plans would be developed with the facility owner or administrator. To minimize disruption of emergency vehicle access, affected jurisdictions ~~should~~ may be asked to identify detours for emergency vehicles, which will then be posted by the contractor. Notify in advance the facility owner or operator of the timing, location, and duration of construction activities and the locations of detours and lane closures.
- Storage of construction materials only in designated areas
- Coordination with local transit agencies for temporary relocation of routes or bus stops in work zones, as necessary.

TR18: Local jurisdictions ~~can and should~~ may meet an identified transportation-related benchmark.

TR19: Local jurisdictions ~~can and should~~ may adopt a comprehensive parking policy that discourages private vehicle use and encourages the use of alternative transportation.

TR20: Project sponsors ~~can and should~~ may build or fund a major transit stop within or near the development.

TR21: Local jurisdictions and transit agencies ~~can and should~~ may provide public transit incentives such as free or low-cost monthly transit passes to employees, or free ride areas to residents and customers.

TR22: Local jurisdictions and project sponsors ~~can and should~~ may promote “least polluting” ways to connect people and goods to their destinations.

TR23: Local jurisdictions and project sponsors ~~can and should~~ may incorporate bicycle lanes, routes and facilities into street systems, new subdivisions, and large developments.

TR24: Local jurisdictions ~~can and should~~ may require amenities for non-motorized transportation, such as secure and convenient bicycle parking.

TR25: Local jurisdictions ~~can and should~~ may ensure that the project enhances, and does not disrupt or create barriers to, non-motorized transportation.

TR26: Local jurisdictions ~~can and should~~ may connect parks and open space through shared pedestrian/bike paths and trails to encourage walking and bicycling.

TR27: Local jurisdictions ~~can and should~~ may create bicycle lanes and walking paths directed to the location of schools, parks and other destination points.

TR28: Local jurisdictions ~~can and should~~ may work with the school districts to improve pedestrian and bike access to schools and to restore or expand school bus service using lower-emitting vehicles.

TR29: Local jurisdictions and transit agencies ~~can and should~~ may provide information on alternative transportation options for consumers, residents, tenants and employees to reduce transportation-related emissions.

- TR30:** Local jurisdictions ~~can and should~~ may educate consumers, residents, tenants and the public about options for reducing motor vehicle-related greenhouse gas emissions. Include information on trip reduction; trip linking; vehicle performance and efficiency (e.g., keeping tires inflated); and low-, and/or near zero- and/or zero-emission vehicles.
- TR31:** Local jurisdictions ~~can and should~~ may purchase, or create incentives for purchasing, low-, and/or near zero and/or zero-emission vehicles.
- TR32:** Local jurisdictions ~~can and should~~ may create local “light vehicle” networks, such as neighborhood electric vehicle systems.
- TR33:** * Local jurisdictions ~~can and should~~ may enforce and follow limits idling time for commercial vehicles, including delivery and construction vehicles.
- TR34:** Local jurisdictions ~~can and should~~ may provide the necessary facilities and infrastructure to encourage the use of low-, and/or near zero- and/or zero-emission vehicles.
- TR35:** Local jurisdictions ~~can and should~~ may reduce GHG emissions by reducing vehicle miles traveled and by increasing or encouraging the use of alternative fuels and transportation technologies.
- TR36:** Local jurisdictions ~~can and should~~ may reduce VMT-related emissions by encouraging the use of public transit through adoption of new development standards that would require improvements to the transit system and infrastructure, increase safety and accessibility, and provide other incentives.
- TR37:** Project Selection: Local jurisdictions ~~can and should~~ may give priority to transportation projects that would contribute to a reduction in vehicle miles traveled per capita, while maintaining economic vitality and sustainability.
- TR38:** Equal Pedestrian Access Local jurisdictions ~~can and should~~ may include separated sidewalks whenever possible, on both sides of all new street improvement projects, except where there are severe topographic or natural resource constraints.
- TR39:*** Public Involvement: Local jurisdictions ~~can and should~~ may carry out a comprehensive public involvement and input process that provides information about transportation issues, projects, and processes to community members and other stakeholders, especially to those traditionally underserved by transportation services.
- TR40:** System Interconnectivity: Local jurisdictions ~~can and should~~ may create an interconnected transportation system that allows a shift in travel from private passenger vehicles to alternative modes, including public transit, ride sharing, car sharing, bicycling and walking, by incorporating the following:
- Ensuring transportation centers are multi-modal to allow transportation modes to intersect;
 - Providing adequate and affordable public transportation choices, including expanded bus routes and service, as well as other transit choices such as shuttles, light rail, and rail;
 - To the extent feasible, extending service and hours of operation to underserved arterials and population centers or destinations such as colleges;
 - Focusing transit resources on high-volume corridors and high-boarding destinations such as colleges, employment centers and regional destinations;
 - Coordinating schedules and routes across service lines with neighboring transit authorities;
 - Supporting programs to provide “station cars” for short trips to and from transit nodes (e.g., neighborhood electric vehicles);
 - Studying the feasibility of providing free transit to areas with residential densities of 15 dwelling units per acre or more, including options such as removing service from less dense, underutilized areas to do so;
 - Employing transit-preferential measures, such as signal priority and bypass lanes. Where compatible with adjacent land use designations, right-of-way acquisition or parking removal may occur to accommodate transit-preferential measures or improve access to transit. The use of access management ~~should~~ may be considered where needed to reduce conflicts between transit vehicles and other vehicles;
 - Providing safe and convenient access for pedestrians and bicyclists to, across, and along major transit priority streets;
 - Using park-and-ride facilities to access transit stations only at ends of regional transitways or where adequate feeder bus service is not feasible.

- TR41:** Transit System Infrastructure: Local jurisdictions ~~can and should~~ may upgrade and maintain transit system infrastructure to enhance public use, including:
- Ensuring transit stops and bus lanes are safe, convenient, clean and efficient;
 - Ensuring transit stops have clearly marked street-level designation, and are accessible;
 - Ensuring transit stops are safe, sheltered, benches are clean, and lighting is adequate;
 - Placing transit stations along transit corridors within mixed-use or transit-oriented development areas at intervals of three to four blocks, or no less than one-half mile.
- TR42:** Customer Service: Transit agencies ~~can and should~~ may enhance customer service and system ease-of-use, including:
- Developing a Regional Pass system to reduce the number of different passes and tickets required of system users;
 - Implementing “Smart Bus” technology, using GPS and electronic displays at transit stops to provide customers with “real-time” arrival and departure time information (and to allow the system operator to respond more quickly and effectively to disruptions in service);
 - Investigating the feasibility of an on-line trip-planning program.
- TR43:** Transit Funding: Local jurisdictions ~~can and should~~ may prioritize transportation funding to support a shift from private passenger vehicles to transit and other modes of transportation, including:
- Give funding preference to improvements in public transit over other new infrastructure for private automobile traffic;
 - Before funding transportation improvements that increase roadway capacity and VMT, evaluate the feasibility and effectiveness of funding projects that support alternative modes of transportation and reduce VMT, including transit, and bicycle and pedestrian access.
- TR44:** Transit and Multimodal Impact Fees: Local jurisdictions ~~can and should~~ may ~~consider the use of assess~~ transit and multimodal impact fees on new developments to fund public transportation infrastructure, bicycle infrastructure, pedestrian infrastructure and other multimodal accommodations.

Above measure revised to clarify intent and emphasize local discretion for revenue programs.

- TR45:** Local jurisdictions ~~can and should~~ may implement traffic and roadway management strategies to improve mobility and efficiency, and reduce associated emissions.
- TR46:** System Monitoring: Local jurisdictions ~~can and should~~ may monitor traffic and congestion to determine when and where new transportation facilities are needed in order to increase access and efficiency.
- TR47:** Arterial Traffic Management: Local jurisdictions ~~can and should~~ may modify arterial roadways to allow more efficient bus operation, including bus lanes and signal priority/preemption where necessary.
- TR48:** Signal Synchronization: Local jurisdictions ~~can and should~~ may expand signal timing programs where emissions reduction benefits can be demonstrated, including maintenance of the synchronization system, and ~~will~~ will ~~coordination~~ with adjoining jurisdictions as needed to optimize transit operation while maintaining a free flow of traffic.
- TR49:** HOV Lanes: Local jurisdictions ~~can and should~~ may encourage the construction of high-occupancy vehicle (HOV) lanes or similar mechanisms whenever necessary to relieve congestion and reduce emissions.
- TR50:** Delivery Schedules: Where operationally feasible, local jurisdictions ~~can and should~~ may establish ordinances or land use permit conditions limiting the hours when deliveries can be made to off-peak hours in high traffic areas.

Above measure revised so that changes to delivery hours consider operational feasibility.

- TR51:** Local jurisdictions ~~can and should~~ may reduce VMT related-emissions by implementing and supporting trip reduction programs.

TR52: Ride-Share Programs: Local jurisdictions ~~can and should~~ may promote ride-sharing programs, including:

- Designate a certain percentage of parking spaces for ride-sharing vehicles;
- Designate adequate passenger loading, unloading, and waiting areas for ride-sharing vehicles;
- Provide a web site or message board for coordinating shared rides;
- Encourage private, for-profit community car-sharing, including parking spaces for car share vehicles at convenient locations accessible by public transit;
- Hire or designate a rideshare coordinator to develop and implement ridesharing programs.

TR53: Employer-based Trip Reduction: Local jurisdictions ~~can and should~~ may support voluntary, employer-based trip reduction programs, including:

- Provide assistance to regional and local ridesharing organizations;
- Advocate for legislation to maintain and expand incentives for employer ridesharing programs;
- Require the development of Transportation Management Associations for large employers and commercial/ industrial complexes;
- Provide public recognition of effective programs through awards, top ten lists, and other mechanisms.

TR54: Ride Home Programs: Local jurisdictions ~~can and should~~ may implement a “guaranteed ride home” program for those who commute by public transit, ride-sharing, or other modes of transportation, and encourage employers to subscribe to or support the program.

TR55: Local Area Shuttles: Transit agencies ~~can and should~~ may encourage and utilize shuttles to serve neighborhoods, employment centers and major destinations.

TR56: Local jurisdictions and transit agencies ~~can and should~~ may create a free or low-cost local area shuttle system that includes a fixed route to popular tourist destinations or shopping and business centers.

TR57: Local jurisdictions ~~can and should~~ may work with existing shuttle service providers to coordinate their services.

TR58: Low- and No-Travel Employment Opportunities: Local jurisdictions ~~can and should~~ may facilitate employment opportunities that minimize the need for private vehicle trips, including:

- Amend zoning ordinances and the Development Code to include live/work sites and satellite work centers in appropriate locations;
- Encourage telecommuting options with new and existing employers, through project review and incentives, as appropriate.

TR59:* Local jurisdictions ~~can and should~~ may support bicycle use as a mode of transportation by enhancing infrastructure to accommodate bicycles and riders, and providing incentives.

TR60: Development Standards for Bicycles: Local jurisdictions ~~can and should~~ may establish standards for new development and redevelopment projects to support bicycle use, including:

- Amending the Development Code to include standards for safe pedestrian and bicyclist accommodations, by incorporating the following:
 - “Complete Streets” policies that foster equal access by all users in the roadway design;
 - Bicycle and pedestrian access internally and in connection to other areas through easements;
 - Safe access to public transportation and other non-motorized uses through construction of dedicated paths;
 - Safe road crossings at major intersections, especially for school children and seniors;
 - Adequate, convenient and secure bike parking at public and private facilities and destinations in all urban areas;
 - Street standards ~~will~~ may include provisions for bicycle parking within the public right of way.

TR61: Local jurisdictions ~~can and should~~ may require new development and redevelopment projects to include bicycle facilities, as appropriate with the new land use, including:

- Construction of weatherproof bicycle facilities where feasible, and at a minimum, bicycle racks or covered, secure parking near the building entrances;

- Provision and maintenance of changing rooms, lockers, and showers at large employers or employment centers.
 - Prohibit projects that impede bicycle and pedestrian access, such as large parking areas that cannot be safely crossed by non-motorized vehicles, and developments that block through access on existing or potential bicycle and pedestrian routes;
 - Encourage the development of bicycle stations at intermodal hubs, with attended or “valet” bicycle parking, and other amenities such as bicycle rental and repair, and changing areas with lockers and showers;
 - Conduct a connectivity analysis of the existing bikeway network to identify gaps, and prioritize bikeway development where gaps exist.
- TR62:** Bicycle and Pedestrian Trails: Local jurisdictions ~~can and should~~ may establish a network of multi-use trails to facilitate safe and direct off-street bicycle and pedestrian travel, and ~~will~~ provide bike racks along these trails at secure, lighted locations
- TR63:** Bicycle Safety Program: Local jurisdictions ~~can and should~~ may develop and implement a bicycle safety educational program to teach drivers and riders the laws, riding protocols, routes, safety tips, and emergency maneuvers.
- TR64:** Bicycle and Pedestrian Project Funding: Local jurisdictions ~~can and should~~ may pursue and provide enhanced funding for bicycle and pedestrian facilities and access projects, including, as appropriate:
- Apply for regional, State, and federal grants for bicycle and pedestrian infrastructure projects;
 - Establish development exactions and impact fees to fund bicycle and pedestrian facilities;
 - Use existing revenues, such as State gas tax subventions, sales tax funds, and general fund monies for projects to enhance bicycle use and walking for transportation.
- TR65:** Bicycle Parking: Local jurisdictions ~~can and should~~ may adopt bicycle parking standards that ensure bicycle parking sufficient to accommodate 5 to 10 percent of projected use at all public and commercial facilities, and at a rate of at least one per residential unit in multiple-family developments (suggestion: check language with League of American Bicyclists).
- TR66:** Local jurisdictions ~~can and should~~ may establish parking policies and requirements that capture the true cost of private vehicle use and support alternative modes of transportation.
- TR67:** Parking Policy: Local jurisdictions ~~can and should~~ may adopt a comprehensive parking policy to discourage private vehicle use and encourage the use of alternative transportation by incorporating the following:
- Reduce the available parking spaces for private vehicles while increasing parking spaces for shared vehicles, bicycles, and other alternative modes of transportation;
 - Eliminate or reduce minimum parking requirements for new buildings;
 - “Unbundle” parking (require that parking is paid for separately and is not included in the base rent for residential and commercial space);
 - Use parking pricing to discourage private vehicle use, especially at peak times;
 - Create parking benefit districts, which invest meter revenues in pedestrian infrastructure and other public amenities;
 - Establish performance pricing of street parking, so that it is expensive enough to promote frequent turnover and keep 15 percent of spaces empty at all times;
 - Encourage shared parking programs in mixed-use and transit-oriented development areas.
- TR68:** Event Parking Policies: Local jurisdictions ~~can and should~~ may establish policies and programs to reduce onsite parking demand and promote ride-sharing and public transit at large events, including:
- Promote the use of peripheral parking by increasing on-site parking rates and offering reduced rates for peripheral parking;
 - Encourage special event center operators to advertise and offer discounted transit passes with event tickets;
 - Encourage special event center operators to advertise and offer discount parking incentives to carpooling patrons, with four or more persons per vehicle for on-site parking;
 - Promote the use of bicycles by providing space for the operation of valet bicycle parking service.

- TR69:** Parking “Cash-out” Program: Local jurisdictions ~~can and should~~ may require new office developments with more than 50 employees to offer a Parking “Cash-out” Program to discourage private vehicle use.
- TR70:** Electric/Alternative Fuel Vehicle Parking: Local jurisdictions ~~can and should~~ may require new commercial and retail developments to provide prioritized parking for electric vehicles and vehicles using alternative fuels.
- TR71:** Local jurisdictions ~~can and should~~ may support and promote the use of low-, and/or near zero- and/or zero-emission vehicles, and alternative fuels, and other measures to directly reduce emissions from motor vehicles.
- TR72:** Low-, and/or near zero and/or Zero Emission Vehicles: Local jurisdictions ~~can and should~~ may support and promote the use of low-, and/or near zero- and/or zero-emission vehicles, by doing the following:
- Develop the necessary infrastructure to encourage the use of low-, and/or near zero- and/or zero-emission vehicles and clean alternative fuels, such as development of electric vehicle charging facilities and conveniently located alternative fueling stations;
 - Encourage new construction to include vehicle access to properly wired outdoor receptacles to accommodate ZEV and/or plug in electric hybrids (PHEV);
 - Encourage transportation fleet standards to achieve the lowest emissions possible, using a mix of alternate fuels, PZEV or better fleet mixes;
 - Establish incentives, as appropriate, to taxicab owners to use alternative fuel or gas-electric hybrid vehicles.

Measure made consistent.

- TR73:*** Vehicle Idling: Local jurisdictions ~~can and should~~ may enforce State idling laws for commercial vehicles, including delivery and construction vehicles.
- TR74:** Pedestrian and Bicycle Promotion: Local jurisdictions ~~can and should~~ may work with local community groups and downtown business associations to organize and publicize walking tours and bicycle events, and to encourage pedestrian and bicycle modes of transportation.
- TR75:** Local jurisdictions ~~can and should~~ may organize events and workshops to promote GHG-reducing activities.
- TR76:** Fleet Replacement: Local jurisdictions and agencies ~~can and should~~ may establish a replacement policy and schedule to replace fleet vehicles and equipment with the most fuel efficient vehicles practical, including gasoline hybrid and alternative fuel or electric models.
- TR77:** Local jurisdictions ~~can and should~~ may implement measures to reduce employee vehicle trips and to mitigate emissions impacts from municipal travel.
- TR78:** Trip Reduction Program: Local jurisdictions ~~can and should~~ may implement a program to reduce vehicle trips by employees, including:
- Providing incentives and infrastructure for vanpooling and carpooling, such as pool vehicles, preferred parking, and a website or bulletin board to facilitate ride-sharing;
 - Providing subsidized passes for mass transit;
 - Offering compressed work hours, off-peak work hours, and telecommuting, where appropriate;
 - Offer a guaranteed ride home for employees who use alternative modes of transportation to commute.
- TR79:** Bicycle Transportation Support: Local jurisdictions ~~can and should~~ may promote and support the use of bicycles as transportation, including:
- Providing bicycle stations with secure, covered parking, changing areas with storage lockers and showers, as well as a central facility where minor repairs can be made;
 - Providing bicycles, including electric bikes, for employees to use for short trips during business hours;
 - Implementing a police-on-bicycles program;
 - Providing a bicycle safety program, and information about safe routes to work.
- TR80:** Municipal Parking Management: Local jurisdictions ~~can and should~~ may implement a Parking Management Program to discourage private vehicle use, including:
- Encouraging carpools and vanpools with preferential parking and a reduced parking fee;

- Institute a parking cash-out program;
- Renegotiate employee contracts, where possible, to eliminate parking subsidies;
- Install on-street parking meters with fee structures designed to discourage private vehicle use;
- Establish a parking fee for all single-occupant vehicles.

TR81: Travel Mitigation: Local jurisdictions ~~can and should~~ may mitigate business-related travel, especially air travel, through the annual purchase of verified carbon offsets.

TR82: Transit Access to Municipal Facilities: Local jurisdiction and agency facilities ~~can and should~~ may be located on major transit corridors, unless their use is plainly incompatible with other uses located along major transit corridors.

TR83: Local jurisdictions and development project sponsors may and are encouraged to coordinate and consult early with the Caltrans District Planning offices of Local Development Intergovernmental Review on any land use proposal that would be located within 500 feet of state transportation facilities to enable consideration of the site specific access and operational safety impacts.

Above measure added in response to a comment from Caltrans.

WATER RESOURCES

W1: Local jurisdictions ~~can and should~~ may encourage new development and industry to locate in those service areas with existing wastewater infrastructure and treatment capacity, making greater use of those facilities prior to incurring new infrastructure costs.

W2: Local jurisdictions ~~can and should~~ may promote reduced wastewater system demand by: designing wastewater systems to minimize inflow and increase upstream treatment and infiltration to the extent feasible, reducing overall source water generation by domestic and industrial users, deferring development approvals for industries that generate high volumes of wastewater until wastewater agencies have expanded capacity.

W3: Wastewater treatment agencies are encouraged to have expansion plans, approvals and financing in place once their facilities are operating at 80 percent of capacity.

W4: Project sponsors ~~can and should~~ may coordinate with the local wastewater provider in order to ensure that existing and/or planned sewer conveyance and treatment facilities are capable of meeting wastewater flow capacity requirements. Each project sponsor ~~can and should~~ may identify specific on- and off-site improvements needed to ensure that impacts related to wastewater conveyance capacity are addressed prior to issuance of plans. Sewer capacity clearance from the local wastewater provider ~~will~~ may be required at the time that a sewer connection permit application is submitted.

W5:* As appropriate, confirmation of the capacity of the surrounding stormwater and sanitary sewer system and state of repair ~~can and should~~ may be completed by a qualified civil engineer with funding from the project sponsor. The project sponsor ~~can and should~~ may be responsible for the necessary stormwater and sanitary sewer infrastructure improvements to accommodate the proposed project. In addition, the sponsor ~~can and should~~ may be required to pay any fees to improve sanitary sewer infrastructure as may be required by the applicable local agencies. Improvements to the existing sanitary sewer collection system ~~can and should~~ may specifically include, but are not limited to, mechanisms to control or minimize increases in infiltration/inflow to offset sanitary sewer increases associated with the proposed project. To the maximum extent practicable, the sponsor ~~will~~ may be required to implement Best Management Practices to reduce the peak stormwater runoff from the project site. Additionally, the project sponsor ~~can and should~~ may be responsible for payment of any required installation or hook-up fees to the affected service providers.

W6: Wastewater treatment agencies ~~can and should~~ may maximize efficiency of wastewater treatment and pumping equipment.

