Planners Committee

Item #2

March 17, 2010

New Metropolitan Transportation Plan (MTP) Update

Issue: Staff has begun preparatory work for the next Metropolitan Transportation Plan (MTP) update.

Recommendation: None. This item is for information only.

Discussion: At the August 2009 Planners Committee meeting a schedule for preparation of the next update of the MTP was presented for information and discussion. In line with that schedule, staff has started on the early phases of work related to the MTP update. These include:

Land Use Allocation: Staff is making preparations to update the 2035 land use allocation, which underpins the travel and air quality modeling that informs the development of the MTP. Part of the work to date includes a staff site visit with each jurisdiction's planning department to get an updated assessment of local planning processes, development projects, regulatory constraints and market conditions. SACOG staff also oriented each planning department to the major milestones of the MTP update to prepare them for their role in the MTP process.

Regional Growth Projections: Stephen Levy from the Center for the Continuing Study of the California Economy presented his preliminary regional growth projections to the full Board of Directors on February 18, 2010. These regional growth projections will form the basis of the next MTP. Staff is currently assessing how the preliminary projections may affect the adopted MTP growth allocation and financial plan.

Financial Plan: Staff is beginning work on the new MTP financial plan by updating revenue forecasts to reflect slower regional growth rates and associated declines in the local and state revenues. Information from the regional growth projections work will be an important input to this work.

Analysis of MTP and SB 375 Planning Scenarios: Lastly, staff has been working to evaluate the potential GHG reduction and transportation benefits of various policy packages as part of SB 375 implementation. The latest version of this analysis is attached.

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SACOG Planning Scenarios and Preliminary Analysis
DRAFT Approach and Results
February 25, 2010

Background

As part of the next Metropolitan Transportation Plan (MTP) effort and SB375 implementation, SACOG is undertaking a preliminary analysis of several "planning scenarios". The purpose of the analysis is to evaluate the potential benefit which could result from the implementation of various policies, over-and-above the level currently included in the adopted MTP. SACOG is coordinating with MPOs around the state on the format, content, and technical approaches used for this analysis, and is sharing this information with local agencies within the region. The analysis is considered ***preliminary*** for several reasons: 1) as part of the buildup to the next MTP, SACOG has engaged the Center for Continuing Study of the California Economy to update the macro-economic forecasts which will be the basis of the next MTP—that process is still underway, but some changes in projections of future growth are likely, and are not yet reflected in this analysis; 2) the GHG reduction target for SB375 requires the California Air Resources Board to project the effect of other elements of the State's greenhouse gas reduction policy related to improving the efficiency of vehicles, and reducing the carbon content of fuels—the technical work on this is still underway, and the GHG estimates shown here do not reflect these changes; and 3) SACOG is consulting with other MPOs and local agencies on all of this work, and expects that some changes in either the basic forecasts and the post-processing of results will change as a result of those consultations.

Planning Scenarios

SACOG is evaluating seven policy scenarios. The most basic scenario is the adopted MTP ("A Creative New Vision for Transportation in the Sacramento Region", adopted in 2008). The adopted MTP was the first long range transportation plan which the region developed after the Blueprint process was complete. Six other scenarios are being evaluated, each of which expands and enhances implementation of various policies over-and-above the adopted MTP. The policies are organized into one of four "bundles", as follows:

- Land use measures
- Transportation projects
- Transportation System and demand management
- Transportation Pricing

Scenario 1 is the currently adopted MTP. In terms of land use measures, the adopted MTP is largely, but not completely, consistent with the Blueprint vision adopted in 2004. In terms of transportation projects, the amount of high-frequency transit service is nearly doubled on a per-capita basis. System and demand management is expanded marginally from current deployment levels, after accounting for population growth. No transportation pricing policies are included in the adopted MTP.

Each of the policy bundles, with the exception of pricing, is represented to some degree in the adopted MTP. The planning scenarios for this analysis are conceptually defined as enhanced implementation of these policy bundles, compared to the levels included in the current MTP. Scenarios 2 through 5 each focus on expanding/enhancing one policy bundle, in addition to currently planned investments.