W7:* Project sponsors with projects requiring the discharge of dredged or fill materials into U.S. waters, including wetlands, ~~can and should~~ may comply with sections 404 and 401 of the Clean Water Act including the requirement to obtain a permit from the U.S. Army Corps of Engineers and the governing Regional Water Quality Control Board.

W8:* Project sponsor ~~can and should~~ may ensure that natural riparian conditions near projects are maintained, wherever feasible, to minimize the effects of stormwater flows at stream crossings. Where feasible, riparian areas ~~can and should~~ may be restored or expanded to mitigate additional impervious surface and associated runoff.

W9:* Prior to construction within the vicinity of a watercourse, the project sponsor ~~can and should~~ may obtain all necessary regulatory permits and authorizations from the U.S. Army Corps of Engineers (Corps), Regional Water Quality Control Board (RWQCB), California Department of Fish and Game, California Coastal Commission, and local jurisdictions, and ~~should~~ may comply with all conditions issued by applicable agencies. Required permit approvals and certifications may include, but not be limited to the following:

- U.S. Army Corps of Engineers (Corps): Section 404. Permit approval from the Corps ~~should~~ may be obtained for the placement of dredge or fill material in Waters of the U.S., if any, within the interior of the project site, pursuant to Section 404 of the federal Clean Water Act.
- Regional Water Quality Control Board (RWQCB): Section 401 Water Quality Certification. Certification that the project will not violate state water quality standards is required before the Corps can issue a 404 permit, above.
- California Department of Fish and Game (CDFG): Section 1602 Lake and Streambed Alteration Agreement. Work that will alter the bed or bank of a stream requires authorization from CDFG.

A qualified environmental consultant ~~can and should~~ may be retained and paid for by the project sponsor to make site visits as necessary; and as a follow-up, submit to the Lead Agency a letter certifying that all required conditions have been instituted during the grading activities.

W10:* Prior to issuance of a demolition, grading, or building permit within vicinity of a watercourse project sponsors ~~can and should~~ may develop a final detailed landscaping and irrigation plan for review and approval by the appropriate local jurisdiction prepared by a licensed landscape architect or other qualified person. Such a plan ~~should~~ may include a planting schedule, detailing plant types and locations, and a system for temporary irrigation of plantings.

- Plant and maintain only drought-tolerant plants on the site where appropriate, as well as native and riparian plants in and adjacent to riparian corridors. Along the riparian corridor, native plants ~~should~~ may not be disturbed to the maximum extent feasible. Any areas disturbed along the riparian corridor ~~should~~ may be replanted with mature native riparian vegetation and be maintained to ensure survival.
- All landscaping indicated on the approved landscape plan ~~should~~ may be installed prior to the issuance of a Final inspection of the building permit, otherwise permitted.

All landscaping areas shown on the approved plans ~~should~~ may be maintained in neat and safe conditions, and all plants ~~should~~ may be maintained in good growing condition and, whenever necessary replaced with new plant materials to ensure continued compliance with all applicable landscaping requirements. All paving or impervious surfaces ~~should~~ may occur only on approved areas.

W11:* Project sponsors ~~can and should~~ may comply with the State-wide construction storm water discharge permit requirements including preparation of Storm Water Pollution Prevention Plans for transportation improvement construction projects. Roadway construction projects ~~can and should~~ may comply with the Caltrans storm water discharge permit. Best Management Practices ~~can and should~~ may be identified and implemented to manage site erosion, wash water runoff, and spill control.

W12:* Project sponsors ~~can and should~~ may comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) to address stormwater runoff. Detailed examples of potential mitigation activities that may be required by the Lead Agency are described below.

ADDITIONAL ACTIVITY

The Project sponsors ~~can and should~~ may submit with the application for a building permit (or other construction-related permit) a completed Construction-Permit-Phase Stormwater Supplemental Form. The project drawings submitted for the building permit (or other construction-related permit) ~~should~~ may contain a stormwater management plan, for review and approval by the appropriate agency, to manage stormwater run-off and to limit the discharge of pollutants in stormwater after construction of the project to the maximum extent practicable. The post-construction stormwater management plan ~~should~~ may include and identify the following:

- All proposed impervious surface on the site;

- Anticipated directional flows of on-site stormwater runoff; and
- Site design measures to reduce the amount of impervious surface area and directly connected impervious surfaces; and
- Source control measures to limit the potential for stormwater pollution;
- Stormwater treatment measures to remove pollutants from stormwater runoff; and
- Hydromodification management measures so that post-project stormwater runoff does not exceed the flow and duration of pre-project runoff, if required under the NPDES permit.

The following additional information ~~should~~may be submitted with the post-construction stormwater management plan:

- Detailed hydraulic sizing calculations for each stormwater treatment measure proposed; and
- Pollutant removal information demonstrating that any proposed manufactured/mechanical (i.e. non-landscape-based) stormwater treatment measure, when not used in combination with a landscape-based treatment measure, is capable of removing the range of pollutants typically removed by landscape-based treatment measures and/or the range of pollutants expected to be generated by the project.

All proposed stormwater treatment measures ~~can and should~~may incorporate appropriate planting materials for stormwater treatment (for landscape-based treatment measures) and ~~should~~may be designed with considerations for vector/mosquito control. Proposed planting materials for all proposed landscape-based stormwater treatment measures ~~should~~may be included on the landscape and irrigation plan for the project. The sponsor is not required to include on-site stormwater treatment measures in the post-construction stormwater management plan if he or she secures approval from an appropriate agency that an alternate approach is appropriate. The project sponsor ~~can and should~~may implement the approved stormwater management plan.

Above measure revised to emphasize detailed information cited as examples.

- W13:*** Project sponsors ~~can and should~~may consult with the RWQCB and Storm Water Management Plan permit holders as projects are designed to ensure that projects protect the goals of the Clean Water Act and comply with federal storm water NPDES permits.
- W14:*** Project sponsors ~~can and should~~may ensure that new facilities include structural water quality control features such as drainage channels, detention basins, oil and grease traps, filter systems, and vegetated buffers to prevent pollution of adjacent water resources by polluted runoff where required by applicable urban storm water runoff discharge permits.
- W15:*** Structural storm water runoff treatment ~~can and should~~may be provided according to the applicable urban storm water runoff permit where facilities will be operated by a permitted municipality or county. Where Caltrans is the operator, the statewide permit applies.
- W16:*** Project sponsors ~~can and should~~may ensure that operational best management practices for street cleaning, litter control, and catch basin cleaning are implemented to prevent water quality degradation in compliance with applicable storm water runoff discharge permits. Efforts ~~can and should~~may be made to assure treatment controls are in place as early as possible, such as during the acquisition process for rights-of-way, not just later during the facilities design and construction phase.
- W17:*** In compliance with applicable municipal separate storm sewer system discharge permits as well as Caltrans' storm water discharge permit, long-term sediment control ~~can and should~~may be affected through erosion control and revegetation programs designed to allow reestablishment of native vegetation on slopes and undeveloped areas.
- W18:*** Drainage of roadway runoff ~~can and should~~may comply with Caltrans' storm water discharge permit. Wherever possible, roadways ~~can and should~~may be designed to convey storm water through vegetated median strips that provide detention capacity and allow for infiltration before reaching culverts.
- W19:*** Treatment and control features such as detention basins, infiltration strips, and porous paving, other features to control surface runoff and facilitate groundwater recharge ~~can and should~~may be incorporated into the design of new transportation projects early on in the process to ensure that adequate acreage and elevation contours are provided during the right-of-way acquisition process.

- W20:*** Project sponsors ~~can and should~~ may assure projects mitigate for changes to the volume of runoff, where any downstream receiving water body has not been designed and maintained to accommodate the increase in flow velocity, rate, and volume without impacting the water's beneficial uses. Pre-project flow velocities, rates, and volumes must not be exceeded. This applies not only to increases in storm water runoff from the project site, but also to hydrologic changes induced by flood plain encroachment. Projects ~~should~~ may not cause or contribute to conditions that degrade the physical integrity or ecological function of any downstream receiving waters.
- W21:*** Impacts ~~can and should~~ may be reduced to the extent possible by providing culverts and facilities that do not increase the flow velocity, rate, or volume and/or acquiring sufficient storm drain easements that accommodate an appropriately vegetated earthen drainage channel.
- W22:*** Project sponsors of improvement projects on existing facilities ~~can and should~~ may include upgrades to stormwater drainage facilities to accommodate any increased runoff volumes. These upgrades may include the construction of detention basins or structures that will delay peak flows and reduce flow velocities, including expansion and restoration of wetlands and riparian buffer areas. System designs ~~can and should~~ may be completed to eliminate increases in peak flow rates from current levels.
- W23:*** Local jurisdictions ~~can and should~~ may encourage Low Impact Development and incorporation of natural spaces that reduce, treat, infiltrate and manage stormwater runoff flows in all new developments, where practical and feasible.
- W24:*** Project sponsor ~~can and should~~ may ensure that for sites less than one acre, project drawings submitted for a building permit (or other construction-related permit) contain a final site plan to be reviewed and approved by the appropriate local agency. The final site plan ~~should~~ may incorporate appropriate site design measures to manage stormwater runoff and minimize impacts to water quality after the construction of the project. These measures may include, but are not limited to, the following:

- Minimize impervious surfaces, especially directly connected impervious surfaces;
- Utilize permeable paving in place of impervious paving where appropriate;
- Cluster buildings;
- Preserve quality open space; and
- Establish vegetated buffer areas.

The approved plan ~~should~~ may be implemented and the site design measures shown on the plan ~~should~~ may be permanently maintained.

- W25:*** Project sponsors ~~can and should~~ may implement BMPs to reduce erosion, sedimentation, and water quality impacts during construction to the maximum extent practicable. Plans demonstrating BMPs ~~should~~ may be submitted for review and approval by the Lead Agency. At a minimum, the project sponsor ~~can and should~~ may provide filter materials deemed acceptable to the Lead Agency at nearby catch basins to prevent any debris and dirt from flowing into the local storm drain system and creeks.
- W26:*** Project sponsors for sites over one acre, ~~must~~ may obtain coverage under the General Construction Activity Storm Water Permit (General Construction Permit) issued by the State Water Resources Control Board (SWRCB). The project sponsor ~~must~~ may file a notice of intent (NOI) with the SWRCB. The project sponsor ~~will~~ may be required to prepare a stormwater pollution prevention plan (SWPPP) and submit the plan for review and approval by the Lead Agency. At a minimum, the SWPPP ~~should~~ may include a description of construction materials, practices, and equipment storage and maintenance; a list of pollutants likely to contact stormwater; site-specific erosion and sedimentation control practices; a list of provisions to eliminate or reduce discharge of materials to stormwater; BMPs, and an inspection and monitoring program. Prior to the issuance of any construction-related permits, the project sponsor ~~should~~ may submit to the lead agency a copy of the SWPPP and evidence of submittal of the NOI to the SWRCB. Implementation of the SWPPP ~~should~~ may start with the commencement of construction and continue through the completion of the project. After construction is completed, the project sponsor ~~can and should~~ may submit a notice of termination to the SWRCB.
- W27:*** Project sponsors ~~can and should~~ may ensure that project drawings submitted for a building permit (or other construction-related permit) contain a drainage plan to be reviewed and approved by the appropriate agency. The drainage plan ~~should~~ may include measures to reduce the post-construction volume and velocity of

stormwater runoff to the maximum extent practicable. Stormwater runoff ~~should~~may not be augmented to adjacent properties or creeks. The drainage plan ~~should~~may include and identify the following:

- All proposed impervious surface on the site;
- Anticipated directional flows of on-site stormwater runoff;
- Site design measures to reduce the amount of impervious surface area and directly connected impervious surfaces;
- Source control measures to limit the potential for stormwater pollution; and
- Stormwater treatment measures to remove pollutants from stormwater runoff.

W28:* Project sponsors ~~can and should~~may submit an erosion and sedimentation control plan for review and approval by the appropriate government agency. All work ~~should~~may incorporate all applicable BMPs for the construction industry, including BMP's for dust, erosion and water quality. The measures ~~should~~may include, but are not limited to, the following:

- On sloped properties, the downhill end of the construction area must be protected with silt fencing (such as sandbags, filter fabric, silt curtains, etc.) and hay bales oriented parallel to the contours of the slope (at a constant elevation) to prevent erosion into the street, gutters, stormdrains.
- In accordance with an approved erosion control plan, the project sponsor ~~should~~may implement mechanical and vegetative measures to reduce erosion and sedimentation, including appropriate seasonal maintenance. One hundred (100) percent degradable erosion control fabric ~~should~~may be installed on all graded slopes to protect and stabilize the slopes during construction and before permanent vegetation gets established. All graded areas ~~should~~may be temporarily protected from erosion by seeding with fast growing annual species. All bare slopes ~~must~~may be covered with staked tarps when rain is occurring or is expected.
- Minimize the removal of natural vegetation or ground cover from the site in order to minimize the potential for erosion and sedimentation problems. Maximize the replanting of the area with native vegetation as soon as possible.
- Install filter materials acceptable to the appropriate agency at the storm drain inlets nearest to the project site prior to the start of the wet weather season (October 15); site dewatering activities; street washing activities; saw cutting asphalt or concrete; and in order to retain any debris flowing into the storm drain system. Filter materials ~~should~~may be maintained and/or replaced as necessary to ensure effectiveness and prevent street flooding.
- Ensure that concrete/granite supply trucks or concrete/plaster finishing operations do not discharge wash water into water courses, street gutters, or storm drains.
- Direct and locate tool and equipment cleaning so that wash water does not discharge into the street, gutters, or stormdrains.
- Create a contained and covered area on the site for storage of bags of cement, paints, flammables, oils, fertilizers, pesticides, or any other materials used on the project site that have the potential for being discharged to the storm drain system by the wind or in the event of a material spill. No hazardous waste material ~~should~~may be stored on-site.
- Gather all construction debris on a regular basis and place them in a dumpster or other container which is emptied or removed on a weekly (or other interval approved by the Lead Agency) basis. When appropriate, use tarps on the ground to collect fallen debris or splatters that could contribute to stormwater pollution.
- Remove all dirt, gravel, refuse, and green waste from the sidewalk, street pavement, and storm drain system adjoining the project site. During wet weather, avoid driving vehicles off paved areas and other outdoor work.
- As appropriate, broom sweep the street pavement adjoining the project site on a daily basis. Caked-on mud or dirt ~~should~~may be scraped from these areas before sweeping. At the end of each workday, the entire site ~~must~~may be cleaned and secured against potential erosion, dumping, or discharge to the street, gutter, and/or stormdrains.
- All erosion and sedimentation control measures implemented during construction activities, as well as construction site and materials management ~~should~~may be in strict accordance with the control standards listed in the latest edition of the Erosion and Sediment Control Field Manual published by the RWQB.

All erosion and sedimentation control measures ~~should~~may be monitored regularly by the project sponsor. If measures are insufficient to control sedimentation and erosion then the project sponsor ~~should~~may develop and implement additional and more effective measures immediately.

- W29:*** Project sponsors ~~can and should~~ may ensure that projects requiring continual dewatering facilities implement monitoring systems and long-term administrative procedures to ensure proper water management that prevents degrading of surface water and minimizes, to the greatest extent possible, adverse impacts on groundwater for the life of the project. Construction designs ~~can and should~~ may comply with appropriate building codes and standard practices including the Uniform Building Code.
- W30:*** Project sponsors, lead agencies, and local jurisdictions ~~can and should~~ may maximize, where practical and feasible, permeable surface area in existing urbanized areas to protect water quality, reduce flooding, allow for groundwater recharge, and preserve wildlife habitat. New impervious surfaces ~~can and should~~ may be minimized to the greatest extent possible, including the use of in-lieu fees and off-site mitigation.
- W31:** Project sponsors ~~can and should~~ may avoid designs that require continual dewatering where feasible.
- W32:** Where feasible, transportation facilities ~~can and should~~ may not be sited ~~in~~ away from groundwater recharge areas, to prevent conversion of those areas to impervious surface.
- W33:** Project sponsors ~~can and should~~ may reduce hardscape to the extent feasible to facilitate groundwater recharge as appropriate.
- W34:*** Project sponsor ~~can and should~~ may ensure that all roadbeds for new highway and rail facilities be elevated at least one foot above the 100-year base flood elevation. Since alluvial fan flooding is not often identified on FEMA flood maps, the risk of alluvial fan flooding ~~should~~ may be evaluated and projects ~~should~~ may be sited to avoid alluvial fan flooding. Delineation of floodplains and alluvial fan boundaries ~~should~~ may attempt to account for future hydrologic changes caused by global climate change.
- W35:*** Project sponsors of transportation improvements ~~can and should~~ may comply with local, state, and federal floodplain regulations. Projects requiring federal approval or funding ~~should~~ may comply with Executive Order 11988 on Floodplain Management, which requires avoidance of incompatible floodplain development, restoration and preservation of the natural and beneficial floodplain values, and maintenance of consistency with the standards and criteria of the National Flood Insurance Program.
- W36:*** Local jurisdictions ~~can and should~~ may, to the extent feasible and appropriate, prevent development in flood hazard areas that do not have appropriate protections, especially in alluvial fan areas of the region.
- W37:*** Local water agencies ~~can and should~~ may continue to evaluate future water demands and establish the necessary supply and infrastructure to meet that demand, as documented in their Urban Water Management Plans.
- W38:** Project sponsors, local jurisdictions, and water agencies ~~can and should~~ may include conjunctive use as a water management strategy when feasible.
- W39:*** Regional water agencies ~~can and should~~ may consider, to the greatest extent feasible, potential climate change hydrology and attendant impacts on available water supplies and reliability in the process of creating or modifying systems to manage water resources for both year-round use and ecosystem health. As the methodology and base data for such decisions is still developing, agencies ~~can and should~~ may use the best currently available science in decision-making. Local jurisdictions and water agencies ~~can and should~~ may rely on current regional analyses when making local decisions regarding future water supply and reliability.
- W40:** Project sponsors and local jurisdictions ~~can and should~~ may reduce exterior uses of water in public areas, and ~~should~~ may promote reductions in private homes and businesses, by shifting to drought-tolerant native landscape plantings (~~xeriscaping~~), using weather-based irrigation systems, educating other public agencies about water use, and installing related water pricing incentives. Local jurisdictions ~~can and should~~ may also work with local retailers and vendors to promote the availability of drought resistant landscaping options and provide information on where these can be purchased. Use of ~~reclaimed~~ recycled water especially in median landscaping and hillside landscaping ~~can and should~~ may be implemented where feasible.

Above measure edited in response to a comment by Metropolitan Water District (MWD).

- W41:*** Project sponsors ~~can and should~~ may coordinate with the local water provider to ensure that existing and/or planned water supply and water conveyance facilities are capable of meeting water demand/pressure

requirements. In accordance with State Law, a Water Supply Assessment ~~can and should~~ may be required for projects that meet the size requirements specified in the regulations. In coordination with the local water provider, each project sponsor ~~will~~ may identify specific on- and off-site improvements needed to ensure that impacts related to water supply and conveyance demand/pressure requirements are addressed prior to issuance of a certificate of occupancy. Water supply and conveyance demand/pressure clearance from the local water provider ~~will~~ may be required at the time that a water connection permit application is submitted.

W42:* Project sponsors ~~can and should~~ may coordinate with the local fire service provider in order to ensure that existing and/or planned fire hydrants are capable of meeting fire flow demand/pressure requirements. The issuance of building permits ~~will~~ may be dependent upon submission, review, approval, and testing of fire flow demand and pressure requirements, as established by the local fire service provider prior to occupancy.

W43:* Project sponsors ~~can and should~~ may implement water conservation measures in new development that ~~should~~ may include but not be limited to the following:

- Installation of high-efficiency toilets (1.28 gallons per flush or less, includes dual flush).
- High-efficiency urinals (0.125 gallons per flush or less, includes waterless)
- Restroom faucet flow rate of 1.5 gallons per minute or less
- Public restroom faucet flow rate of 0.5 gallons per minute or less and self-closing
- Showerhead flow rate of 2.0 gallons per minute or less
- Limit of one showerhead per shower stall
- High efficiency clothes washers (water factor of 4.0 or less)
- High efficiency dishwashers (Energy Star rated)
- Domestic water heating system located in close proximity to point(s) of use, as feasible; use of tankless and on-demand water heaters as feasible
- Cooling towers must be operated at a minimum of 5.5 cycles of concentration
- Install on-site water recycling as feasible
- Use of recycled water (if available) for appropriate end uses (irrigation, cooling towers, sanitary)
- Single pass cooling ~~should~~ may be prohibited (e.g. any vacuum pumps or ice machines)
- Irrigation ~~should~~ may include:
 - Weather-based irrigation controller with rain shutoff
 - Flow sensor and master valve shutoff (for large landscaped areas)
 - Matched precipitation (flow) rates for sprinkler heads
 - Drip/microspray/subsurface irrigation where appropriate
 - Minimum irrigation system distribution uniformity of 75%
 - Proper hydro-zoning, turf minimization and use of native/drought tolerant plant materials
 - Use of landscape contouring to minimize precipitation runoff

W44:* Project sponsors ~~can and should~~ may consult with the local water provider to identify feasible and reasonable measures to reduce water consumption, including, but not limited to, systems to use ~~reclaimed~~ recycled water for landscaping, drip irrigation, re-circulating hot water systems, water conserving landscape techniques (such as mulching, installation of drip irrigation systems, landscape design to group plants of similar water demand, soil moisture sensors, automatic irrigation systems, clustered landscaped areas to maximize the efficiency of the irrigation system), water conserving kitchen and bathroom fixtures and appliances, thermostatically controlled mixing valves for baths and showers, and insulated hot water lines.

Above measure edited in response to a comment from MWD.