- ***Scenario 2*** is fully consistent with the Blueprint's distribution of new rural residential at one percent of new housing stock. The Blueprint had in total 31 percent of new housing in large-lot single family and 69 percent of new housing in small lot single family and attached. This scenario moves slightly beyond this distribution to 27 percent large-lot single family and 73 percent small lot single family and attached. Approximately 16% of housing units and 11 % of jobs shifted from new growth area locations in the MTP to transit priority areas in Scenario 2.
- ***Scenario 3*** expands investment in transit. As mentioned above, the adopted MTP would nearly double high-frequency transit by 2035; Scenario 3 would advance much of this transit service to the interim year, and significant expand total transit by 2035. Implementation or expansion of two streetcar lines currently beyond the horizon for the adopted MTP would be advanced.
- ***Scenario 4*** would expand and enhance the planned investment in transportation systems and demand management in the adopted plan. The adopted MTP includes some expansion of the current employer based programs (primarily marketing, education, and coordination), and growth of the region's ITS and incident management to account for population growth. Scenario 4 would expand the investment in employer-based programs to include more direct incentives for non-single-occupant vehicle commuting (e.g. transit passes, non-motorized subsidies, etc.), and provide more resources for ITS and incident management. Additionally, this scenario would provide some level of public subsidy to establish car-sharing programs in at least 2 communities or employment centers where market demand alone is unlikely to support a private car-sharing venture.
- ***Scenario 5*** would add significant new transportation pricing policies which are not included to any degree in the adopted MTP. Four policies are included: congestion pricing for the regions major freeways; a VMT-based charge of $0.01 to $0.03 per mile; policy-based increases to off-street parking charges at employment centers; and additional subsidies to transit fares, to reduce out-of-pocket costs for using transit.

Scenarios 6 and 7 look at combining the policy bundles:

- ***Scenario 6*** would combine land use measure, transportation projects, and system and demand management; no pricing policies are included.
- ***Scenario 7*** would combine all four policy bundles.

Each scenario is based on enhanced, coordinated implementation of the policy bundle in question, without reference to cost or actual implementation potential, so the analysis results presented here focus on the benefits only and portray the maximum benefits reasonably expected from implementation of the policies. Through the consultation with other MPOs and with local agencies in the SACOG region as the MTP and SB375 implementation process progresses, the costs, cost-effectiveness and implementation potential of the various policies will be detailed and documented by SACOG and local agency staff, and considered by policy makers involved in the MTP process.

Travel Indicators

Five travel indicators are shown: passenger vehicle GHG; passenger vehicle miles traveled (VMT); transit trips; non-motorized (i.e. bike and walk) trips; and congested VMT. All indicators are shown as per capita values. The travel indicators, along with a summary description of the planning scenarios, are provided in Table 1 (attached).

All indicators are shown as absolute values for 2005 (the base year for SACOG's forecasts), and as percentage changes from 2005 for all future years. For example: the "-4.2%" shown in "Passenger vehicle GHG per capita" for Scenario 1 (Adopted MTP) for 2020 means that this GHG measure would decrease by 4.2 percent compared to 2005; since 2005 passenger vehicle GHG per capita is estimated at about 24.9 pounds per day, the 2020 value would be 23.9 pounds, or one pound less than the 2005 level.

The primary source of estimates for future year changes to travel indicators is SACOG's regional travel demand model, SACSIM. SACSIM is unique among regional travel demand models in that it uses parcel-level land use data. SACSIM was one of the first regional travel demand models to implement a person-based simulation of travel demand for all household-generated travel, using a day-pattern, tour approach for representing travel. SACOG also elected to develop SACSIM using parcel level data mainly because the capacity to analyze the effects of land use on travel behavior requires data far more detailed than conventional traffic analysis zones. These features and SACSIM's documented sensitivity to key factors like land use, demographics, transportation costs and proximity to transit make SACSIM a powerful tool for measuring the potential for influencing travel through both land use and transportation policies.

SACOG recognizes that no travel demand model is perfect, and each has limitations. SACSIM does not explicitly model the effects of many "supply side" management policies (e.g. incident management, ITS, etc.)[1], transportation demand management policies (e.g. employer-based TDM strategies), and pricing (e.g. congestion pricing)[2].

[1] SACOG is engaged in the Strategic Highway Research Program, Phase 2 "C10" project, which will link SACSIM to a micro-simulation assignment software package; this work is expected to be complete in 2012, and will significantly enhance SACSIM as an evaluation tool for supply-side, operations-oriented strategies.
[2] SACOG has been awarded funding from the California Strategic Growth Council for enhancement of SACSIM's representation of travel costs, and development of the capability to represent pricing policies such as congestion pricing and transit fares. This work will be completed by 2012.