W45:* Project sponsors ~~can and should~~ may incorporate compliance with local drought measures as appropriate including prohibiting hose watering of driveways and associated walkways; requiring decorative fountains to use recycled water, and repairing water leaks in a timely manner.

W46:* Project sponsors ~~can and should~~ may incorporate automatic sprinkler systems that irrigate landscaping during morning hours or during the evening to reduce water losses from evaporation. Sprinklers ~~should~~ may be required to reset to water less often in cooler months and during the rainfall season, so that water is not wasted in excessive landscape irrigation.

W47:* Prior to issuance of building permits, project sponsors ~~can and should~~ may pay any appropriate fees imposed by local water providers to off-set any fair share project costs as identified by the local water provider.

- W48:** As part of the general plan update process, local jurisdictions ~~can and should~~ may coordinate with water providers to identify water budgets for development within their jurisdiction. Local water providers may provide for new water supply through a combination of water conservation (on and potentially off-site) and recycled water, such that the net increase in water demand (not including demand for recycled water) does not exceed the calculated demand anticipated in the most recent Urban Water Management Plan or other similar document.
- W49:*** Project sponsors ~~can and should~~ may create water-efficient landscapes.
- W50:*** Project sponsors ~~can and should~~ may install water-efficient irrigation systems and devices, such as soil moisture-based irrigation controls and use water-efficient irrigation methods.
- W51:*** Project sponsors ~~can and should~~ may incorporate water-reducing features into building and landscape design.
- W52:** Project sponsors ~~should~~ may make effective use of graywater for landscape irrigation. (Graywater is untreated household wastewater from bathtubs, showers, bathroom wash basins, and water from clothes washing machines.)
- W53:*** Project sponsors ~~can and should~~ may implement low-impact development practices that maintain the existing hydrology of the site to manage storm water and protect the environment by doing the following:
- Devise a comprehensive water conservation strategy appropriate for the project and location.
 - Design buildings to be water-efficient. Install water-efficient fixtures and appliances.
 - Offset water demand from new projects so that there is no net increase in water use.
 - Provide education about water conservation and available programs and incentives.
- W54:** Local jurisdictions ~~can and should~~ may adopt and implement a comprehensive strategy to increase water conservation and the use of recycled water that includes similar measure to the following:
- **Water Consumption Reduction Target:** Regional water agencies ~~should~~ may work together to set a target for to reduce per capita water consumption by 2020.
 - **Water Conservation Plan:** Regional water agencies ~~should~~ may establish a water conservation plan that may include such policies and actions as:
 - Tiered rate structures for water use;
 - Restrictions on time of use for landscape watering, and other demand management strategies;
 - Performance standards for irrigation equipment and water fixtures;
 - Requirements that increased demand from new construction be offset with reductions so that there is no net increase in water use.
 - **Recycled Water Use:** Local jurisdictions and regional water agencies ~~should~~ may establish programs and policies to increase the use of recycled water, including:
 - Create an inventory of non-potable water uses within the jurisdiction that could be served with recycled water;
 - Produce and promote the use of recycled water for agricultural, industrial, and irrigation purposes, including grey water systems for residential irrigation;
 - Produce and promote the use of treated, recycled water for potable uses where GHG emissions from producing such water are lower than from other potable sources.
 - **Water Conservation Outreach:** Local jurisdictions and regional water agencies ~~should~~ may implement a public education and outreach campaign to promote water conservation, and highlights specific water-wasting activities to discourage, such as the watering of non-vegetated surfaces and using water to clean sidewalks and driveways.
- W55:** Local jurisdictions ~~can and should~~ may ensure that building standards and permit approval processes promote and support water conservation.
- W56:*** Local jurisdictions ~~can and should~~ may establish building design guidelines and criteria to promote water-efficient building design, including minimizing the amount of non-roof impervious surfaces around the building(s).

- W57:*** Local jurisdictions ~~can and should~~ may establish menus and check-lists for developers and contractors to ensure water-efficient infrastructure and technology are used in new construction, including low-flow toilets and shower heads, moisture-sensing irrigation, and other such advances.
- W58:*** Local jurisdictions ~~can and should~~ may establish criteria and standards to permit the safe and effective use of gray water (on-site water recycling), and review and appropriately revise, without compromising health and safety, other building code requirements that may prevent the use of such systems.
- W59:** Local jurisdictions ~~can and should~~ may establish programs and policies to ensure landscaping and forests are installed and managed to optimize their climate benefits.
- W60:*** Project sponsors ~~can and should~~ may install water efficient landscapes and irrigation, including:
- Planting drought-tolerant and native species, and covering exposed dirt with moisture-retaining mulch;
 - Installing water-efficient irrigation systems and devices, including advanced technology such as moisture-sensing irrigation controls; and/or
 - Installing edible landscapes that provide local food.
- W61:*** Regional water agencies ~~can and should~~ may maximize efficiency at drinking water treatment, pumping, and distribution facilities, ~~including development of off peak demand schedules for heavy commercial and industrial users.~~

Above measure edited in response to a comment from MWD.

W62: Impacts to waters of the state (i.e., water bodies, drainages, and the beneficial uses they support) from proposed transportation (and/or development) projects -- or loss of beneficial uses from cumulative projects and their impacts, may be mitigated by enhancing or restoring water quality attributes and environmental values of water bodies impacted by previous transportation (and/or development) projects. For example, a new project could examine where an earlier project (preferably in close proximity to the new project area), created impairment to a riparian wildlife corridor, and then plan to remove this impairment as mitigation. Alternatively a new project could remove an obstruction to sediment transport, or remove a check dam currently preventing fish (for example, steelhead trout) migration.

Above measure added in response to a comment from RWQCB, Santa Ana Region.



A New Direction

Our Changing Relationship with Driving
and the Implications for America's Future

U.S. PIRG
Education Fund

FRONTIER GROUP

A New Direction

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Executive Summary

The Driving Boom—a six decade-long period of steady increases in per-capita driving in the United States—is over.

Americans drive fewer total miles today than we did eight years ago, and fewer per person than we did at the end of Bill Clinton’s first term. The unique combination of conditions that fueled the Driving Boom—from cheap gas prices to the rapid expansion of the workforce during the Baby Boom generation—no longer exists. Meanwhile, a new generation—the Millennials—is demanding a new American Dream less dependent on driving.

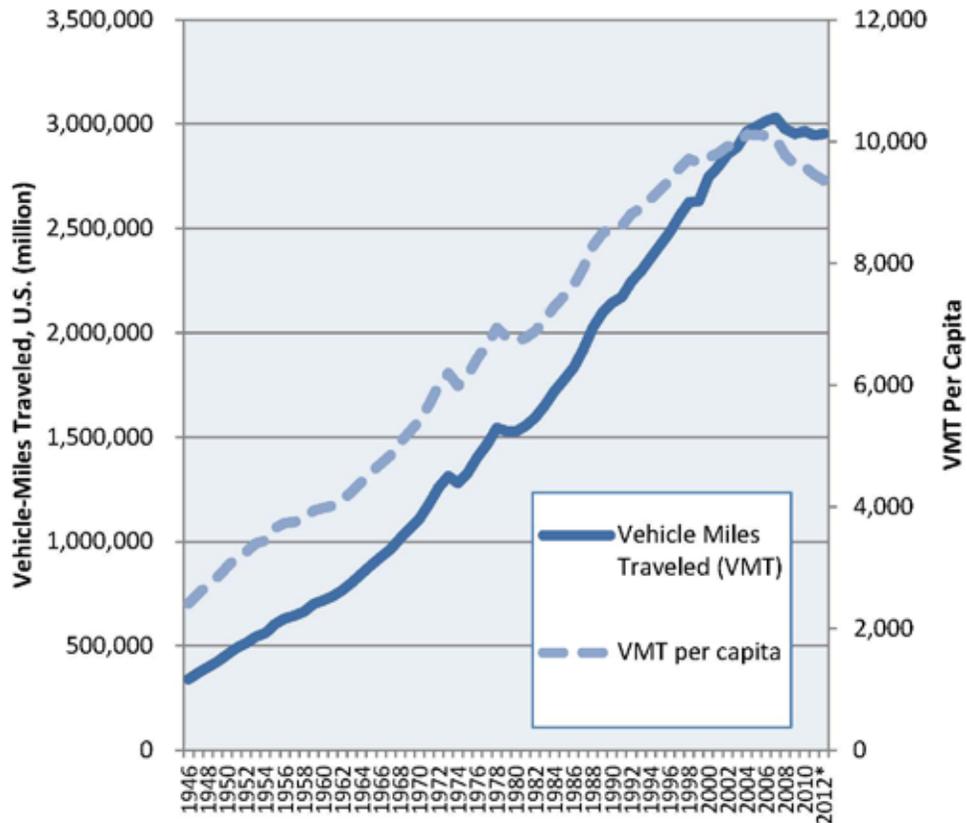
Transportation policy in the United States, however, remains stuck in the past. Official forecasts of future vehicle travel continue to assume steady increases in driving, despite the experience of the past decade. Those forecasts are used to justify spending vast sums on new and expanded highways, even as existing roads and bridges are neglected. Elements of a more balanced transportation system—from transit systems to bike lanes—lack crucial investment as powerful interests battle to maintain their piece of a shrinking transportation funding pie.

The time has come for America to hit the “reset” button on transportation policy—replacing the policy infrastructure of the Driving Boom years with a more efficient, flexible and nimble system that is better able to meet the transportation needs of the 21st century.

The Driving Boom is over.

- Americans drove more miles nearly every year between the end of World War II and 2004. (See Figure ES-1, next page.) By the end of this period of rapid increases in per-capita driving—which we call the “Driving Boom”—the average American was driving 85 percent more miles each year than in 1970.
- Americans drive no more miles in total today than we did in 2004 and no more per person than we did in 1996.
- On the other hand, Americans took nearly 10 percent more trips via public transportation in 2011 than we did in 2005. The nation also saw increases in commuting by bike and on foot.

Figure ES-1. Total and Per-Capita Vehicle-Miles Traveled, U.S.



* 2012 data from U.S. Department of Transportation's (U.S. DOT) *Traffic Volume Trends* series of reports; data from previous years from U.S. DOT's *Highway Statistics* series of reports.

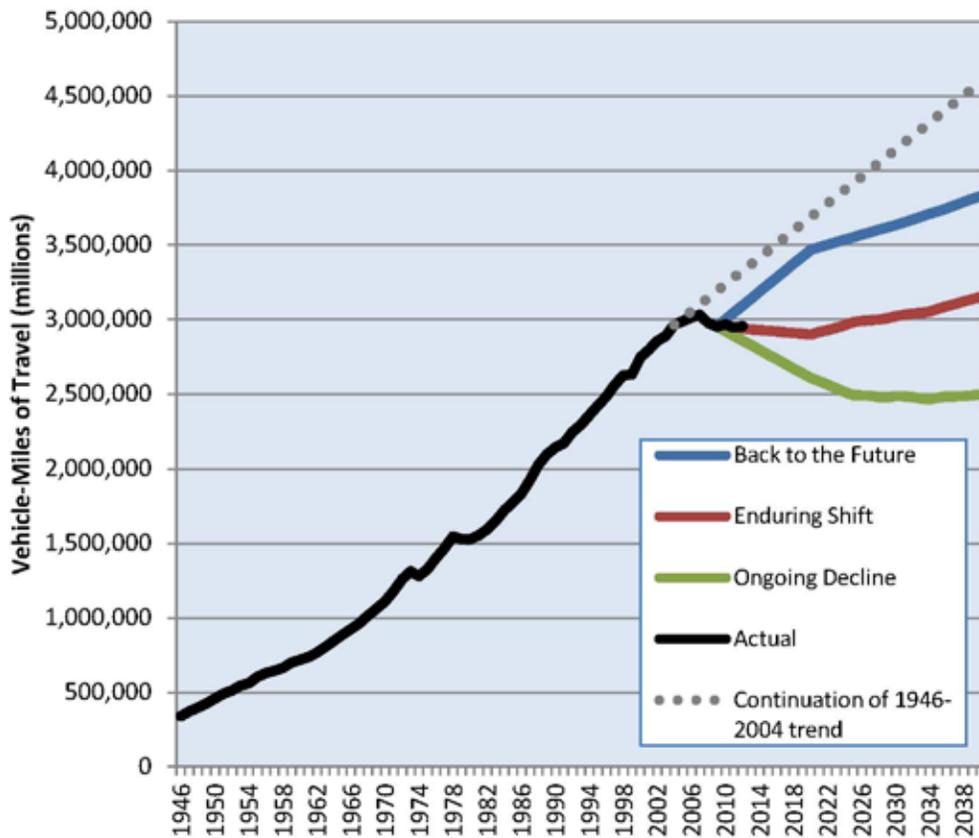
- A return to the steady growth in per-capita driving that characterized the Driving Boom years is unlikely given the aging of the Baby Boom generation, the projected continuation of high gas prices, anticipated reductions in the percentage of Americans in the labor force, and the peaking of demand for vehicles and driver's licenses and the amount of time Americans are willing to spend in travel.

The Millennial generation has led the recent change in transportation

trends—driving significantly less than previous generations of young Americans. Millennials are already the largest generation in the United States and their choices will play a crucial role in determining future transportation infrastructure needs.

- The Millennials (people born between 1983 and 2000) are now the largest generation in the United States. By 2030, Millennials will be far and away the largest group in the peak driving age 35-to-54 year old demographic, and will continue as such through 2040.

Figure ES-2. Aggregate Vehicle-Miles Traveled in the United States under Several Scenarios of Future Travel Growth, 1946-2040



- Young people aged 16 to 34 drove 23 percent fewer miles on average in 2009 than they did in 2001—a greater decline in driving than any other age group. The severe economic recession was likely responsible for some of the decline, but not all.
- Millennials are more likely to want to live in urban and walkable neighborhoods and are more open to non-driving forms of transportation than older Americans. They are also the first generation to fully embrace mobile Internet-connected technologies, which are rapidly spawning new transportation options and shifting the way young Americans relate to one another, creating new avenues for living connected, vibrant lives that are less reliant on driving.
- If the Millennial-led decline in per-capita driving continues for another dozen years, even at half the annual rate of the 2001-2009 period (illustrated by the *Ongoing Decline* scenario in Figure ES-2 above), total vehicle travel in the United States could remain well below its 2007 peak through at least 2040—despite a 21 percent increase in population. If

Millennials retain their current propensity to drive less as they age and future generations follow (*Enduring Shift*), driving could increase by only 7 percent by 2040. If, unexpectedly, Millennials were to revert to the driving patterns of previous generations (*Back to the Future*), total driving could grow by as much as 24 percent by 2040.

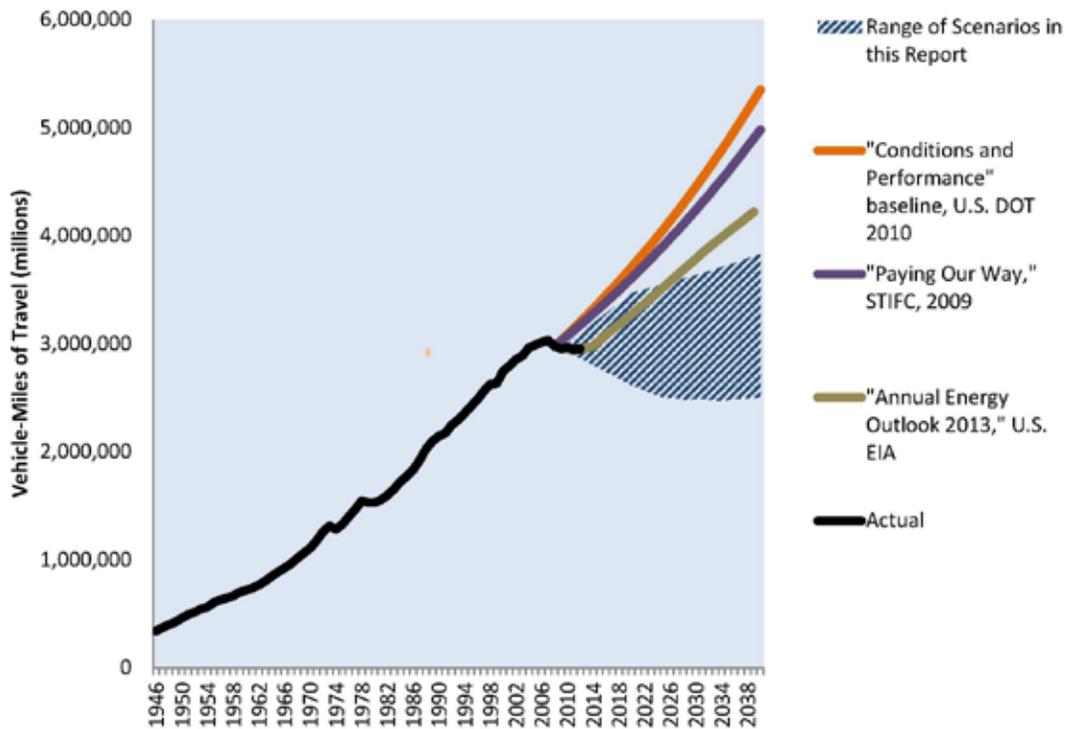
- All three of these scenarios yield far less driving than if the Driving Boom had continued past 2004. Driving declines more dramatic than any of these scenarios would result if future per-capita driving were to fall at a

rate near that of recent years or if annual per-capita reductions continue through 2040.

- Regardless of which scenario proves true, the amount of driving in the United States in 2040 is likely to be lower than is assumed in recent government forecasts. This raises the question of whether changing trends in driving are being adequately factored into public policy. (See Figure ES-3.)

The recent reduction in driving has already delivered important benefits for

Figure ES-3. Recent Official Forecasts of Vehicle Travel Compared to Range of Scenarios, 1946-2040



U.S. DOT = U.S. Department of Transportation
 STIFC = Surface Transportation Infrastructure Financing Commission
 U.S. EIA = U.S. Energy Information Administration

the nation, while raising new challenges. Future driving trends will have major implications for transportation policy and other aspects of American life.

- **Traffic congestion has fallen.** According to data from the Texas Transportation Institute, Americans spent 421 million fewer hours stuck in traffic in 2011 than they did in 2005. Further reductions in driving could lead to additional easing of congestion without massive investments in new highway capacity, as long as roads are maintained in a state of good repair.
- **America is less dependent on oil.** In 2011, gasoline consumption for transportation hit a 10-year low. Further reductions in driving consistent with the *Ongoing Decline* scenario—coupled with expected vehicle fuel economy improvements—could result in the nation using half as much gasoline or other fuels in our cars and trucks by 2040 as we use today.
- **Our roads are getting less use ... but the gas tax is bringing in less income.** Reduced vehicle travel (particularly in large trucks) reduces the wear and tear on our nation’s roads, reducing maintenance needs. Reduced driving, however, also reduces the amount of revenue brought in by the already-strained gasoline tax.

The recent reduction in driving and embrace of less auto-dependent ways of living by Millennials and others creates a golden opportunity for America to adopt transportation policies that use resources more efficiently, preserve our existing infrastructure, and provide support for Americans seeking alternatives to car travel.

A new vision for transportation policy should:

- **Plan for uncertainty.** With future driving patterns uncertain, federal, state and local transportation officials should evaluate the costs and benefits of all transportation projects based on several scenarios of future demand for driving. Decision-makers should also prioritize those projects that are most likely to deliver benefits under a range of future circumstances.
- **Support the Millennials and other Americans in their desire to drive less.** Federal, state and local policies should help create the conditions under which Americans can fulfill their desire to drive less. Increasing investments in public transportation, bicycling and pedestrian infrastructure and intercity rail—especially when coupled with regulatory changes to enable the development of walkable neighborhoods—can help provide more Americans with a broader range of transportation options.
- **Revisit plans for new or expanded highways.** Many highway projects currently awaiting funding were initially conceived of decades ago and proposed based on traffic projections made before the recent decline in driving. Local, state and federal governments should revisit the need for these “legacy projects” and ensure that proposals for new or expanded highways are still a priority in light of recent travel trends.
- **Refocus the federal role.** The federal government should adopt a more strategic role in transportation policy, focusing resources on key priorities (such as repair and maintenance of existing infrastructure and the expansion of transportation options) and evaluating projects competitively on the basis of their benefits to society.

- **Use transportation revenue where it makes the most sense.** Transportation spending decisions should be based on overall priorities and a rigorous evaluation of project costs and benefits—not on the source of the revenue.
- **Do our homework.** Federal and state governments should invest in research to evaluate the accuracy and usefulness of transportation models and better understand changing transportation trends in the post-Driving Boom era.

Introduction

No region of the United States is as closely associated with “car culture” as Southern California. So much of what Americans associate with the car—from hot rodding to drive-ins and from smog to traffic congestion—either began or reached its fullest expression in the region. As early as the mid-1930s, according to one analyst, Los Angeles had become “America’s first thoroughly motorized metropolis.”¹

Like the rest of America, California experienced rapid growth in driving from World War II through the turn of the 21st century. The number of miles driven in the state doubled between 1981 and 2002—an average rate of growth of more than 3 percent per year.²

With all signs in the 1980s pointing to continued increases in the demand for driving, officials in Southern California began looking for ways to expand their clogged freeway network. In Orange County, officials launched a plan to build a series of toll roads to ease existing and anticipated congestion.³ When the first of the toll roads opened in 1993, a state senator confidently stated that the roads would be a success because, “People around

here will do anything to avoid gridlock.”⁴ Several other toll roads—some built and operated by private corporations—opened in the region between the early 1990s and late 2000s.

Far from meeting the initial predictions of success, however, Southern California’s toll roads have served as a cautionary tale of what can happen when millions of dollars are spent on expanded highways ... and the cars don’t show up.

Traffic on Orange County’s San Joaquin Hills toll road fell short of projections almost immediately after opening—by 2010, traffic on the road was less than half of what had been anticipated.⁵ Another Orange County project, the Foothill/Eastern toll road, met expectations until 2008, when traffic slumped.⁶ In San Diego County, the privately built South Bay Expressway, which opened in 2007, fell so far short of its traffic projections that the private enterprise that built and operated the road was forced into a form of bankruptcy.⁷

These failed predictions have serious consequences. In Orange County, tolls on the highways have been raised to among the highest in the nation in a grab for revenue. The bonds issued by one of the toll

road authorities have been downgraded to junk bond status,⁸ and an investigation was launched in late 2012 of the finances of the local government agencies responsible for building and operating the Orange County highways.⁹

Southern California toll roads aren't the only highways getting less traffic these days, either in California or across the country. After decades of relentless growth in vehicle travel, Californians are driving about as much today as they did a decade ago, mirroring nationwide trends.¹⁰

After roughly a decade of stagnation in driving, it is becoming clear that the rapid increases in per-capita driving that took place in California and across the nation between 1946 and the early 2000s—a period we call the “Driving Boom”—are over. Yet, transportation policy in the United States has failed to catch up with the times, leaving the nation at risk of over-investing in transportation infrastructure that we don't need while under-investing in the repair of our existing transportation network and the broader range of transportation choices Americans increasingly seek

in the 21st century.

The nation needs a new transportation policy—one that embraces the recent change in driving patterns and seeks to maximize their benefits. That new transportation policy would accept the fact that future transportation demands are uncertain and prioritize investments that would deliver benefits under a broad range of potential futures. It would create a coherent and refocused role for the federal government in ensuring that our transportation infrastructure is well-maintained and in partnering with cities and states that seek to provide new transportation options to their people. And it would reevaluate whether previous plans for major highway expansion projects still make sense in light of changing trends in driving.

With the fate of tens of billions of dollars in transportation investments at stake, the time has come for policymakers and the public to understand the seismic implications of changing driving trends on transportation policy, and to build a new transportation policy that reflects the needs of 21st century America.

The End of the Driving Boom

The Driving Boom—a six decade-long period of steady increases in per-capita driving—is now over. Americans drove no more per person in 2012 than we did at the end of Bill Clinton’s first term as president. Many long-term economic and demographic trends suggest that the period of prolonged stagnation in vehicle travel may just be beginning.

The recent change in driving trends—led by young Americans—has huge implications for transportation policy. To understand those implications, it is important to answer a few basic questions: Why did the Driving Boom happen? Why did it end? And why is it unlikely to return?

The Rise in Driving from 1946-2004

Throughout the 20th century—with short interruptions for crises such as wars or energy shocks—the number of miles Americans drove each year marched steadily upward. By 2004, the total number of miles

driven annually on America’s roads was approaching 3 trillion—more than double the amount of just three decades earlier.¹¹ Between 1970 and 2004, the number of miles driven per capita skyrocketed by 85 percent—from 5,400 miles per year to just over 10,000.¹²

Rapid increases in driving were so commonplace during this period—which we call the “Driving Boom”—as to be considered inevitable. Rising traffic congestion (or the threat of it), along with the perceived importance of highways to economic growth, spurred government officials to invest hundreds of billions of dollars in expanded highway capacity. Between 1980 and 2010, the nation expanded its freeway capacity (measured in lane-miles) by 35 percent, the equivalent of building a new lane of freeway stretching from New York to Los Angeles every single year.¹³

Table 1. Average Annual Change in Vehicle Travel, Driving Boom and Post-Driving Boom¹⁴

	1946-2004	2004-2012
Total miles	3.8%	0.0%
Miles per capita	2.5%	-1.0%

New highways, in turn, spurred additional driving. New off-ramps in previously rural communities fueled sprawling real estate development in distant suburbs and exurbs consisting largely of housing subdivisions, office parks and shopping centers, many of them designed so as to be accessible only by automobile. The percentage of Americans living in suburbs increased from 23 percent in 1950 to 50 percent in 2000.¹⁵

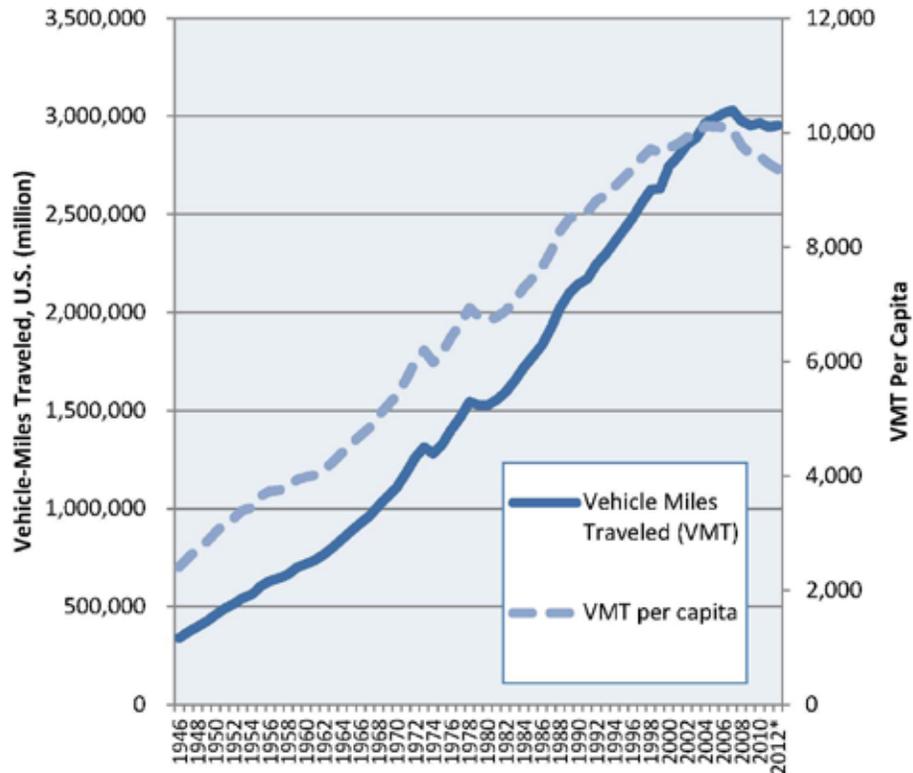
As longer commutes and the need to use a car for virtually every daily task led to more driving, revenues from the gasoline tax increased steadily. Between 1970 and 2000, the real value of highway “user fees”—gasoline taxes, vehicle registration fees and other taxes and fees paid by drivers—collected by all levels of government increased by 34 percent.¹⁶

Because federal and state governments devoted most (and in some cases, all¹⁷) revenues from drivers to highways—and because most of the nation’s existing highways were still relatively new and did not yet require major reconstruction—vast amounts of revenue were available to add new highway capacity. In 2000, for example, even after more than four decades of rapid highway construction, 46 percent of federal highway funding was still being spent on new roads and expansion of capacity on existing roads.¹⁸

This self-reinforcing cycle—new roads fed new development that led to more driving, which created more revenue, which made possible more roads—continued for decades.

Then, around the turn of the 21st century, it stopped.

Figure 1. Total and Per-Capita Vehicle-Miles Traveled, U.S.¹⁹



* 2012 data based on U.S. Department of Transportation’s (U.S. DOT) *Traffic Volume Trends* report. Previous years based on U.S. DOT *Highway Statistics* series of reports.

The Crest of the Wave: Driving Trends in the 21st Century

By the late 1990s, the rapid rise in vehicle travel that characterized the Driving Boom began to slow, then stop, and ultimately reverse. Americans now drive no more in total than they did in 2004 and no more on average than they did at the end of Bill Clinton's first term as president. (See Figure 1.)

The recent reduction in vehicle travel is nearly unprecedented in American history.²⁰ The longest previous drop in vehicle travel was during World War II—a period of gasoline rationing and extraordinary societal disruption. It took five years and the conclusion of the war for 1941 levels of driving to be surpassed again in 1946. The United States has now gone more than five years since its last peak in vehicle travel.²¹

Why the Driving Boom Is Over ... and Why it's not Coming Back

There are many reasons to believe that driving per-capita has peaked, at least for the foreseeable future, signaling the end of the Driving Boom. While the *total* number of miles driven on American roads may inch upwards over time with population growth, the pace of that increase in vehicle travel—if it occurs at all—will be far slower than during the Driving Boom years.

Saturated with Driving

In the decades after World War II, rising incomes put automobile ownership within reach of an increasing number of Americans. The construction of new highways and development of new low-density

suburbs created a new—and to many, appealing—automobile-oriented lifestyle. The increased participation of women in the workforce, particularly from the 1960s onward, put millions of new commuters on the roads and changed travel patterns in fundamental ways. Meanwhile, dramatic improvements in vehicles and the opening of shiny new highways enabled Americans to increase the number of miles they drove without sacrificing time for work or leisure.

Each of these changes led more Americans to take to the roads, helping to fuel the dramatic increase in the number of miles driven between World War II and 2004. By the turn of the 21st century, however, these trends had largely played themselves out, and some had shown signs of beginning to reverse. (See Figure 2, next page.)

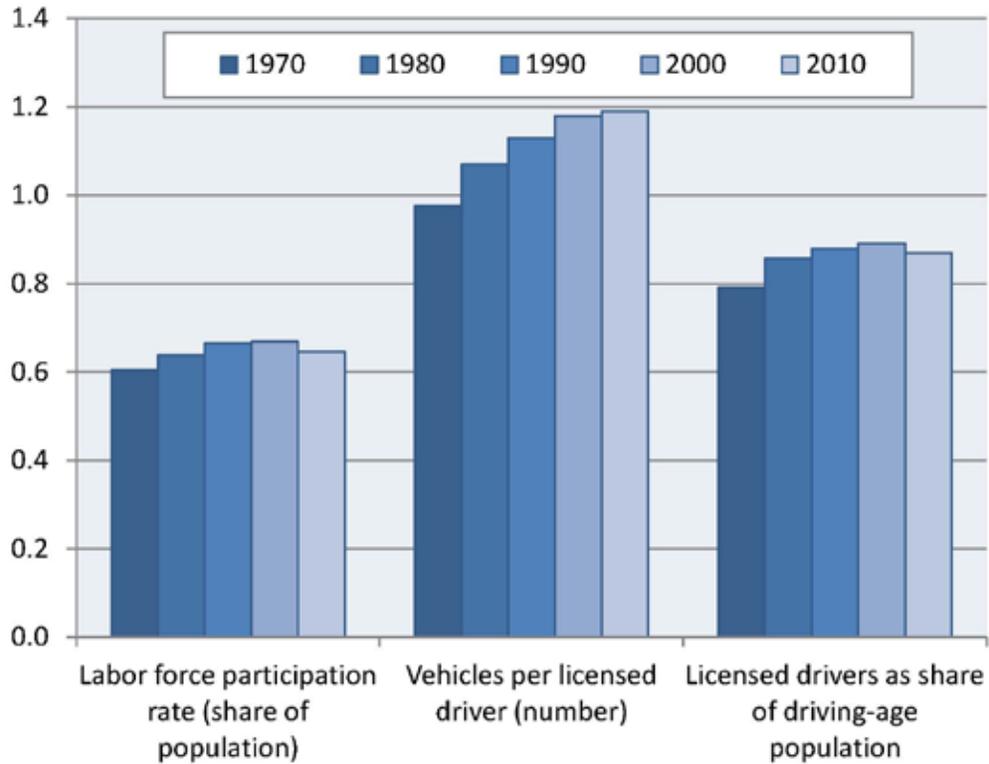
Labor Force Participation

Workers tend to drive more miles than non-workers, and the Driving Boom years saw a dramatic expansion in the share of the American population taking part in the labor force. Between 1970 and 2000, the share of Americans in the labor force increased from just over 60 percent to a peak of 67.3 percent.²³ Since 2000, however, the share of Americans in the labor force has dropped to 63.6 percent, a level roughly equal to that of 1979.²⁴ The drop in labor force participation began well before the current recession and is expected to continue well beyond it, largely due to the aging of the Baby Boom generation. A 2011 Congressional Budget Office report projected that the participation rate would drop to 63 percent by 2021.²⁵

Vehicle Ownership

People who have greater access to a vehicle could be expected to drive more frequently than those with less access—even in situations where they might otherwise walk, take transit, or not travel at all. During the Driving Boom, the number of Americans who owned cars increased dramatically. In

Figure 2. Trends in Driver’s Licensing, Vehicle Ownership and Labor Force Participation Rate²²



1972, the number of vehicles registered in the United States exceeded the number of people licensed to drive them for the first time.²⁶ Over the next three decades, the ratio of vehicles to licensed drivers continued to increase, reaching a peak of 1.24 vehicles per driver in 2006. Since 2006, however, vehicle ownership per licensed driver has declined by 4 percent, suggesting that Americans may have reached a limit in the number of vehicles they can beneficially use.

Driver’s Licensing

Increasing vehicle ownership was matched in the Driving Boom years by an increasing share of the population holding a license to drive. By 1992, 90 percent of the driving-age population of the United States was licensed to drive—an all-time high with

little room for further increase. Since then, however, the percentage of driving-age (16 and older) Americans holding driver’s licenses has stagnated and then declined—by 2011, 86 percent of driving-age Americans held driver’s licenses, the lowest percentage in 30 years.²⁷

Time Spent in Travel

Highway expansion and vehicle improvements during the Driving Boom years meant that Americans could go farther, faster, and in greater comfort than ever before. Improvements in average highway travel speeds continued right up through the 1980s, making it possible for Americans to live or work in ever-more distant suburbs or exurbs without losing precious work or family time. Since the early 1990s, however, travel speeds (at least for commute

trips) have slowed.²⁸ Barring major technological advances, there are few prospects for a repeat of the quantum leap in travel speeds that occurred during the Driving Boom.²⁹

This finding is important because some transportation theorists believe that there are inherent—if difficult to define—boundaries to the average amount of time each day that people are willing to spend in travel.³⁰ This limit is thought to be in the range of 1.1 to 1.3 hours per day.³¹ In 2011, Americans spent an average of 1.17 hours a day in travel, slightly less time than they had spent in travel in 2005.³²

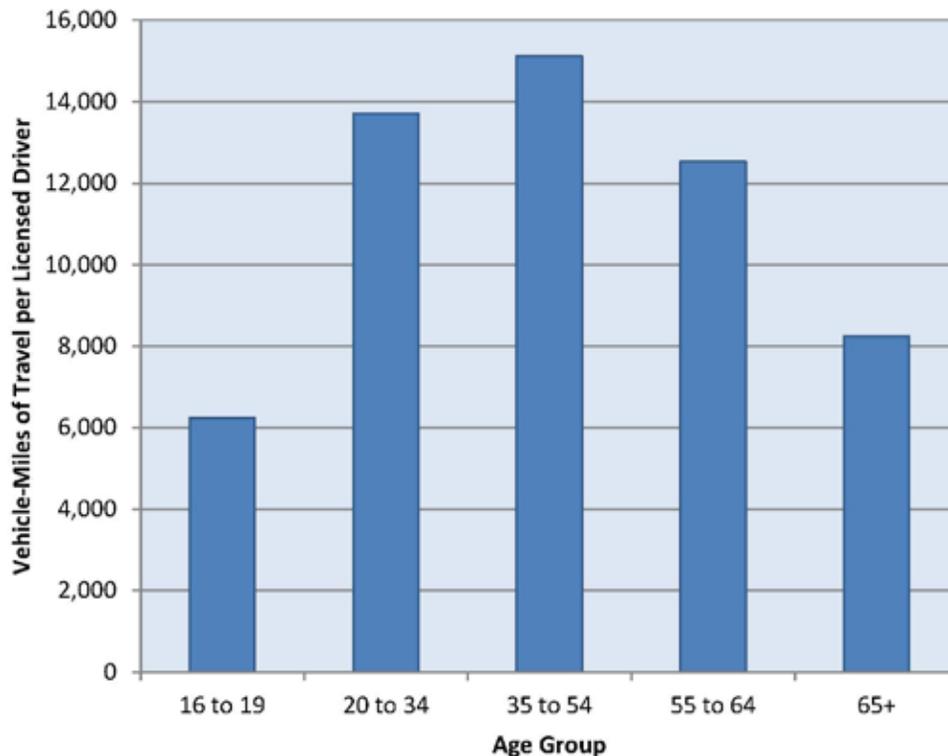
In short, Americans may be hitting the limit of the amount of time they are willing to spend in their cars each day—meaning that, unless travel speeds increase, they may be hitting the limit of the number of miles they are willing to drive each day as well.

Demographics: The Graying of America

The Driving Boom coincided, in large measure, with the lives of those born in the Baby Boom—the massive demographic bubble consisting of those born between 1946 and 1964. The passage of the Baby Boomers through their peak working and child-rearing years turbocharged the trend toward increased driving—especially between the 1980s and 2000s.

Driving is an activity that is highly dependent on one’s stage of life. People in their prime earning and child-rearing years tend to drive the most, as they commute to jobs, shuttle children to activities, and often opt to live in more spacious suburban communities that are also more auto-dependent. Younger people and older people, on the other hand, are less likely to drive. (See Figure 3.)

Figure 3. Vehicle Miles Traveled per Licensed Driver by Age, 2009³³



Regardless of other trends, therefore, the greater the share of Americans in the peak driving-age 35-to-54 age group, the more one can expect per-capita vehicle travel, as averaged across the entire population, to increase. In the latter years of the Driving Boom, the percentage of Americans in the peak driving-age demographic increased rapidly. By 2000, 35 to 54 year-olds accounted for 29.5 percent of the U.S. population, up from 25.3 percent of the population in 1990 and 21.4 percent of the population in 1980. (See Figure 4.)

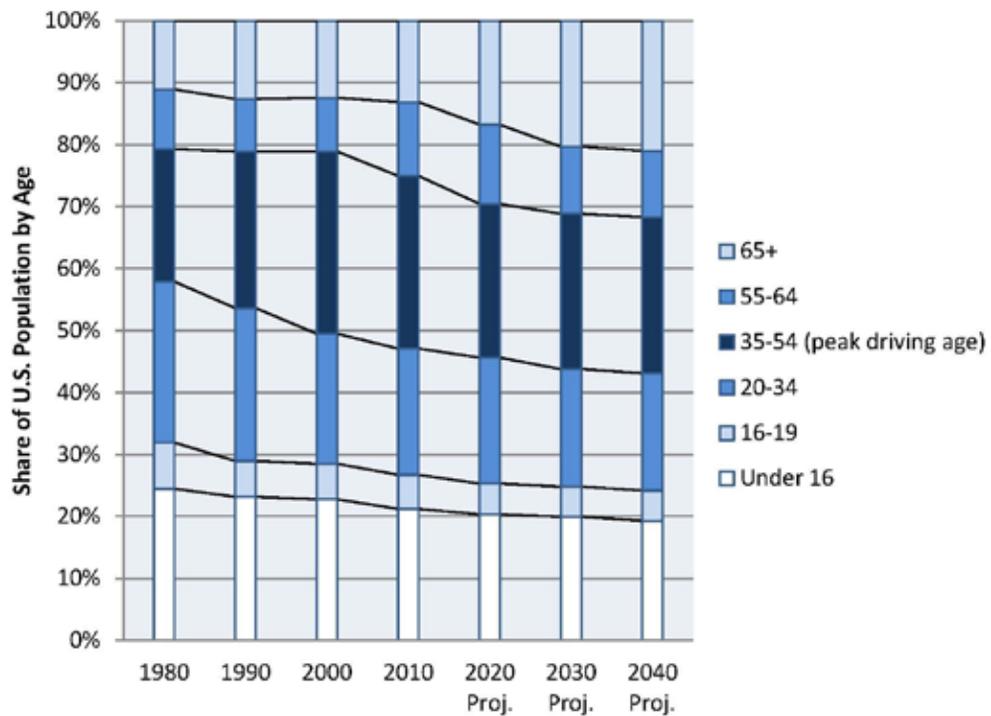
The Baby Boom generation is now passing through the prime driving years and heading toward retirement. By 2010, the share of Americans in the 35 to 54 year-old age bracket fell to 27.9 percent and by

2020 it is projected to fall further to 24.8 percent. In fact, despite overall population growth, there are projected to be fewer 35 to 54 year-olds *in total* in 2020 than there were in either 2010 or 2000.

At the same time, the share of population in the 65 and older age bracket is projected to increase dramatically between now and 2040. In 1980, seniors 65 and older made up 11 percent of the population; by 2040, their share of the population is expected to roughly double to 21 percent.³⁵

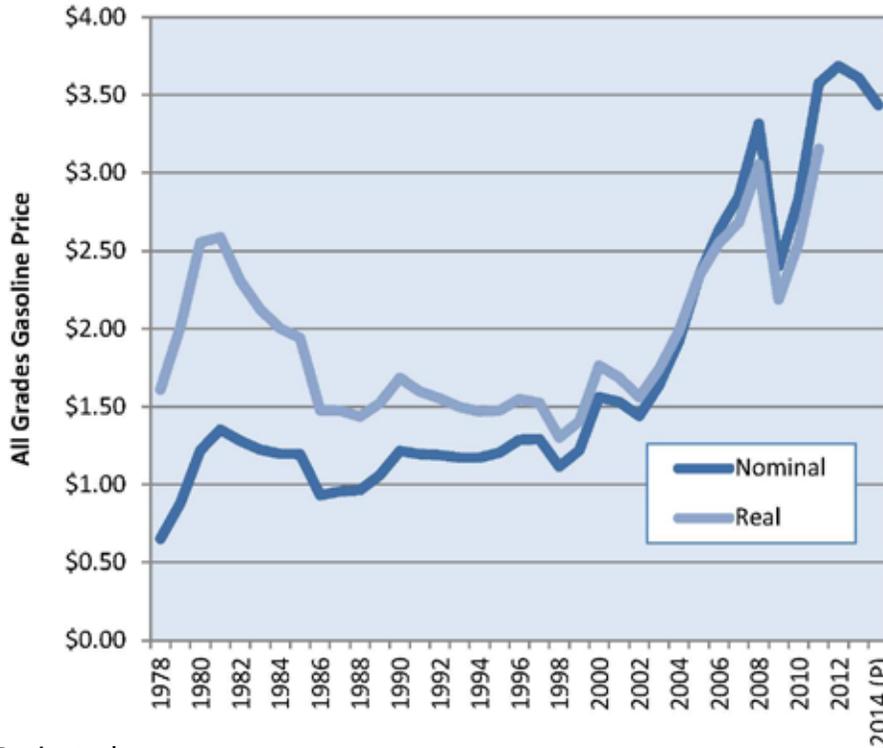
A greater share of Americans, therefore, will soon be in age groups that have historically driven fewer miles. This demographic shift can be expected to reduce the number of miles driven per capita when averaged across the entire population.