SACSIM Forecasts

SACSIM is being used to evaluate the "Land Use Measures" and "Transportation Projects" policy bundles. For each of these policies, SACOG has developed future year datasets which reflect reasonably the enhanced, more-Blueprint-oriented land use measures included in Scenario 2, and the accelerated implementation and expansion of transit service included in Scenario 3. These policies are the basis for new SACSIM regional forecasts for these two planning scenarios. Additionally, for Scenarios 6 and 7, both of which combine the land use and transportation projects policy bundles, new SACSIM regional forecasts were prepared.

Post-Processing of SACSIM Forecasts

As mentioned above, it is fully recognized that SACSIM does not currently represent many of the policies included in the system and demand management policy bundle, and the pricing policy bundle. In all scenarios where these policies are included, including Scenario 1, some level of post-processing of results was performed to ensure that a reasonable estimate of benefit of these policies was reflected in the results. The post-processing approaches are based on several sources:

- For GHG reduction potential, the recently published Urban Land Institute "Moving Cooler" report was heavily utilized.
- For pricing policies, analysis results recently published by the Metropolitan Transportation Commission (MTC), from that agency's adopted regional transportation plan, are heavily utilized.
- Published transportation elasticities from many sources are used as reasonable-ness checks.

<u>Transportion System and Demand Management Post-Processing</u>

The "Moving Cooler" report provides information on the GHG reduction potential for several system and demand management strategies, at different deployment levels and for different horizon years. These reduction estimates for the "Aggressive Deployment" level for 2020 and 2030 are used as a basis for computing GHG reduction percentages which are applied to the basic SACSIM forecasts prepared for this analysis. The calculated post-processing reductions for system and demand management policies, cumulatively, are:

- For Scenario 1 (Adopted MTP), and for scenarios based on MTP (2, 3 and 5):
  - -0.6% in GHG per capita;
  - -0.5% in VMT per capita;
  - +0.3% in transit trips per capita (equivalent to about 600 trips per day in 2020, and 1,300 in 2035)
  - -0.3% reduction in congested VMT per capita.
- For Scenario 4 (MTP + Enhanced Management), and for scenarios based on Scenario 4 (6 and 7):
  - -1.1% in GHG per capita;
  - -1.0% in VMT per capita;
  - +0.5% in transit trips per capita (equivalent to about 1,000 trips per day in 2020, and 1,900 in 2035)
  - -0.5% reduction in congested VMT per capita.

Pricing Policy Post-Processing

The pricing policy bundle was assumed to include four elements: congestion pricing; VMT charges; parking pricing; and additional transit fare subsidy. For each policy, the "market" for potentially affected travelers was based on the basic SACSIM model runs performed for this analysis. Each policy was enumerated in terms of the most likely increase to average travel cost to the affected travelers. Published elasticities are then applied to compute changes in VMT and number of trips to compute the most likely changes to travel indicators. The resulting changes in VMT are compared to those published for the above-referenced analysis performed by MTC, to judge reasonable-ness of the results.

- For Scenario 5 (MTP + Pricing) and for Scenario 7 (MTP + All Policies):
  - For 2020 deployment level (see Table 2):
    - -1.5% reduction in GHG per capita;
    - -1.4% reduction in VMT per capita;
    - +3.0% increase in transit trips per capita; and
    - -0.7% reduction in congested VMT per capita.
  - For 2035 deployment level (see Table 2):
    - -4.2% reduction in GHG per capita;
    - -3.7% reduction in VMT per capita;
    - +7.5% increase in transit trips per capita; and
    - -2.0% reduction in congested VMT per capita.

Appendix A provides a more detailed accounting of the post-processing for system and demand management, and for pricing.

Deployment Level Statistics

To fairly represent the level of deployment of various policies under being evaluated, SACOG has assembled data (where possible) or descriptions of the policy bundles defined above. In general, those land use and transportation projects policy bundles, which are evaluated primarily using SACSIM, are quantified, and the level of deployment was described as a percent change from 2005. For the system management and pricing bundles, a mix of quantitative and qualitative descriptions are provided. The deployment level statistics are presented in Table 2 (attached). Specific metrics are described below.

Land Use Metrics

Six specific metrics are currently used and presented in Table 2. Two metrics relate to residential product type:

- Percentage of residential growth which is large-lot single family or rural residential; and
- Percentage of residential growth which is small-lot single family or attached dwellings.
- Net residential density (total, without rural residential dwelling).