Figure 4. Shares of U.S. Population by Age Group³⁴



The share of Americans in their peak driving years (age 35-54) is shown in dark blue. Between 1980 and 2000, the share of Americans in the peak driving demographic ballooned from 21.4 percent of the population to 29.5 percent, as the Baby Boomers reached peak driving age. With the Baby Boom generation now headed toward retirement, the share of Americans in the peak driving age group is projected to decline to 24.8 percent by 2020.

Figure 5. Average Annual Regular Grade Gasoline Prices, United States, Nominal and Real (Adjusted for Inflation)³⁸



(P)=Projected

**Economics:
The Sustained Rise in
Gasoline Prices**

The cost of driving has gone up dramatically in the last decade. Between 2002 and 2011, the average inflation-adjusted price of a gallon of gasoline doubled.³⁶

The cost of gasoline has both short- and long-term impacts on the amount people drive. In the short term, people may pass up the opportunity to take certain trips due to high prices. The perception of higher gasoline prices in the long-term, meanwhile, can cause people to reorient their lives to avoid the expense of fuel—for example, by moving closer to their work or purchasing a more fuel-efficient car.³⁷

U.S. government forecasters project that gasoline prices will remain well above

historical levels, which would tend to depress vehicle travel. However, trends in gasoline prices may become less important over time as vehicle fuel economy improves and alternative fuel vehicles become more common on American roads.

**Rising Use of Transit and Other
Transportation Modes**

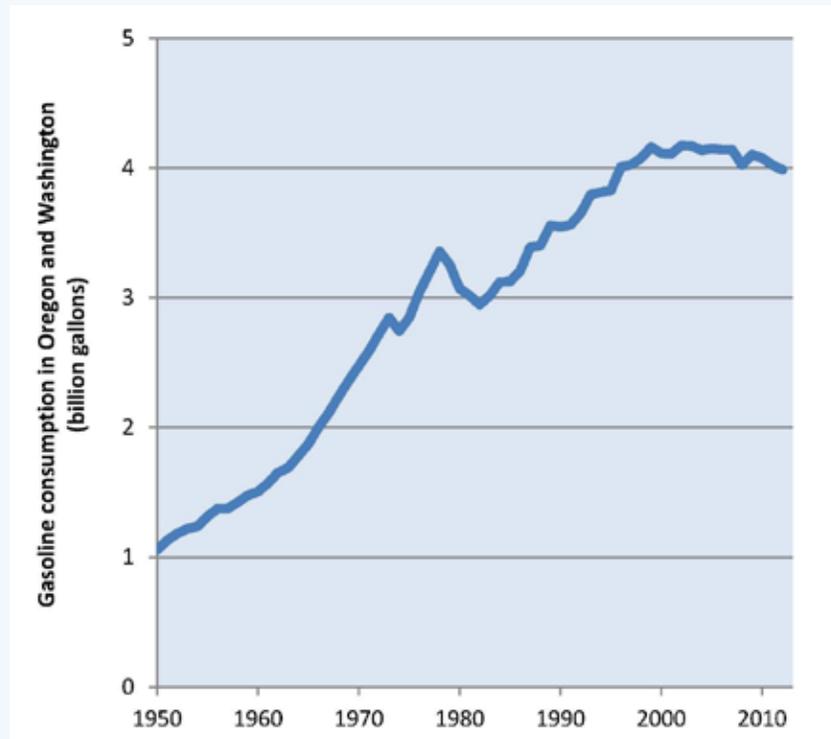
Another contributing factor to the recent decline in driving has been the increasing eagerness of many Americans to choose other modes of transportation—light rail, buses, trains, bicycles or walking—for trips they might once have taken by car. Indeed, while driving has been stagnant or declining in recent years, the use of nearly all of these other modes of transportation has increased. (continued, page 18)

Implications of Changing Driving Trends: The View from the Pacific Northwest

By **Clark Williams-Derry, Sightline Institute**

The Pacific Northwest was well ahead of the curve in the national trend toward reduced driving and fuel consumption. Out here in the land of mist and mountains, gasoline consumption plateaued way back in 1999.⁴³ (See Figure 6.) Total vehicle travel on Washington and Oregon's state highways flattened out in 2002.⁴⁴ And, after factoring in population growth, gas consumption per resident in the two states has now fallen to its lowest level since 1964—a dramatic decline, though one that has received surprisingly little attention from the region's policy-makers.⁴⁵

Figure 6. Gasoline Consumption in Oregon and Washington⁴⁶



Because driving slumped here before it did in the rest of the nation, we're among the first to confront the fiscal fallout of stagnating gas tax revenues.

Like many states across the country, Washington and Oregon financed highway expansion by floating bonds, intending to pay for highway construction by tapping

into ever-growing fuel tax collections anticipated in the future. But flat-lining gas tax receipts have driven the region's transportation officials into a panic. Oregon recently announced that flat or declining revenue from the gasoline tax, coupled with rising debt payments, decreased federal funding, and increasing construction costs, could force deep cuts in the state's transportation budget in the next several years.⁴⁷

Washington is in even worse shape. After years of denial, the state recently slashed long-term revenue forecasts by billions of dollars.⁴⁸ But since the state back-loaded interest payments on many of its highway bonds, its debt obligations will rise even if fuel tax receipts dip. Within just a few years, more than 70 percent of the state's gas tax receipts will go to pay off debts on projects that have *already* been completed—leaving precious little gas tax revenue for maintenance of existing roads, let alone new construction.⁴⁹

Both Oregon and Washington have flirted with tolling to finance new highways—gambling that drivers who are reluctant to pay for expensive gas will prove willing to pay costly tolls instead. Washington took a foray into toll-financed construction on the Tacoma Narrows Bridge. But the fiscal outlook for the project is grim. Traffic across the new span has fallen,⁵⁰ rather than growing as anticipated,⁵¹ leaving a widening gap between toll collections and the rising payments for construction debt. At the same time, a high-occupancy toll (HOT) lane pilot project southeast of Seattle has generated far less revenue than hoped.⁵² And the state has been forced to slash its projected toll revenue from a tunnel project under downtown Seattle; the state now expects to raise at most \$200 million in tolls⁵³ towards a \$4 billion project.⁵⁴

In short, Washington's and Oregon's transportation agencies are speeding towards a fiscal cliff of their own making. If anything, they're stepping on the accelerator by continuing to move forward with costly megaprojects—wider highways, bigger bridges and a budget-busting tunnel—that the states don't need and can't afford.

One obvious solution to the Northwest's transportation finance crisis is to cancel, or at least downsize, some of these megaprojects. (Who needs bigger highways if traffic isn't growing?) Yet so far, transportation officials see flat-lining traffic simply as the cause of a funding shortfall, rather than an opportunity to rethink the region's road construction priorities.

It took the Northwest states nearly a decade to accept that a sea change in car travel trends had sown the seeds of a transportation revenue crisis. Let's hope it doesn't take another decade to accept that the best solution to that crisis is to scale back our highway-building ambitions, so that they match both our financial means and our newly restrained driving habits.

Sightline Institute is an independent, nonprofit research and communications center based in Seattle, dedicated to making the Pacific Northwest a global model of sustainability—strong communities, a green economy and a healthy environment.

Table 2. Factors that Influence Driving: Past, Present and Future⁵⁵ (Green = Indicates Higher Per-Capita Driving, Yellow=Neutral, Stable or Unknown, Red=Indicates Lower Per-Capita Driving)

	Driving Boom	Recent	Future
Labor Force Participation Rate	Rapid increases due to increased participation of women, demographic bubble	Declining	Declining due to Baby Boomer retirements
Speed of Automobile Travel	Increasing due to highway and vehicle improvements	Stable or declining	Unlikely to improve in the absence of major technological changes
Share of Population of Peak Driving Age (35-54)	Steadily increasing due to Baby Boom	Declining	Declining in short term, increasing slowly thereafter, but not above previous Baby Boom peak
Cost of Gasoline	Mostly stable and low	Increasing, followed by relative stability at higher level	Projected to remain high
Vehicle Ownership	Increasing to near-universal vehicle ownership	Stable or declining	Unknown, but potential for further growth above historic, near-saturation highs is limited
Driver's Licensing	Increasing to near-universal licensure	Declining	Unknown, but unlikely to exceed previous peak
Use of Non-Driving Modes	Dramatically decreasing, then stagnant	Increasing	Unknown, though demand for transit among younger and older Americans could be expected to increase

In 2011, Americans took nearly 10 percent—or 900 million—more trips via public transportation than they had in 2005.³⁹ That growth in transit use continued through 2012, despite reductions in service and increases in fares in many cities in the wake of the Great Recession.⁴⁰ A 2011 American Public Transportation Associa-

tion survey of transit agencies found that more than half had either increased fares or cut service since the beginning of 2010, while more than 20 percent of the agencies had both raised fares *and* cut service.⁴¹

Public transportation isn't the only non-automobile mode to experience an increase in recent years. For example, the

number of workers commuting to work by bike increased by 39 percent between 2005 and 2011, while the number of people commuting on foot increased by 20 percent between 2005 and 2009.⁴²

In addition, in recent years, advances in mobile technology have enabled a range of new transportation options—from bike sharing to car sharing to ride sharing—to take root in an increasing number of cities. (See page 26.) It is too soon to determine how these new options might change transportation behaviors over the long term, but they create the potential for further changes in transportation habits that could affect overall demand for driving in the years to come.

Summary

The Driving Boom of the second half of the 20th century coincided with rapid economic, cultural and demographic changes in the United States. Those changes largely pointed in the same direction: toward a more automobile-oriented society.

Many of those trends, however, have either reached their natural limits or have reversed direction. (See Table 2.) A review of those trends points to the conclusion that the trajectory toward increased per-capita driving that prevailed during the Driving Boom has likely reached its end, and that the levels of per-capita driving achieved in the early 2000s are unlikely to be surpassed in the foreseeable future.

What Comes Next? How the Millennials Will Determine the Future of Transportation

Transportation infrastructure lasts for decades. The investments we make in transportation infrastructure, therefore, must be based on anticipated future needs at least as much as the needs of today.

For decades, transportation planners have assumed that economic and population growth would create continuous increases in demand for driving, necessitating new and ever-wider highways to alleviate the crippling congestion that was sure to follow. Over the last decade, though, those anticipated increases in driving have failed to materialize.

The degree to which driving will increase in the future depends crucially on the Millennial generation—otherwise known as “Generation Y”—those born between 1983 and 2000. In 2010, the Millennials surpassed the Baby Boomers as the largest generation in the United States, with the more than 77 million members of the Millennial generation accounting for nearly one in four Americans.⁵⁶

By the end of this decade, Millennials will begin moving into what has traditionally been the peak driving age (35 to 54 year-old) demographic, and by 2030 they

will represent the vast majority of the members of that age group. As a result, the evolving driving behaviors of the Millennials will be a key determinant of whether the trend toward stagnating vehicle travel will continue, reverse or even accelerate in the years to come.

Defining the Generations

There is no standard definition of generational boundaries. In this report, generations are defined as follows:

- **Baby Boomers:** those born between 1946 and 1964
- **Generation X:** those born between 1965 and 1982
- **Millennials (Generation Y):** those born between 1983 and 2000
- **Generation Z:** those born after 2000.

The New Transportation Habits of the Millennials

No age group has experienced a greater change in its driving habits than young Americans.

According to the National Household Travel Survey, from 2001 and 2009, the annual number of vehicle-miles traveled by 16 to 34 year-olds (a group that included a mix of Millennials and younger members of Generation X) decreased from 10,300 miles to 7,900 miles per capita—a drop of 23 percent.⁵⁷ (See “Generation X Has Also Reduced its Driving,” next page.)

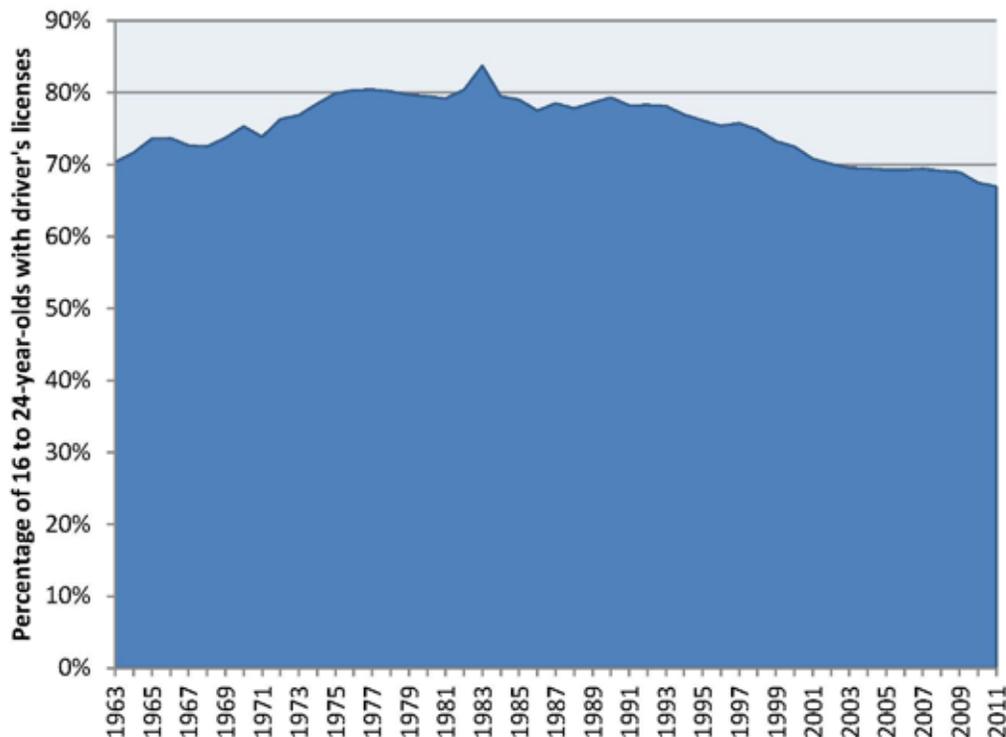
The percentage of young people with a driver’s license has been dropping for years. In 2011, the percentage of 16 to 24 year-olds with driver’s licenses dipped to 67 percent—the lowest percentage since at least 1963.⁵⁸

While young Americans are driving less than they did at the beginning of the 2000s, they have increased their use of other forms of transportation. In 2009, 16 to 34 year-olds as a whole took 24 percent more total bike trips than they took in 2001, despite the age group actually shrinking in size by 2 percent. From 2001 to 2009, the number of passenger-miles traveled per capita by 16 to 34 year-olds on public transit increased by 40 percent.⁵⁹

Why are Millennials driving less? The economy is likely one factor. The recession has been particularly difficult for young Americans—reducing job prospects, curtailing disposable income, and causing many young people to delay forming new households.

However, there are a number of compelling reasons to believe that the economy is not the only factor at play:

Figure 7. Percentage of 16 to 24-Year-Olds with Driver’s Licenses⁵⁸



Generation X Has Also Reduced its Driving

Recent changes in transportation behavior among members of the Millennial generation have attracted great notice, and for good reason—the changes in driving patterns in the United States have been most dramatic among the Millennials, and as America’s largest generation, the preferences and habits of the Millennials have the greatest implications for the future.

However, Millennials were not the only Americans to reduce the number of miles they drove during the 2000s. Members of Generation X (those born between 1965 and 1982) also experienced declines in per-capita driving. Among younger “Gen X’ers” between 30 and 34 years of age in 2009, per-capita driving fell by 17 percent relative to drivers of a similar age in 2001, with a similar decline among those 35 to 39 years of age. The oldest members of Generation X—those between 40 and 44 years of age in 2009—experienced only a slight 3 percent decline in per-capita driving relative to 2001.⁶⁰

- **Driving started to decline before the start of the recession:** The trend toward reduced per-capita VMT began long before the recent recession. Per-capita vehicle travel peaked in 2004, while the recent recession did not begin until the fall of 2007.
- **Driving has fallen among those with jobs:** Among young people, per-capita driving declined among both those with jobs and those without them between 2001 and 2009. Among 16 to 34 year-olds with jobs, per-capita vehicle travel declined by 16 percent during that time span.⁶¹
- **Driving and economic growth have diverged:** After moving in lock-step for decades, trends in economic growth and growth in vehicle travel have diverged in recent years, with per-capita GDP generally growing faster than per-capita vehicle travel since the late 1990s, suggesting that economic growth and vehicle travel are no longer as closely correlated as they once seems to be. (See Figure 8.)
- **New limits have been imposed on young drivers:** Between 1996 and 2006, every state one but one enacted a Graduated Driver’s Licensing law.⁶² These laws impose restrictions on young drivers, limiting the conditions under which new drivers may operate a vehicle and imposing additional costs, thereby discouraging driving.

The recent recession no doubt reduced the number of miles young Americans drove, but the economy is clearly not the only factor at play. Members of the Millennial generation have expressed a greater willingness to pursue less auto-oriented lifestyles than previous generations, and have been the first to grow up with access to the mobile Internet-connected technologies that are reshaping society and how people connect with one another. These changes could be playing a role in the dramatic reduction in driving among young Americans.

Figure 8. Trends in Per-Capita Vehicle-Miles Traveled and Real Gross Domestic Product ⁶³



For decades, economic growth and vehicle travel were closely correlated. Since the beginning of the 21st century, however, economic growth and vehicle travel have diverged, suggesting a weakening link between the state of the economy and the number of miles Americans drive.

Transportation and Lifestyle Preferences of the Millennials

In survey after survey, Millennials express preferences for housing and transportation that differ—sometimes markedly—with those of older generations.

Walkable Neighborhoods

Millennials are twice as likely as Baby Boomers and Generation X'ers to express a desire to live in a city.⁶⁸ According to a survey by the National Association for

Realtors, conducted in March 2011, 62 percent of people ages 18-29 said they would prefer to live in an area described as having a mix of single family houses, apartments and condominiums, with stores, restaurants, libraries, schools and access to public transportation nearby, than in a sprawl-style neighborhood. The percentage of young people who preferred to live in mixed-use, walkable neighborhoods was between four and 11 points higher than that of all other age groups.⁶⁹ Nearly two-thirds of Millennials surveyed for an Urban Land Institute report in 2011 said

Implications of Changing Driving Trends: The View from Wisconsin

By **Bruce Speight, WISPIRG Foundation**

Wisconsin continues to spend heavily on new road capacity and highway expansion, despite the fact that Wisconsinites are driving less.

The average Wisconsinite drove nearly 500 fewer miles in 2010 than in 2004, when total and per-capita VMT peaked. Yet, Wisconsin's transportation spending plans and recent state budgets have been tone deaf to these emerging trends. A January 2013 WISPIRG Foundation report found that Wisconsin has committed a disproportionately large amount of its planned spending to building new and wider highways. Wisconsin ranked 11th among the 50 states in the percentage of funds it is committing to new road capacity, with 30 percent of its State Transportation Improvement Plan (STIP) designated for new capacity, compared to a national average of 20 percent.⁶⁴ Those investment choices appear strange, not only because of the recent reductions in driving but also because Wisconsin's population is expected to grow much more slowly than the U.S. population over the next several decades.⁶⁵

The trends hardly justify diverting limited transportation resources from other transit and repair needs to major highway expansion projects. But that is exactly what state leaders have done. In the 2011-2013 biennial budget, state leaders increased the major highway budget by nearly 10 percent, while decreasing state funding for transit systems by 10 percent, as well as cutting funding for local road repair.

Major components of Wisconsin's transportation system are crumbling and in some cases inadequate. According to a 2008 report, 43 percent of Wisconsin's roads were rated as being in "less than good" condition, and 1,142 structurally deficient bridges in Wisconsin stood in need of repair in 2010. Drivers in Wisconsin pay an average of an extra \$281 per year in vehicle operating costs due to the poor condition of our roads and bridges.⁶⁶

Shrinking transit systems, meanwhile, are leaving Wisconsinites with fewer options for travel. With state budget cuts to transit agencies, local transit systems are increasingly cutting service, raising fares, or both. A University of Wisconsin Milwaukee study found that in Milwaukee, bus service miles have been reduced by nearly 20 percent since 2001. As a result, tens of thousands of jobs have become inaccessible to Milwaukee residents, making economic recovery more difficult for both the city and the state.⁶⁷

The time has come to reevaluate the state's transportation planning process to ensure that transportation investments reflect population, demographic and transportation trends.

WISPIRG Foundation is a non-profit organization that works to protect consumers and promote good government.

that walkability was essential (14 percent) or preferable (50 percent) in their housing choices.⁷⁰

Changing Values and Preferences

According to a recent survey by KRC Research and Zipcar, 44 percent of young people (18-34 years old) polled said they have consciously made an effort to replace driving with other transportation options—this is compared with 33 percent of those aged 35 to 44 and 26 percent of those 55 years old and up.⁷¹ A survey conducted by RCLCO in 20 major metropolitan areas found that 20 percent of Millennials would consider giving up a car as an unjustified expense, a far higher percentage than other generations.⁷²

Fading Car Culture

Mobile communications and computers have supplanted cars as the most important technology in the lives of Millennials. According to a survey conducted for Zipcar, 35 percent of those aged 18 to 34 believe that losing their computer would have the greatest negative impact on them, with 30 percent saying that loss of their mobile phone would be most negative. Only 28 percent said the same thing about their car. Baby Boomers ranked these choices in the opposite order, with nearly half of those aged 55 and up reporting that losing their car would have the greatest negative impact on their life, while 31 percent said the same thing about their computer and only 7 percent said their mobile phone.⁷³ Nearly two out of three college students responding to a 2011 survey by computer networking company Cisco said that they would choose an Internet connection over access to a car.⁷⁴

Millennials are also less likely to express an interest in automobiles as a hobby or cultural phenomenon: less than 15 percent of Millennials describe themselves as “car enthusiasts” as opposed to 30 percent of Baby Boomers.⁷⁵

The Mobile Technology Revolution, Millennials and Transportation

The use of mobile, Internet-connected technology has increased at almost incomprehensible speed. As recently as October 2010, according to the Nielsen market research firm, only 29 percent of all mobile phones in the United States were smartphones.⁷⁶ Less than two years later, that figure had nearly doubled to 55.5 percent.⁷⁷

No generation has adopted high-tech lifestyles as quickly or as enthusiastically as the Millennials. Internet use is near universal among Millennials, with 95 percent of 18 to 29 year-olds using the Internet compared to 52 percent of those 65 years old and up.⁷⁸ Two-thirds of young adults (18 to 29) own smartphones, compared with 45 percent of the population overall.⁷⁹ Cell phone owners between the ages of 18 and 24 exchange more than 100 text messages *per day* on average, compared with 41 for the population as a whole.⁸⁰

Technology has created revolutionary changes in Millennials’ social and economic lives. Three-quarters of 18 to 24 year-olds were using social networking by December 2008, a time when less than one-third of Americans over the age of 35 were using the technology.¹³⁷ A survey by computer networking equipment maker Cisco in 2012 found that two-thirds of college students and young professionals spend at least as much time with friends online as they do in person.⁸¹ Young people report being more likely to purchase items online rather than traveling to a store, and more likely to choose to spend time with friends online than driving to see them.⁸²

The spread of mobile, Internet-connected technology has the potential to change transportation just as it has changed other aspects of society. Specifically:

- **Mobile technology makes non-driving travel options more appealing.** Mobile technology can remove many of the day-to-day barriers that dissuade people—especially casual users—from using public transportation. New mobile apps allow transit riders to obtain real-time information on arrivals and departures, gain assistance with route and schedule planning, and even pay fares by smartphone. Because these tools are relatively new, there is little research on their impact on transit utilization, though a recent study found that the launch of real-time bus information in Chicago had led to a modest increase in bus ridership.⁸³

Mobile technology also allows transit riders to engage in recreational or job-related activities while riding—something that is difficult and dangerous to do while driving—and provides pedestrians and bicyclists with access to navigational information, including the location of nearby stores, transit stops and other amenities.

- **Mobile technologies enable new transportation options.** The past several years have seen an explosion of new transportation alternatives that rely on the Internet or mobile technologies. Several varieties of car sharing, bike sharing, taxi-booking services, and real-time ride sharing have come onto the scene. Again, with the exception of traditional car sharing (which has become mainstream and has been shown to reduce vehicle travel⁸⁴) it is too early to tell if any of these new transportation options will gain broad acceptance or make a significant impact on vehicle travel. Each of them, however, create new options that travelers can use to reduce the need to own a personal vehicle.

- **Mobile technologies can substitute directly for driving.** Telework, e-shopping, social networking, teleconferencing and distance education all have the potential to substitute for trips that might once have been made by car. Research on the impact of activities such as telework and e-shopping on vehicle travel has been mixed, though most studies suggest that telework leads to a reduction in VMT.⁸⁵

Unsurprisingly, Millennials have been the most likely to report having used these new, technology-enabled alternatives. According to the recent Zipcar survey cited above, 25 percent of those aged 18 to 34 reported that mobile transportation apps (such as taxi apps, real-time transit information and car sharing) had reduced their driving frequency, compared with only 9 percent of those 55 years of age and older.⁸⁶ People who use these apps quickly come to rely on them—when a popular bus-tracking application in Washington, D.C., ceased functioning in December 2012, the company’s in-box was quickly flooded with more than 7,000 angry e-mails from customers.⁸⁷

Summary

Millennials are demonstrating significantly different lifestyle and transportation preferences than older generations. They drive less on average than previous generations of young people. More of them say they wish to live in cities and walkable neighborhoods. And more of them are drawn to forms of transportation other than driving. Moreover, the Millennials are the first generation whose lifestyles are shaped by the availability of mobile, Internet-connected technologies, social media, and the innovative forms of social connection, commerce

and mobility that those technologies are spawning.

There is a chance that the differences in transportation and lifestyle habits currently demonstrated by Millennials may fade as they age. But it is also possible that cultural changes and advances in mobile technology will continue or even accelerate Millennials' transition away from

driving—with massive implications for transportation policy.

How could the changing driving behaviors of the Millennials and subsequent generations affect overall demand for driving? And what implications would those changes have on transportation policy? The next two sections address those questions.

Americans Will Drive Less than Was Predicted a Few Years Ago. How Much Less Is Uncertain.

The maturing Millennials play a profound role in determining America's future transportation needs. It is too soon to tell whether their desire for less auto-intensive lifestyles will persist or even grow over time. It is increasingly clear, however, that Americans will likely drive far fewer miles in the future than government agencies forecast even a few years ago. That conclusion has powerful ramifications for transportation policy in the years to come.

Three Scenarios of Future Driving

One way to understand the potential implications of changing driving trends is through the use of **scenario analysis**. According to one definition, "A scenario is a tool for ordering one's perceptions about alternative future environments in which today's decisions might be played out."⁸⁸ Scenario analysis enables the public and policy makers to assess the likely

implications of various "what ifs" of future trends. Scenarios are *not* predictions of the future, but rather visions of possible futures that may unfold.⁸⁹

In this report, we present three simplified scenarios of future trends in driving up to 2040 as a means to consider the possible implications for transportation policy of various pathways. All three scenarios are built on a common set of population projections and demographic assumptions from the Census Bureau. (See "Methodology" for the full details on how the scenarios were constructed.)

In comparison to recent trends in vehicle-miles traveled per capita, the three scenarios are all quite conservative. None portray the possibility that per-capita driving might continue to decline at the annual pace it did for specific age cohorts between 2001 and 2009, much less accelerate. Nor does any scenario portray a future in which per-capita driving continues to fall for any age cohort after 2025. The amount of vehicle travel under scenarios with more aggressive or persistent reductions would fall far below any of those represented here, with far more dramatic consequences.

Back to the Future

The **Back to the Future** scenario assumes that the decline in driving in the United States since 2004 is a temporary “blip,” not a lasting trend. It is consistent with a worldview that attributes the recent decline in driving largely to economic factors (such as slower economic growth and higher gas prices) and assumes that those conditions will fully reverse. The *Back to the Future* scenario is consistent with a world in which the housing and transportation preferences of Millennials increasingly come to mimic those of previous generations, economic growth returns to its brisk pace of the late 20th century, and the net effect of mobile, Internet-connected technology on demand for driving is minimal to non-existent. We represent the *Back to the Future* scenario by assuming that driving among members of a particular age group and sex will return to that group’s per-capita driving levels of 2004 by 2020 and continue at those levels thereafter.

Enduring Shift

The **Enduring Shift** scenario assumes that the shift in driving behaviors that has occurred over the last decade is real and lasting. It is consistent with a worldview in which the shift in housing preferences toward walkable neighborhoods and embrace of a broader range of transportation choices by Millennials and others persists as they age and is adopted by future generations as they reach driving age. The *Enduring Shift* scenario represents a world in which the cost of gasoline continues to remain high, a revival of economic growth does not result in a proportional increase in vehicle travel, and changes due to advances in mobile, Internet-connected technology continue to alter patterns of vehicle ownership and reduce per-capita driving, but only to the degree they have already done so.

We represent the *Enduring Shift* scenario by assuming that drivers in each age and sex cohort retain the same relative size of their

reduction in driving as they age that they experienced relative to the previous cohort of drivers their age between 2001 and 2009. For example, if 20 year-old males in 2009 drove 20 percent less than 20 year-old males did in 2001, it is assumed that eleven years later in 2020 they will similarly drive 20 percent less than 31-year-old males did in 2001. Similarly, it is assumed that in 2030 this same cohort will drive 20 percent less than 41-year old males did in 2001. New drivers are assumed to reduce their driving (relative to 2001 per-capita driving levels by age) by the same percentage as 16-to-24-year-olds did between 2001 and 2009. Thus, a 20-year-old male in 2020 or 2030 will drive approximately the same amount as a member of this cohort did in 2009.

Ongoing Decline

The **Ongoing Decline** scenario assumes that the decline in driving that has taken place over the last decade is the beginning of a deeper change in transportation patterns. The *Ongoing Decline* scenario is consistent with a worldview in which the recent change in driving patterns among young people is but the start of a broader shift—driven by changes in technology and consumer preferences—that makes driving a less necessary or desirable task for daily living than it has been in the recent past. The *Ongoing Decline* scenario may also represent a world in which external factors—such as dramatically higher gasoline prices, increased concern about the environment, or prolonged economic malaise—will increase the level of urgency for individuals to find alternatives to auto-oriented lifestyles. This scenario does not suggest that driving will become obsolete for Americans, but rather that it will stabilize at a much lower level per-capita after a period of additional change.

We represent the *Ongoing Decline* scenario by assuming that the percentage reduction in driving behavior experienced by each cohort during the eight years between

2001 and 2009 will be replicated over the 16 years between 2009 and 2025, and that new drivers will drive even less than young drivers did in 2009.

Implications of Possible Futures

The three scenarios do not represent predictions of the future. Rather, they are intended to illustrate a range of plausible outcomes.

As can be seen in Figure 9, the *Back to the Future* scenario would result in a rapid return to overall VMT growth, though, due to demographic shifts, driving would

still increase at a slower rate than in the past. Ultimately, VMT would increase by 24 percent by 2040. In the *Enduring Shift* scenario, overall VMT remains roughly at today's levels through the mid-2020s before rising again (though at a slower rate than in previous decades) as Millennials hit peak driving age, resulting in an 7 percent increase in VMT in 2040. That 7 percent increase in VMT compares with a 21 percent increase in population over the same time span. In the *Ongoing Decline* scenario, total VMT declines steadily through the mid-2020s—bottoming out at a level roughly 19 percent below the peak VMT of 2007. VMT remains roughly stable thereafter and fails to ever regain its 2007 peak by the end of the study period in 2040.

These three scenarios represent dra-

Figure 9. Vehicle-Miles Traveled under the Three Scenarios, 1946-2040

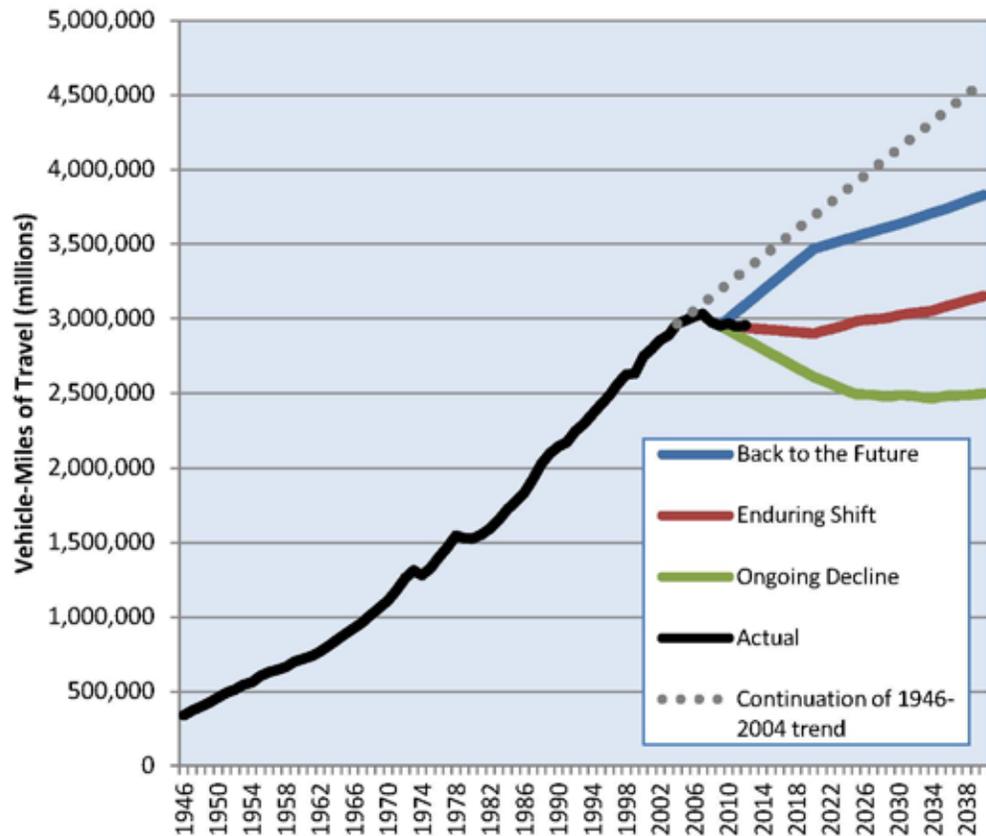
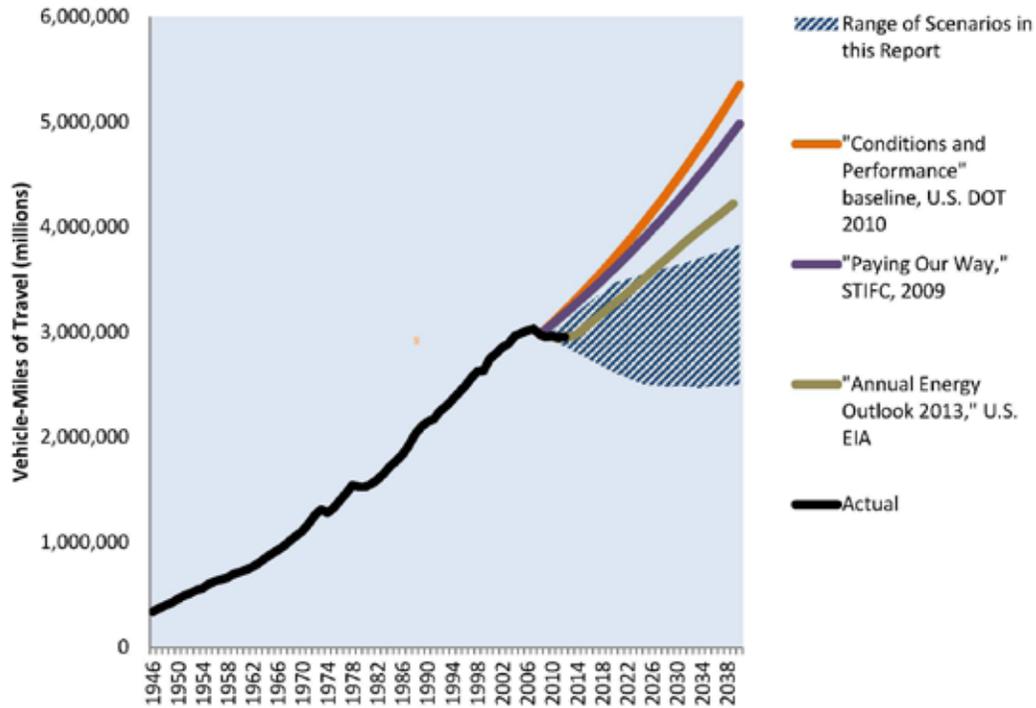


Figure 10. Recent Government Forecasts Compared with the Three Scenarios of VMT, 1946-2040



U.S. DOT = U.S. Department of Transportation
 STIFC = Surface Transportation Infrastructure Financing Commission
 U.S. EIA = U.S. Energy Information Administration

matically different visions of the future. By 2040, the difference in VMT among the three scenarios reaches nearly 1.3 trillion miles. All three scenarios, however, represent a break from the trend in driving during the Driving Boom era. Had those trends continued without change, Americans could have been expected to drive more than 4.5 trillion miles by 2040.

The “starting point” for each of the three scenarios is 2009—the last year for which data on vehicle travel by age are available from the National Household Travel Survey.⁹⁰ Actual aggregate VMT data from 2010, 2011 and 2012 have so far tracked nearly exactly with the *Enduring Shift* scenario. This does not necessarily

mean that the *Enduring Shift* scenario is most likely to represent future driving trends. It does mean that neither the rapid return to previous levels of driving assumed by the *Back to the Future* scenario nor the deeper trend away from driving described by the *Ongoing Decline* scenario appear to have yet begun.

While the three scenarios differ greatly with one another, *all three scenarios* would represent a departure from recent government forecasts of future driving. Figure 10 above compares the range of VMT from the three scenarios above with three recent government documents that forecast future VMT growth rates:

- *Paying Our Way*, the 2009 report of the National Surface Transportation Infrastructure Financing Commission (STIFC), a blue-ribbon panel created by Congress to evaluate the nation's transportation funding needs.⁹¹
- The U.S. Department of Transportation's (U.S. DOT) *2010 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance* ("Conditions and Performance") report, the latest in a series of biennial reports to Congress on the status of the nation's transportation system.⁹²
- The U.S. Energy Information Administration's (U.S. EIA), *Annual Energy Outlook 2013: Early Release*, the latest in a series of annual forecasts of energy use in the United States.⁹³

Only the most recent of these projections—published by the EIA—is near the boundaries of the three scenarios evaluated

here. (Although previous EIA forecasts have failed to foresee the recent decline in driving, see page 41.) Indeed, actual levels of vehicle travel have already diverged from the government forecasts made a few years ago, which were issued after the start of the recession and after several years of declining per-capita travel.

While we cannot be certain about the magnitude of future changes in driving trends, it is increasingly clear that Americans will drive significantly fewer miles in the future than was forecast even a few years ago. And if Millennials and others continue to reduce their driving relative to previous generations of Americans, it is possible that future driving behaviors will diverge from those predictions even more dramatically.

Changing driving trends have many important implications for transportation policy and various aspects of American life. The following section explores these implications in detail.

The Implications of Changing Driving Trends: Opportunities and Challenges

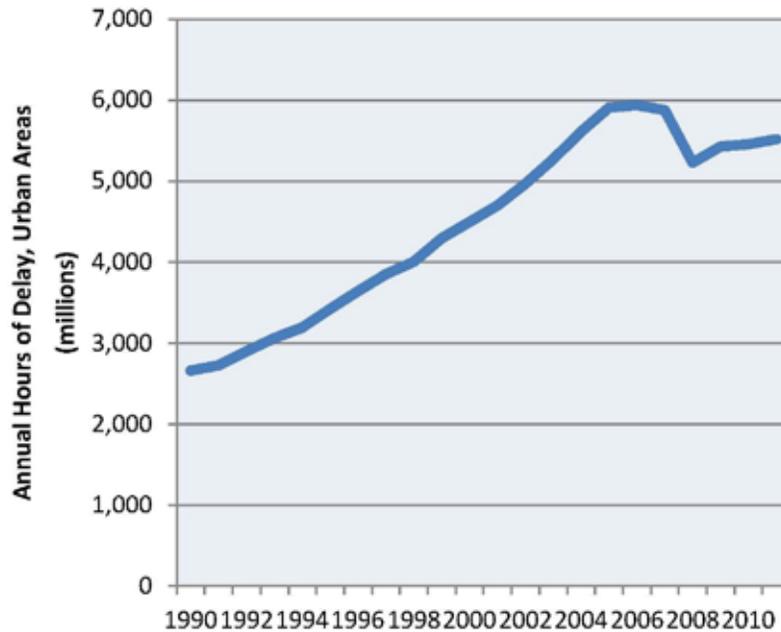
Changing trends in driving both create great opportunities and pose significant challenges to the United States. Flagging demand for driving curbs the threat of traffic congestion, reduces oil consumption and its resulting pollution, curtails the potential need for expensive new investments in highway expansion, and reduces the wear and tear on our roadways. However, reduction in the rate of growth in driving also threatens the stability of the nation's transportation funding system, which is already failing to meet its obligations.

Less Congestion

As driving has fallen in recent years, so has traffic congestion. According to data from the Texas Transportation Institute's (TTI) Urban Mobility Report, Americans spent 421 million fewer hours stuck in traffic in 2011 than they did in the peak congestion year of 2005.⁹⁴ After decades of increasing

road congestion, Americans now spend less total time stuck in traffic than they did in 2004, according to the TTI analysis—despite an 8.5 percent increase in urban population over that span of time.⁹⁵ Congestion continued to fall in 2012, according to the travel monitoring company, INRIX, which estimated that congestion fell by a whopping 22 percent in 2012 before ticking up again in the opening months of 2013.⁹⁶

Congestion levels do not necessarily track with total VMT. If vehicle travel is rising in urban areas and declining in rural areas, or if individuals are shifting travel to more-congested highways or times of day in which congestion is more likely, it is quite possible for congestion to increase even amid stagnating VMT. It is likely, however, that a rapid rise in VMT such as that posited in the *Back to the Future* scenario would cause a rise in congestion, while the *Enduring Shift* scenario would result in congestion remaining at roughly today's levels for at least another decade, and the *Ongoing Decline* scenario resulting in further reductions in congestion. None of these scenarios would result in congestion

Figure 11. Hours Lost to Traffic Delay Annually, 1990-2011⁹⁷

levels that would be predicted by models that assumed the steady increases in VMT common during the Driving Boom.