Four other metrics combine land use and transportation system characteristics to some degree, and are quantitative representations of the so-called "D's" measures:

- Two accessibility measures, both regional averages (the "destinations" D):
  - Total jobs within 20 minutes drive.
  - Total jobs within 45 minutes transit travel time.
- Mix of use at place of residence (the "diversity" D):
  - SACOG's mix index, which is a 0 to 100 scale based on the mix of uses within ½ mile of place of residence. For this index 0 means homogenous development, and 1 means a mix in perfect balance based on regional averages.
- Street pattern (the "design" D):
  - SACOG uses an intersection density measure, which tallies the number of 3 or 4 legged intersections per acre within ¼ mile of place of residence—this variable was found to be a powerful predictor of non-motorized travel in Sacramento and elsewhere.

Transportation Projects Metrics

Three metrics are provided as measures of change in the region's transportation system:

- Total transit service (quantified as vehicle service hours) per capita
- High-frequency vehicle service hours per capita (defined as services of all types which operate at 15-minute-or-better headways)
- The percentage of freeway lane miles which are high-occupancy vehicle lanes

System and Demand Management Deployment

In lieu of this quantitative description, the policy bundles are qualitatively described in terms of the level of deployment of three policy elements, compared to the level of deployment in the adopted MTP:

- ITS and incident management
- Employer-based transportation demand management
- Car-sharing programs

Pricing

Four policies are included in the evaluation:

- Congestion pricing, with average tolls of $0.10 per mile in 2020, and $0.25 per mile in 2035
- VMT charges, with $0.01 per mile in 2020 and $0.03 per mile in 2035.
- Parking policy, with policy-generated increases in off-street parking in employment centers of 25 percent in 2020 and 50 percent in 2035.
- Additional transit fare subsidies, which are assumed to reduce out-of-pocket transit costs by 10 percent in 2020 and 25 percent in 2035.

TABLE 1. SACOG PLANNING SCENARIOS: PRELIMINARY CALCULATION OF BENEFITS FOR CONCEPTUAL POLICY OPTIONS

Name		Scenario Project/Policy Bundle: Land Use Measures	Transportation Projects (Transit, HOV, Complete Streets, etc.)	System + Demand Management /2/	Pricing Policies /2/	Transportation Indicators /1/: PassVeh GHG Per Capita (lbs per day) /3/	PassVeh VMT Per Capita (miles per day)	Transit Trips Per Capita (trips per day)	Bike/Walk Trips Per Capita (trips per day)	Congested VMT Per Capita (miles per day)
0: Base Year (2005)						23.0	24.1	0.049	0.804	1.58
						% Change from 2005				
1: Adopted MTP	2020	Mainly (but not entirely) consistent with Blueprint	Per Adopted MTP	Per Adopted MTP	None	-2.5%	-1.3%	+34.3%	+6.1%	+20.0%
	2035	Mainly (but not entirely) consistent with Blueprint	Per Adopted MTP	Per Adopted MTP	None	-7.5%	-5.4%	+96.6%	+11.6%	+27.7%
2: Land Use Only	2020	Blueprint + Transit Oriented Development Emphasis	Per Adopted MTP	Per Adopted MTP	None	-7.6%	-6.0%	+100.3%	+20.8%	+8.4%
	2035	Blueprint + Transit Oriented Development Emphasis	Per Adopted MTP	Per Adopted MTP	None	-9.7%	-7.7%	+149.4%	+21.5%	+23.6%
3: Transportation Only	2020	Mainly (but not entirely) consistent with Blueprint	More Transit than MTP in 2020	Per Adopted MTP	None	-4.7%	-3.0%	+39.9%	+6.0%	+19.8%
	2035	Mainly (but not entirely) consistent with Blueprint	More Transit than MTP in 2035	Per Adopted MTP	None	-7.6%	-5.5%	+114.4%	+11.5%	+26.3%
4: Management Only	2020	Mainly (but not entirely) consistent with Blueprint	Per Adopted MTP	Employer-based TDM & ITS expanded from MTP; support for car-sharing programs added	None	-3.1%	-1.9%	+34.7%	+6.4%	+19.6%
	2035	Mainly (but not entirely) consistent with Blueprint	Per Adopted MTP	Employer-based TDM & ITS expanded from MTP; support for car-sharing programs added	None	-8.0%	-5.9%	+97.1%	+11.9%	+27.3%
5: Pricing Only	2020	Mainly (but not entirely) consistent with Blueprint	Per Adopted MTP	Per Adopted MTP	Toll Lanes; VMT charge; parking pricing; transit fare subsidy	-3.5%	-2.2%	+38.0%	+6.6%	+19.4%
	2035	Mainly (but not entirely) consistent with Blueprint	Per Adopted MTP	Per Adopted MTP	Toll Lanes; VMT charge; parking pricing; transit fare subsidy	-10.8%	-8.5%	+110.8%	+13.4%	+25.6%
6: All Enhanced, No Pricing	2020	Blueprint + Transit Oriented Development Emphasis	More Transit than MTP in 2020	Employer-based TDM & ITS expanded from MTP; support for car-sharing programs added	None	-8.3%	-6.6%	+104.4%	+21.0%	+7.9%
	2035	Blueprint + Transit Oriented Development Emphasis	More Transit than MTP in 2035	Employer-based TDM & ITS expanded from MTP; support for car-sharing programs added	None	-10.5%	-8.4%	+169.3%	+21.5%	+23.3%
7: All Enhanced, w/ Pricing	2020	Blueprint + Transit Oriented Development Emphasis	More Transit than MTP in 2020	Employer-based TDM & ITS expanded from MTP; support for car-sharing programs added	Toll Lanes; VMT charge; parking pricing; transit fare subsidy	-9.7%	-7.9%	+110.5%	+21.8%	+7.2%
	2035	Blueprint + Transit Oriented Development Emphasis	More Transit than MTP in 2035	Employer-based TDM & ITS expanded from MTP; support for car-sharing programs added	Toll Lanes; VMT charge; parking pricing; transit fare subsidy	-14.2%	-11.8%	+189.5%	+23.7%	+21.0%