Thus, transportation investment can safely focus less on preventing massive increases in traffic congestion and more on other priorities.

Reduced Fossil Fuel Consumption and Air Pollution

Gasoline consumption for transportation—which accounts for 45 percent of America’s consumption of oil—contributes to a litany of problems.⁹⁸ It leaves America dependent on foreign regimes for oil (contributing to national security challenges and the trade deficit), it contributes to global warming and to dangerous air pollution in our

cities, and it leaves Americans’ pocketbooks vulnerable to volatile swings in world oil prices.

The recent reduction in driving in the United States has helped reduce our dependence on oil. In 2011, U.S. gasoline consumption for transportation hit a 10-year low, due in part to both stagnant driving and improved vehicle fuel economy.⁹⁹ The decline in transportation oil consumption was one of several factors contributing to a reduction in petroleum imports to their lowest level since 1995.¹⁰⁰ Emissions of carbon dioxide, the leading global warming pollutant, from transportation were the lowest since 1999.¹⁰¹

Consumption of energy for light-duty vehicles is expected to decline in the next several decades as a result of improved fuel economy. However, fuel consumption would decline even more under scenarios with greater reductions in vehicle travel. By 2040, for example, the *Enduring Shift* scenario would result in the United States

using the equivalent of 16 billion fewer gallons of gasoline per year for our cars and light-duty trucks than in the *Back to the Future* scenario—the rough equivalent of all the gasoline currently consumed each year in California. The *Ongoing Decline* scenario, meanwhile, would result in the nation using roughly half as much gasoline or alternative fuels in our cars and light trucks by 2040 as we use today. Proportional reductions in health-threatening air pollution and pollution that contributes to global warming could also be expected.

In sum, a future in which vehicle travel resembles the *Enduring Shift* or *Ongoing Decline* scenarios represents a great opportunity to reduce the nation's persistent problems with oil dependence, as well as the environmental and public health costs associated with our reliance on fossil fuels.

Reduced Expenditures for Highway Expansion and Maintenance

Reduced VMT growth can have a major impact on assumptions of future transportation investment needs. Reduced vehicle travel reduces congestion—undermining the cost-benefit rationale for many highway expansion projects—and reduces wear and tear, reducing the need for maintenance expenditures in the long run.

Two recent estimates of highway investment needs illustrate the dramatic savings that are possible by reducing vehicle travel. The U.S. Department of Transportation's 2010 *Conditions and Performance* report evaluated two scenarios for highway investment needs: one that reflected states' projections that VMT would increase by an annual rate of 1.85 percent per year,

and another that reflected a more modest 1.23 percent per year increase. At the higher VMT projection, the department estimated that there was more than \$105 billion in “cost-beneficial” spending that could occur each year, as opposed to \$80 billion in the lower VMT scenario.¹⁰²

Similarly, the American Association of State Highway and Transportation Officials' (AASHTO) 2009 *Bottom Line* report mapped out alternative transportation investment scenarios assuming 1.4 percent and 1.0 percent annual VMT growth going forward, with the 1.0 percent scenario costing 20 percent less than the one reflecting steeper growth.¹⁰³

Maintenance needs are affected not just by the amount of traffic, but also by the types of vehicles traveling on roads and bridges. Heavy-duty trucks impose far greater damage on roads than light-duty vehicles.¹⁰⁴ As a result, a future in which there are fewer miles driven overall, but more of them in heavy trucks, could result in similar or greater wear and tear on highways. However, the number of miles driven in the heaviest trucks has actually declined *faster* than overall vehicle travel in recent years, falling by 11 percent between 2007 and 2011.¹⁰⁵ There is little evidence thus far for the proposition that reductions in household driving must coincide with an increase in heavy-duty truck traffic.

The *Back to the Future*, *Enduring Shift* and *Ongoing Decline* scenarios, therefore, can be expected to have dramatically different implications for future highway maintenance and construction needs, with the investments required under the *Back to the Future* scenario resembling those described by recent evaluations of transportation investment needs by AASHTO, the U.S. DOT and others. The *Enduring Shift* and *Ongoing Decline* scenarios, however, hold out the possibility that those needs might not be quite so great.

These scenarios speak to future maintenance needs, not the pressing need to

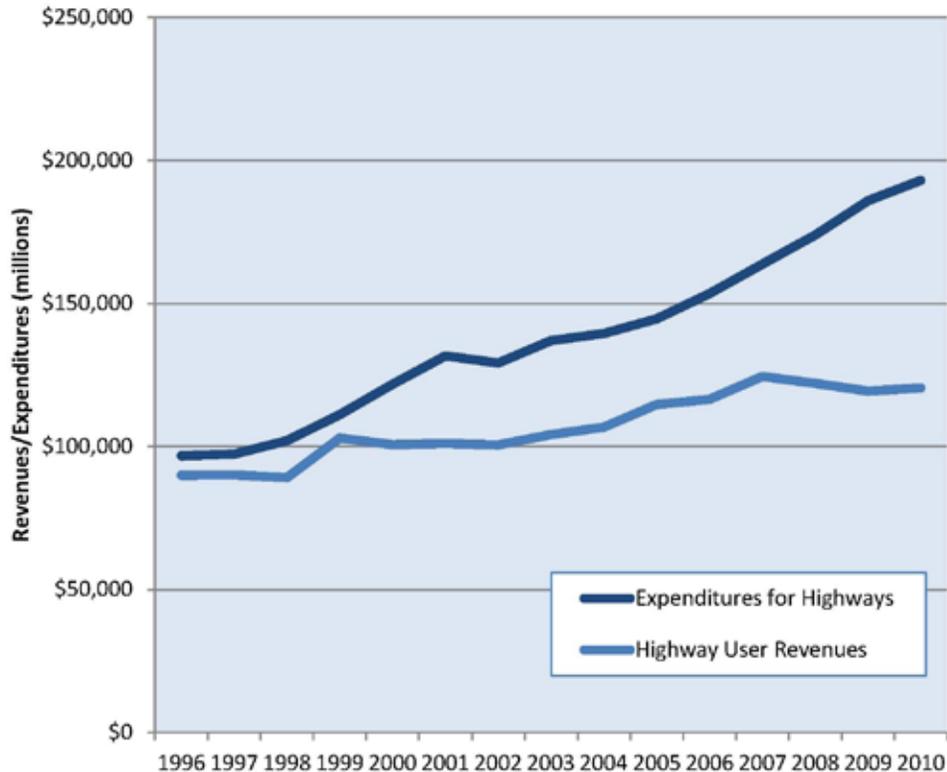
address the significant and mounting backlog of infrastructure repair projects in the United States at present. Shifting funds from highway expansion projects that may not be necessary in the future to repair and maintenance projects would be a reasonable response to any of the three scenarios.

Reduced Revenue from the Gasoline Tax

While reduced driving lessens the need for new highways and repairs of old ones, it also diminishes the amount of money available to fund transportation improvements by eroding the chief source of transportation revenue: the gas tax.

There remains a common misconception that “roads pay for themselves”—that is, that revenues from the gasoline tax are sufficient to cover the costs of highways and driving.¹⁰⁶ By 2010, revenue brought in from gas taxes and other user fees (not all of which is dedicated to highways¹⁰⁷) equaled only 62 percent of highway spending by all levels of government.¹⁰⁸ In other words, for every two dollars of highway improvements paid for by drivers, general taxpayers chipped in a third dollar—a subsidy of \$73 billion in 2010 alone. While projects paid for by the American Recovery and Reinvestment Act helped fuel the continued increase in road spending in 2009 and 2010—widening the gap between revenues and expenditures—the long-term trajectory has been toward increased dependence on general taxpayers for transportation funding, both at the federal level and in many states.¹⁰⁹

Figure 12. Highway User Revenues versus Expenditures for Highways¹¹⁰



In 2009, the National Surface Transportation Infrastructure Financing Commission (STIFC) concluded that the nation faced a “crisis” in transportation finance. The commission concluded that making up the gap between anticipated revenues and the cost of investments needed to maintain the system would require an increase in state and federal gasoline taxes of 53 to 58 cents per gallon, or a per-mile fee on driving (VMT fee) of 3.2 to 3.5 cents per mile.¹³⁸

The recent trend toward reduced driving—coupled with continued moves to improve vehicle fuel economy—makes the commission’s bleak revenue projections look positively rosy.

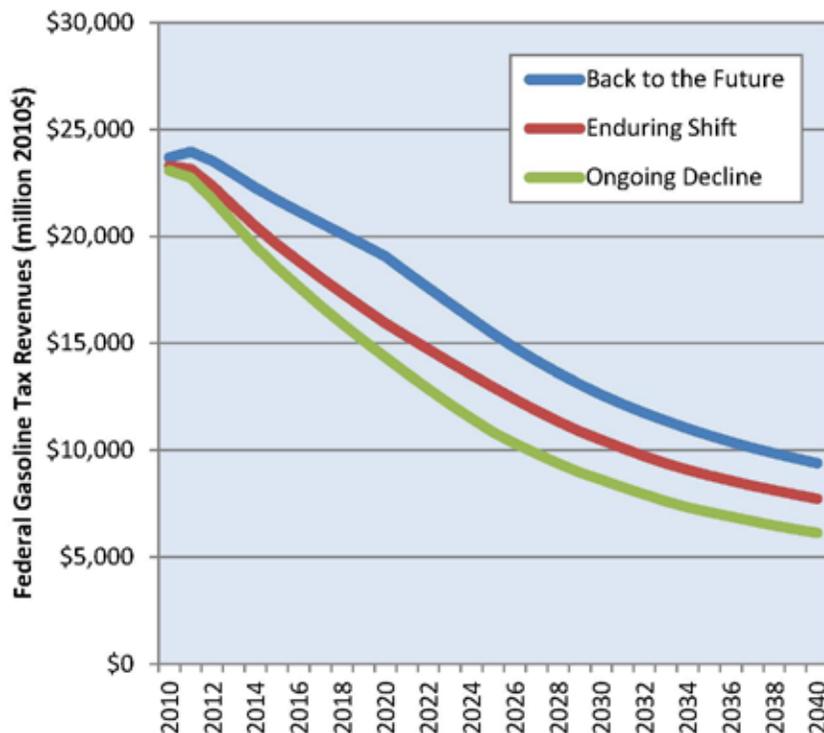
To estimate the impact of the various scenarios on federal gasoline tax revenue, we multiplied the light-duty portion of VMT under each of the three scenarios

presented in this report¹¹¹ by the current federal gasoline tax rate of 18.4 cents per gallon and divided that figure by the fleet average real-world vehicle fuel economy (in miles per gallon) projected by the EIA in its *2013 Annual Energy Outlook*.¹¹²

All three scenarios would result in significantly lower real revenues in future years due to the effects of inflation and improvements in vehicle fuel economy, but the size of the reduction depends greatly on trends in vehicle travel. Under the *Back to the Future* scenario, gasoline tax revenue would decline by 60 percent by 2040 when corrected for inflation, relative to 2011 levels. Under the *Enduring Shift* scenario, the decline is a more significant 67 percent, while under the *Ongoing Decline* scenario it is 74 percent.

Since most states also fail to index their gasoline taxes to inflation, the decline in

Figure 13. Inflation-Adjusted Federal Gasoline Tax Revenue under the Three Scenarios (2010\$)



the real value of the gasoline tax will be magnified.¹¹³ The 36 states with flat rate (i.e., non-indexed) gasoline and diesel taxes have already seen a 29 percent erosion in the value of their fuel taxes since the last time those taxes were raised, contributing to a \$10 billion decline in real state gas tax revenue.¹¹⁴ Stagnation in driving, coupled with improving fuel economy and the effects of inflation, would compound the erosion of transportation funding at the state level as well.

Changes in VMT trends would also affect the sustainability of funding from VMT-based fees, a commonly proposed alternative to the gasoline tax. VMT fees would need to become significantly higher over time in order to generate the same amount of revenue.

Increased Risk for Public-Private Partnerships

As gasoline tax revenues have dried up, federal and state transportation officials have sometimes looked toward public-private partnerships (PPPs) as a potential alternative. There are many possible ways for government to partner with the private sector, including traditional forms of financing and procurement that raise private money through the municipal bond market and hire private contractors to provide materials and labor. But most of the attention given to PPPs involves the potential for a private entity to agree to build and/or maintain a highway for a given period of time in exchange for revenue—in many cases, from vehicle tolls.

Uncertainty regarding VMT trends reduces the attractiveness of toll revenue as a payout to private investors. Fewer investors will be willing to invest the massive amounts of capital required to build and maintain a toll road if the

number of paying customers is not likely to rise over time. In 2005 and 2006, foreign toll road operators financed by large financial companies made large bets on future traffic volume by purchasing a 99-year lease in Chicago and a 75-year lease in Indiana for major toll roads. In each of these deals and many smaller ones, the private investors acted as concessionaires, collecting tolls for their own bottom line. Many people thought these toll concessions were the wave of the future.

Several toll concessions have produced less revenue than expected. Some have needed to be bailed out by the government. Others—such as a brand-new billion-dollar toll road in Texas that sought to attract traffic by posting the nation’s fastest speed limit, 85 miles per hour—have faced the threat of a credit downgrade as a result of flagging traffic.¹¹⁵ These shortfalls in privately collected tolls do not necessarily mean that the government received a “good deal,” since more expensive private capital costs and other potential compensation must also be covered.¹¹⁶

More recently, the trend toward toll concessions has been replaced with an alternative form of long-term PPP arrangement in which private investors are paid a pre-established rate by the government for making toll lanes available.¹¹⁷ A downside of using these so-called “availability payment” arrangements is that they merely shift the risk of lower-than-expected toll revenue from reduced travel from private enterprise to taxpayers, eliminating one of the important potential benefits claimed for PPPs.

The trend away from toll concessions and toward availability payments can be seen as an implicit bet by Wall Street and other investors against the idea that vehicle travel will return to the sustained growth of the Driving Boom years, and an indication that investors are seeking a hedge against VMT trends similar to those

in the *Enduring Shift* and *Ongoing Decline* scenarios.

Emergence of trends similar to those of the *Back to the Future* scenario would likely set off a resurgence of investor interest in toll road concessions, whereas the other scenarios would likely solidify the trend away from toll concessions. Another implication is that governments could doubly lose out if they invest in building and maintaining new toll lanes based on financing projections that assume the *Back to the Future* scenario. If the *Enduring Shift* or *Ongoing Decline* scenarios instead come about, then governments could find they have paid for new lanes that are both unneeded and fall far short of covering their expected costs.

Changing vehicle travel trends pose risks not just for private investors but for taxpayers as well—regardless of how the risks are distributed at the outset of a PPP arrangement.

Summary

Changing trends in driving bring with them tremendous opportunities, as well as significant challenges. Stagnant or declining VMT would significantly reduce many of the environmental and public health problems caused by driving, while reducing growth in congestion and alleviating the need for costly expenditures to maintain and rebuild highways. However, reduced driving has already contributed to the nation's transportation funding woes by eroding gasoline tax revenue, and it also poses major obstacles to potential funding sources that have been suggested as alternatives to the gas tax, including VMT charges and public-private partnerships.

Transportation policy in the United States should work to maximize the benefits of changing driving trends by supporting the desires of Millennials and others to reduce their driving, while also addressing the funding challenges posed by reductions in vehicle travel. The following section lays out a blueprint for how transportation policy could be revised to meet the needs of the 21st century.

A New Vision for Transportation Policy

The nation's current transportation policies were borne out of the needs of early to mid-20th century America. Those policies did an excellent job of raising money for and building new highway capacity. By the end of the 20th century, these policies had succeeded in completing the Interstate Highway System and largely financed the creation of a road network designed to encourage and accommodate the postwar Driving Boom.

The needs of 21st century America are different, but our transportation policies remain stuck in the past. We continue to spend vast sums on highway construction projects of dubious value, even as the highway infrastructure America built in the 20th century ages and deteriorates. Meanwhile, there is little recognition among policymakers that transportation trends have changed, or that the needs and desires of rising generations such as the Millennials may be different from those of previous generations of Americans.

America's current transportation policy framework is unproductive and unsustainable. The nation needs to hit the "reset" button on transportation policy to account for recent changes in driving habits and to

create a transportation system that meets the needs of the 21st century.

A new vision for transportation policy in the United States begins with a few common-sense principles.

1. Plan (and invest) for uncertainty.

The evidence is clear that the Driving Boom—the 60-year period of regular, steady increases in per-capita driving—is now over. We don't yet know, however, what will replace it.

Are the changes that have occurred in driving behaviors—particularly among young Americans—temporary shifts that will be erased by renewed economic growth? Are they just the beginning of a more sustained shift away from auto-oriented lifestyles? Or is the reality somewhere in between?

The scenarios of future demand for driving presented in this report are *all* a sea change from the defining assumptions of the Driving Boom era, and

the investments suggested by any of these scenarios differ from those suggested by recent government forecasts that anticipated a return to rapid and sustained growth in vehicle travel. But differences in the three scenarios in this report illustrate a significant gulf between future possibilities. The investment decisions that would be required to accommodate the increase in driving in the *Back to the Future* scenario are vastly different than those that would be needed if the recent drop in driving is the beginning of a deeper decline. How can policymakers possibly make wise long-term investments in such an atmosphere of uncertainty?

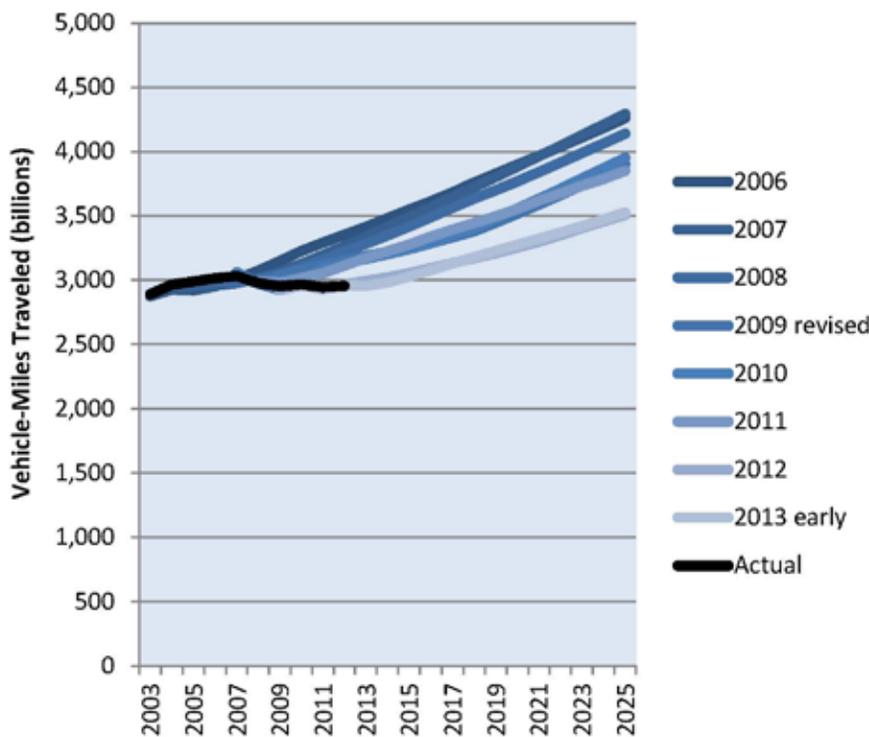
The first step is for policymakers to stop pretending that future increases in driving are foreordained. Over the past decade, official forecasts have continued to predict steady, rapid increases in vehicle travel that have failed to materialize. For example, the

U.S. Energy Information Administration (EIA)—which produces the official U.S. government forecasts of energy use—forecast in 2006 that Americans would be driving more than 3.3 trillion miles per year by 2012. Instead, Americans drove less than 3 trillion miles—10 percent fewer than had been predicted just six years earlier. Figure 14 shows how official forecasts have predicted a resumption of vehicle travel growth year after year, even as that growth has failed to materialize.

To the extent that these forecasts have influenced public policy, America likely finds itself today over-investing in highway capacity at the expense of other transportation and societal priorities.

Transportation planners and public officials must understand that there are important uncertainties in future demand for driving and that these uncertainties are unlikely to be properly accounted for

Figure 14. Recent Energy Information Administration Forecasts of Vehicle-Miles Traveled by Date of Forecast¹¹⁸



using assumptions developed during the Driving Boom.

The second step is for policymakers to incorporate uncertainty into transportation decision-making. Specifically, planners and policymakers should:

- Evaluate transportation proposals under a variety of scenarios of future driving. Regional transportation plans and individual project proposals should be tested against different scenarios for economic growth and gasoline prices, as well as changes in population, demographics and consumer preferences.
- Prioritize projects that are the most likely to deliver benefits under any scenario. Investments in transportation demand management, for example, may compare favorably with large highway expansion projects given that they deliver benefits under a variety of possible future conditions and may be lower in cost and risk.
- Incorporate uncertainty into cost-benefit equations and risk calculations for PPPs. Effective management of PPPs requires a sophisticated understanding of risk. To the degree that private sector entities involved in PPPs take on traffic-related risks in the construction of private toll roads or other infrastructure, the public must be able to understand the potential for and implications of possible default or bailouts. To the extent that the public takes on those risks by agreeing to make future “availability payments,” decision-makers must clearly assess whether the benefits of the project are worth the costs under a variety of scenarios of possible future driving. Consideration of lower-VMT scenarios may be particularly important for selecting

the recipients of the competitive federal “innovative financing” loans (under the Transportation Infrastructure Finance and Innovation Act, TIFIA), so as to avoid overstating the congestion-reducing merits and creditworthiness of highway PPPs.