Source: SACOG, February 26, 2010

/1/ The results presented here are preliminary, and based wherever possible on direct results of SACOG's travel demand forecasting model (SACSIM). In some cases, indicators were reckoned or manually calculated based on the results of scenarios actually run using the model.

/2/ Effects of "System & Demand Management" and "Pricing" policy bundles were not modeled. Effectiveness of these policies in reducing GHG were based on information provided in the "Moving Cooler: Ana Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions" (Cambridge Systematics, 2009), as well as published materials from the Metropolitan Transportation Commission for that agency's last RTP, plus other sources.

/3/ Passenger vehicle GHG was estimated using EMFAC2007 and SACOG's vehicle activity forecasts, WITHOUT accounting in any way for the State's non-SB375 GHG policy initiatives (i.e. low carbon fuels initiative, and the Pavley vehicle fleet efficiency initiative. For this reason, the percentage reduction in passenger vehicle GHG as shown in this column should NOT be taken as an SB375 GHG reduction target.

LEGEND:

GHG = Greenhouse Gas
HOT = High Occupancy Toll
HOV = High Occupancy Vehicle
ITS = Intelligent Transportation Systems
MPO = Metropolitan Planning Organization
MTP = Metropolitan Transportation Plan
TDM = Transportation Demand Management
VMT = Vehicle Miles Traveled

This information is provided to initiate discussions with SACOG's MPO partners around the state regarding the opportunity to propose SB375 targets to CARB.
None of the information should be cited elsewhere.