2. Support the desire of Millennials and other Americans to drive less.

The Millennial generation is saying loud and clear that it is looking for alternatives to auto-oriented lifestyles. Reducing the growth in driving on American roads can bring great benefits to society—curbing the nation’s dependence on oil, reducing congestion without the massive expense and disruption of expanding highways, and reducing emissions of air pollutants that threaten the environment and public health.

Considering that Millennials and subsequent generations will be the primary beneficiaries of the transportation infrastructure we build today (and the ones who will ultimately pay for it) why shouldn’t the investments we make today reflect their needs, particularly if doing so would also deliver broad benefits to society?

At the local level, many city governments are beginning to respond to these new demands, with cities increasingly racing to add bike lanes, streetcars and other infrastructure that enables new transportation options. Development is also now booming in many urban centers. An EPA analysis found that “infill” development in already built-out portions of metropolitan areas attracted a greater share of new residential construction in the late 2000s than earlier in the decade

in nearly three-quarters of the metropolitan areas studied.¹¹⁹ In 2011, the population of large cities grew faster than that of suburban areas for the first time in at least nine decades.¹²⁰ Some state governments are beginning to respond to these new demands as well.¹²¹ But the bulk of America's transportation policy framework is still designed to make building highways easy and investing in other solutions difficult.

In the postwar years, when Americans expressed their desire for suburban housing and greater mobility, the full weight of federal and state governments swung into action, building the Interstate Highway System, enacting automobile-focused planning and zoning codes, and subsidizing new housing in the suburbs.

What might a transportation policy look like that did the same for the Millennials? At minimum, it would:

- Make the expansion of transportation choices to a broader range of Americans a national priority in the 21st century—much as the development of the Interstate Highway System was seen as a national priority in the 20th century.
- Encourage state and local governments to reassess automobile-oriented planning and zoning rules—prioritizing the development of streets and roads suitable for driving, bicycling and walking; revising zoning rules that stand in the way of compact, mixed-use development; and ensuring that transportation infrastructure investments are consistent with land-use plans.
- Refocus federal investment on transportation infrastructure projects that received less investment and attention during the Driving Boom, including investments in the nation's

passenger rail network and in urban transit systems.

While the Millennials will play a critical role in determining future driving trends, transportation policymakers must obviously keep in mind the needs of *all* Americans. The aging members of the Baby Boom generation—largely concentrated in the suburbs—will soon find themselves with new transportation needs. Federal, state and local governments must also consider how the changing mobility needs of the Baby Boom generation will affect demand for public transportation and paratransit services in areas that are often poorly served by current transit systems and must devote resources toward serving those needs.

3. Revisit plans for new or expanded highways.

Short-term and long-term transportation plans are filled with highway projects that were planned under very different expectations of future travel growth. Many of these “legacy projects” were originally proposed decades ago, and approved based on assessments of future travel made a decade ago or more.¹²² Meanwhile, state and federal governments continue to invest vast resources in further expansions of highway capacity, despite nearly a decade of zero growth in vehicle travel. Between 2004 and 2008, states continued to devote 57 percent of highway funding to expansion projects, versus only 43 percent to system preservation.¹²³

The assumptions of future growth in vehicle travel that undergird Long-Range Transportation Plans and short-term Transportation Improvement Programs appear to have not yet been reviewed in any systematic way since the close of the Driving

Boom. For example, the 2010 version of U.S. Department of Transportation's (U.S. DOT) biannual *Conditions and Performance* report—which provides a comprehensive view of the investment needs of the nation's highway and transit systems—was published in March 2012, well after the trend toward stagnant vehicle travel had become apparent. However, the U.S. DOT's study was based on state-supplied VMT growth forecasts that amounted to a 1.8 percent average annual growth rate in VMT—a rate of year-over-year growth that has not been achieved in *any* single year since 2004, and is more than double the average rate of growth between 2000 and 2010.¹²⁴

The period of no growth or slow growth in vehicle travel is likely to continue for at least the next several years, if not longer. Even the Energy Information Administration's 2013 forecast, which anticipates an eventual return to sustained growth in driving, does not anticipate total VMT returning to its peak 2007 level until 2016.¹²⁵ If future driving trends more closely resemble those of the *Enduring Shift* scenario, it will be more than another decade before total VMT returns to its 2007 level; if trends resemble those in the *Ongoing Decline* scenario, they may not return to that level until after 2040, if ever.

This interregnum in vehicle travel growth provides an excellent opportunity to rethink previous transportation investments and reconfigure our priorities. Specifically, federal, state and local governments should:

- Begin an immediate review of projects on state and regional Transportation Improvement Programs and Long-Range Transportation Plans in light of new understandings about trends in vehicle travel. Projects that cannot be justified based on lower levels of expected traffic volume should be delayed or scrapped.
- Refuse to devote additional resources to new highway expansion projects unless the projects have been demonstrated to deliver significantly greater societal benefits compared with other transportation alternatives under a range of possible scenarios of future vehicle travel growth.

4. Refocus the federal role.

The recent sharp decline in federal fuel tax revenues—which has forced the infusion of ever-larger amounts of cash from the general fund to keep the Highway Trust Fund afloat—has led to a new set of conversations about the proper role of the federal government in transportation policy.

The federal government clearly has a role to play in making investments that address strategic national priorities. The current system, however, distributes highway funds to states with little accountability for results and no clear connection to broader strategic objectives.

The United States should establish clear, relevant national priorities for transportation investment. We propose the following priorities:

- The nation should set a goal of bringing the highway and transit systems to a state of good repair as soon as is practical.
- The federal government should serve the changing transportation needs of Americans by supporting the development of communities with multiple transportation options.
- The federal government should expand efforts to promote innovation in the application of technology and small-scale solutions to transportation chal-

lenges. A collection of inexpensive, small-scale fixes can sometimes be just as effective as a major infrastructure expansion in reducing congestion.¹²⁶

The advent of mobile Internet-connected technology provides more opportunities for such small-scale innovations. The federal government can help states to gain access to new solutions and to share their expertise and experiences with those solutions with one another.

Absent from this list of national priorities is expansion of the existing highway system. State and regional governments would be free, under this new vision of federal priorities, to propose highway projects as solutions to transportation needs, but no longer would those investments be first in line for federal taxpayer resources or receive a favorable federal match compared with transit projects or other transportation alternatives.

Once the nation sets clear priorities, all significant transportation investments should be evaluated based on the degree to which projects meet those objectives. The two-year federal transportation law passed in July 2012 (*Moving Ahead for Progress in the 21st Century*, or MAP-21) mandates the creation of performance metrics for states and the federal government, but those state metrics need not be established until years after the law has expired and will yield little benefit if they are not attached to clear triggers that reallocate transportation resources to better meet those goals and reward success.¹²⁷ The current law places light penalties on states that do not develop risk-based asset management plans after 2014 and can impose some light penalties for neglect of federally financed assets after 2018. While these provisions are a first step toward ensuring that transportation spending is aligned with true priorities and that the projects that receive federal funds are those that can deliver the greatest “bang

for the buck,” much more must be done to ensure the effectiveness and accountability of federal transportation spending.

5. Use transportation revenue where it is most needed.

America’s transportation investments continue to be shaped by policies adopted nearly a century ago when paved roads were uncommon and the automobile was a novelty. In those years, state governments began to adopt statutory or constitutional provisions dedicating revenue from the gasoline tax to roads and bridges.¹²⁸ Many of these provisions remain in effect today, while the assumption that all revenues obtained from drivers should be spent for their exclusive benefit continues to shape the transportation debate.

The needs of 21st century America demand that we spend transportation revenue in ways that maximize the benefits for future Americans. Local, state and federal governments should be free to invest in transportation projects that deliver the greatest benefits to society. Outmoded constitutional provisions that bar the use of gasoline tax revenue for public transportation or other transportation alternatives should be discarded, while current federal policies that require transit projects to undergo a more difficult review process than highways or receive a less generous federal match should be eliminated.

6. Do our homework.

The recent decline in driving has exposed the inadequacy and inaccuracy of the current models and planning tools used

to guide infrastructure investments in the United States. At both the national and local levels, transportation planners have continually overestimated traffic demand.

After roughly eight years of stagnation in vehicle travel, the time has come to revisit whether we know everything we need to know about Americans' travel preferences and choices as we plan for the future.

Federal, state and local officials should launch renewed research efforts to inves-

tigate changing transportation trends and to evaluate the impact of new technologies and new patterns of development on accessibility and mobility. Key travel surveys—especially the National Household Travel Survey—should be conducted more frequently (ideally annually¹²⁹) to provide better, more up-to-date information on transportation behaviors. State and local governments should also take steps to consider the implications of changing travel trends in their own planning processes.

Conclusion

The end of the Driving Boom has brought uncertainty to U.S. transportation policy. But it has also brought opportunity. A future of stabilized demand for driving is one in which roads last longer and are cheaper to maintain, traffic congestion remains stable or declines, America is less dependent on oil, and our cars produce less pollution.

The changing transportation priorities of the Millennial generation, the advance of new technology, and other changes provide an opportunity for the United States to create a new transportation policy that meets the needs of the 21st century. To achieve that goal, however, the nation

must integrate our growing understanding of recent changes in transportation trends into every aspect of transportation decision-making, from the ways in which we estimate future transportation funding needs to the ways in which we choose our investment priorities.

We may not know the exact shape of the future, but it is increasingly likely that it will look very different from the past. By retiring Driving Boom-era assumptions and policies that no longer serve the nation's needs, we can build a transportation system that is more affordable, more efficient and more sustainable for the long haul.

Methodology

The scenarios presented in this report are intended to illustrate various visions for how aggregate vehicle-miles traveled (VMT) could change in the future, so as to better understand the implications of those changes on transportation policy. These scenarios are based on historic trends in per-capita VMT by age and gender from the National Household Travel Survey (NHTS), and projections of future population from the U.S. Census Bureau.

The three scenarios evaluated in this report—the *Back to the Future*, *Enduring Shift* and *Ongoing Decline* scenarios—align conceptually with the alternative hypotheses of future trends in driving (“interrupted growth,” “saturation” and “peak car”) suggested by Phil Goodwin in *Peak Travel, Peak Car and the Future of Mobility: Evidence, Unresolved Issues, Policy Implications and a Research Agenda*, International Transport Forum, discussion paper prepared for the roundtable on long-run trends in travel demand, 29-30 November 2012.

Constructing a Profile of Per-Capita VMT by Age and Sex

The scenario analysis required creation of a year-by-year estimate of per-capita VMT by age and sex. The NHTS includes estimates of vehicle-miles traveled by age category and sex for years in which the survey took place (2001, 2009). Data on annual vehicle-miles traveled by age group and sex were downloaded using the NHTS data extraction tool (nhts.ornl.gov/det/Extraction2.aspx) for the 2001 and 2009 surveys, and were divided by the number of licensed drivers of each sex in each age category (obtained from the FHWA’s *Highway Statistics* series of reports) to arrive at a figure for VMT per licensed driver for members of each age group and sex.

To arrive at an estimate of average per-capita VMT for each age and gender, VMT-per-licensed-driver was multiplied by the number of licensed drivers of that sex and age group¹³⁰ from U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* series of reports, and divided by population for that age and sex from the U.S. Census Bureau.¹³¹

Population Estimates and Projections

Population estimates for the 2001 through 2010 period, broken down by age and sex, were obtained from the U.S. Census Bureau (www.census.gov/popest/data/intercensal/index.html). Population estimates for 2010 and 2011 were also obtained from the Census Bureau. Updated population projections for 2012 through 2040 were obtained from the U.S. Census Bureau in December 2012 (www.census.gov/population/projections/data/national/2012.html).

Constructing the Scenarios

This report uses three scenarios—*Back to the Future*, *Enduring Shift*, and *Ongoing Decline*—to illustrate the implications of various potential trends in per-capita household vehicle travel on transportation policy.

All three scenarios are built on estimates of household VMT, from which estimates of total VMT are calculated as described in the “Factoring in Non-Household VMT” section below. All three scenarios share a base year of 2009, the last year for which age and gender-specific VMT data are available. Household vehicle-miles traveled for 2009 were calculated by multiplying age- and gender-specific estimates of per-capita VMT in 2009 (calculated based on the NHTS and FHWA sources described above) by age- and sex-specific population estimates from the Census Bureau.

Back to the Future

The *Back to the Future* scenario assumes that average per-capita VMT by age and sex will return to its 2004 level by 2020 and continue at those levels thereafter.

For those of driving age (16 and older) at the time of completion of the 2009 NHTS, the following formula was used to estimate per-capita VMT for each sex and year of age, using linear interpolation between 2001 and 2009 values for per-capita VMT by age and sex to estimate values in the peak per-capita driving year of 2004:

$$PCVMT = PCVMT_{2001a} + \frac{\{((PCVMT_{2009a} - PCVMT_{2001a}) + (PCVMT_{2009a} - PCVMT_{2001b})) * 3/8\}}{2}$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by year of age and sex in 2009

$PCVMT_{2001a}$ = Per capita VMT by year of age and sex in 2001

$PCVMT_{2001b}$

= Per capita VMT by year of age and sex in 2001 of those of a particular age in 2009 (e.g. a 21 year old in 2001 who is 29 years old in 2009.).

For those not of driving age in 2009, the formula is as follows:

$$PCVMT = PCVMT_{2001a} + ((PCVMT_{2009a} - PCVMT_{2001a}) * \frac{3}{8})$$

VMT per capita by age and sex were multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Enduring Shift

The *Enduring Shift* scenario assumes that drivers in each age cohort reduce (or increase) their driving as they age by the same percentage by which they changed their driving compared with an older cohort in 2009. For example, if 20-year-old males in 2009 drove 20 percent less than 20-year-old males did in 2001, it is assumed that eleven years later in 2020 they will similarly drive 20 percent less than did 31-year-old males did in 2001. In 2030, this same age cohort will drive 20 percent less than 41-year old males did in 2001. New drivers are assumed to reduce their driving (relative to 2001 per-capita driving levels by age) by the same percentage as 16 to 24 year-olds did between 2001 and 2009. Thus, a 20-year old male in 2020 or 2030 will drive approximately the same amount as members of that age group did in 2009. For those of driving age at the time of the 2001 NHTS, the formula for per-capita VMT by year of age and sex is as follows.

$$PCVMT = PCVMT_{2009a} * \left(\frac{PCVMT_{2009b}}{PCVMT_{2001c}} \right)$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by age and sex in 2009

$PCVMT_{2009b}$
= Per capita VMT by age and sex in 2009 for the cohort being measured in year x
(e.g. VMT in 2009 at age 29 for people who are 40 years old in 2020)

$PCVMT_{2001c}$
= Per capita VMT by age and sex in 2001 for sex and age represented by $PCVMT_{2009b}$
(in the above example, 29 year olds in 2001)

For those who were not of driving age during the 2001 NHTS, the following formula applies:

$$PCVMT = PCVMT_{2001a} * \left(\frac{PCVMT_{16-24\ 2009}}{PCVMT_{16-24\ 2001}} \right)$$

Where:

$\frac{PCVMT_{16-24\ 2009}}{PCVMT_{16-24\ 2001}}$
= the average per capita VMT of drivers 16 to 24 years old in 2009 divided by the average per capita VMT of drivers in that same age group in 2001, by sex.

VMT per capita by age and sex was multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Ongoing Decline

The *Ongoing Decline* scenario assumes that the percentage change in driving behavior experienced by each age group between 2001 and 2009 will be replicated between 2009 and 2025, and that new drivers will drive even less than young drivers did in 2009. It assumes no change in driving behavior after 2025, but total and aggregate per-capita VMT still changes as a result of population growth and demographic shifts.

For those who were of driving age in 2001, the formula for per-capita VMT by year of age and sex in 2020 and subsequent years is as follows:

$$PCVMT = PCVMT_{2009a} * \left(\frac{PCVMT_{2009b}}{PCVMT_{2001c}} \right)^x$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by age and sex in 2009

$PCVMT_{2009b}$

= Per capita VMT by age and sex in 2009 for the cohort being measured in year y (e.g. VMT in 2009 at age 29 for people who are 40 years old in 2020)

$PCVMT_{2001c}$

= Per capita VMT by age and sex in 2001 for sex and age represented by $PCVMT_{2009b}$ (in the above example, 29 year olds in 2001)

$x = 2$ in 2025 and subsequent years, and an amount between 1.6875 and 2 in 2020 through 2024

For those not of driving age in 2001, the formula for per-capita VMT by year of age and sex in 2020 and subsequent years is as follows:

$$PCVMT = PCVMT_{2001a} * \left(\frac{PCVMT_{16-24\ 2009}}{PCVMT_{16-24\ 2001}} \right)^x$$

Where $x=2$ in 2025 and subsequent years, and an amount between 1.6875 and 2 from 2020 through 2024.¹³³

VMT per capita by age and sex was multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Treatment of Non-Household VMT

The National Household Travel Survey only reflects vehicle travel made in households, which accounts for approximately three-quarters of all vehicle travel.¹³⁴ Non-household vehicle travel includes travel in everything from heavy-duty trucks to rental cars to delivery vehicles to pick-up trucks used for work purposes. Not all of these types of vehicle travel are tracked by existing data sources. Complicating matters further, even those portions of non-household VMT that are regularly tracked—such as travel in certain types of commercial trucks—are represented in data sets that have experienced significant methodological changes in recent years, making time-series comparisons difficult.¹³⁵

In this paper, we assume that the proportion of household to non-household

VMT—calculated by subtracting household VMT in 2009 (from NHTS data) from total VMT (as reported by the Federal Highway Administration’s *Highway Statistics* series of reports)—remains constant through 2040. This approach has been used by other analysts seeking to establish a relationship between household and total VMT,¹³⁶ though the relationship between household VMT as estimated by the NHTS and total VMT as estimated in publications such as *Highway Statistics* has been inconsistent over time.

The relationship between household and non-household VMT is particularly challenging to forecast since some changes that might reduce household VMT (e.g., increased e-commerce) could increase non-household VMT (e.g., increasing miles traveled in delivery trucks). We hope that additional research and better data sets will enable a fuller exploration of future trends in aggregate non-household VMT.

Notes

- 1 David W. Jones, *Mass Motorization and Mass Transit: An American History and Policy Analysis*, Indiana University Press, 2008, 129.
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Attachment : Issues for Statement of Concerns & Intent

- Concern: The SCS land pattern and/or RTP EIR mitigation measures could be construed as binding Transportation Control Measures (TCMs).
- Assurance: Nothing in the Plan or EIR is intended to be a Transportation Control Measure (TCM).
- Concern: Quality projects supported by local communities that are outside PDAs will be unable to be determined to be consistent with the SCS if outside PDAs under CEQA's requirement for projects to consider consistency with applicable regional plans; projects not in PDAs or not a PDA place type will have to do a full blown EIR under CEQA "applicable regional plan" provisions (*note: this is a separate issue from SB 375 "statutory" consistency with the SCS for purposes of CEQA streamlining*).
- Assurance: For purposes of applicable plan CEQA consistency, it is not the agencies' intent that inconsistency and a significant impact requiring a full blown EIR will be triggered simply by a project being outside a PDA or different than one of the PDA place types.
- Concern: The Plan will be used to attack housing and job development outside PDAs by opponents based on inconsistency with the SCS.
- Assurance: The Plan is intended to promote and provide incentives for development of the PDAs. It is not intended to create direct or indirect obstacles to a local government's decision to approve development projects outside PDAs or different than one of the PDA place types.
- Concern: The Plan represents a regional agency policy statement that development types and locations other than that set forth in the SCS projected land pattern and/or other than the regional agency defined "Place Types" necessarily represent "bad planning" that is inconsistent with MTC's and ABAG's statutory responsibilities, goals and objectives.
- Assurance: Nothing in the Plan is intended to establish a particular land use pattern or development solely within PDAs of the PDA Place Types as a regional "policy."
- Concern: The 80%/20% SCS land pattern for housing and the related ratio for jobs will expressly or implicitly become "hard caps" or "development budgets."
- Assurance: The ratio of projected jobs and housing in the Plan is not intended to act as a direct or indirect "cap" on development locations in the region the "exceedance" of which would impede MTC's and ABAG's statutory responsibilities, goals and objectives. The intent in adopting this SCS is to comply with SB 375 requirement to set forth a land use pattern that if implemented, would meet the GHG targets. The Plan EIR shows that a wide range of regional land use patterns over the planning horizon can, in combination with the Project transportation improvement plan and Climate Initiatives achieve the SB 375 targets. The Plan does not intend to dictate local land use policy or development approvals.
- Concern: The Plan is intended to discourage new single family housing development and represents a regional agency value judgment about the lifestyle choices of those who live in suburban areas or aspire to do so.
- Assurance: The Plan is not intended to make value judgments by MTC and ABAG about different housing and lifestyle choices, nor is it intended to discourage local governments from making their own land use decisions; rather, it is intended to increase housing choices by providing incentives.
- Concern: Regional agency/staff will be in the business of opining on whether future development projects are consistent with the SCS.

Assurance: For purposes of determining consistency with the SCS (both “applicable plan” and “SB 375 statutory”), the lead agency such as the city or county shall make the determination. Neither MTC nor ABAG or their respective staffs will interject themselves in local land use planning and opine on project consistency. MTC and ABAG’s actions regarding project consistency will be limited to establishing advisory guidance for local agencies to consider in making consistency determinations. This guidance will be developed in close consultation with local agencies and stakeholders and clearly identified as advisory only.

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