TABLE 2. SACOG PLANNING SCENARIOS: DEPLOYMENT LEVEL METRICS

Name		Land Use: Total Growth: Population (000's)	Land Use: Total Growth: Jobs (000's)	Land Use: Growth/Change Metrics (Note: 2005=total; Future Years = Change): Rural Residential	Large Lot Single Family	% Small Lot + Attached	Net Resid Density (Excl. Rural Res)	Net Empl Density /1/	Land Use: Total Land Use/Built Environment (D's) Metrics: Net Res Density (Excl. Rural Res)	Jobs in 20' drive	Jobs in 45' transit	Mix Index (0-1 scale)	Street Patt	Transit + Managed Roadways: Total Service Hours / Capita	% of VSH <=15' Headway	HOV LaneMi as % of Frwy LaneMi	Frwy LaneMi Per Capita (X1000)	System+Demand Management: ITS/ Incident Mgmt	TDM	Car Sharing	Eco-Driving	Pricing: Cong. Pricing	VMT Charge	Parking Pricing Policy	Additional Transit Fare Subsidy
0: Base Year (2005)		2,057	1,001	8%	59%	33%	5.7	13.1	5.7	278,892	25,132	0.30	22.3	0.64	19.0%	4.2%	0.792	Moderate	Standard	None	None	None	None	None	n/a
		% Change from 2005		Characteristics of Change/Growth					% Change from 2005																
1: Adopted MTP	2020	+33%	+29%	3%	43%	54%	8.5	28.3	+9.4%	+12.0%	+72.2%	+15.4%	+0.7%	+14.8%	+49.7%	+134.6%	-18.2%	System expansion tracks population growth	Program expansion slightly higher than population gowth	Limited (likely in 2 communities)	None	None	None	None	None
	2035	+63%	+54%	3%	37%	60%	8.8	27.7	+16.9%	+27.1%	+141.7%	+23.9%	+2.6%	+72.9%	+98.6%	+161.2%	-29.8%	"	"	"	"	"	"	"	"
2: Land Use Only	2020	+32%	+28%	3%	26%	71%	13.2	49.9	+17.3%	+24.2%	+133.0%	+12.3%	+10.9%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP
	2035	+60%	+50%	1%	26%	73%	12.2	43.6	+27.6%	+35.4%	+180.4%	+25.4%	+16.6%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP
3: Transportation Only	2020	+33%	+29%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	+9.4%	+12.1%	+84.6%	+15.4%	+0.7%	+31.1%	+65.5%	+134.6%	-18.2%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP
	2035	+63%	+54%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	+16.9%	+27.2%	+191.2%	+23.9%	+2.6%	+113.4%	+194.6%	+161.2%	-29.8%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP
4: Management Only	2020	+33%	+29%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Sytem expansion exceeds population growth	Program expansion exceeds population growth, plus includes employee subsidy	Car-sharing available in 4 or more communities	None	Same as MTP	Same as MTP	Same as MTP	Same as MTP
	2035	+63%	+54%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	"	"	"	"	Same as MTP	Same as MTP	Same as MTP	Same as MTP
5: Pricing Only	2020	+33%	+29%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	$0.10 per congested freeway VMT	$0.01 per mile	Off Street Pkg x 1.25 in employment centers	Fares = 10% reduction
	2035	+63%	+54%	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	Same as MTP	$0.25 per congested freeway VMT	$0.03 per mile	Off Street Pkg x 1.5 in employment centers	Fares = 25% reduction
6: All Enhanced, No Pricing	2020	+32%	+28%	3%	26%	71%	13.2	49.9	+17.3%	+24.3%	+145.6%	+12.3%	+10.9%	+31.7%	+66.8%	+134.6%	-17.5%	Sytem expansion exceeds population growth	Program expansion exceeds population growth, plus includes employee subsidy	Car-sharing available in 4 or more communities	None	Same as MTP	Same as MTP	Same as MTP	Same as MTP
	2035	+60%	+50%	1%	26%	73%	12.2	43.6	+27.6%	+35.4%	+235.6%	+25.4%	+16.6%	+116.1%	+195.3%	+161.2%	-28.8%	"	"	"	"	Same as MTP	Same as MTP	Same as MTP	Same as MTP
7: All Enhanced, w/ Pricing	2020	+32%	+28%	3%	26%	71%	13.2	49.9	+17.3%	+24.3%	+145.6%	+12.3%	+10.9%	+31.7%	+66.8%	+134.6%	-17.5%	Sytem expansion exceeds population growth	Program expansion exceeds population growth, plus includes employee subsidy	Car-sharing available in 4 or more communities	None	$0.15 per congested freeway VMT	$0.01 per mile	Off Street Pkg x 1.25 in employment centers	Fares = 10% reduction
	2035	+60%	+50%	1%	26%	73%	12.2	43.6	+27.6%	+35.4%	+235.6%	+25.4%	+16.6%	+116.1%	+195.3%	+161.2%	-28.8%	"	"	"	"	$0.25 per congested freeway VMT	$0.03 per mile	Off Street Pkg x 1.5 in employment centers	Fares = 25% reduction

Source: SACOG, February 26, 2010

/1/ Net employment density excludes K-12 schools and special uses such as airports, prisons, military bases, landfills and wastewater treatment plants.

This information is provided to initiate discussions with SACOG's MPO partners around the state regarding the opportunity to propose SB375 targets to CARB.
None of the information should be cited elsewhere.

APPENDIX A:
Travel Demand Modeling and Post-Processing Approaches Used in SACOG's MPO Planning Scenario Analysis

Overview

For the analysis of planning scenarios presented in the main document, the results of which are summarized in Table 1, SACOG relied on its regional travel demand model, SACSIM, as the basis of each scenario. However, recognizing the limitations of SACSIM to fully capture the potential benefit of some policy bundles, post-processing approaches to augment the basic travel demand model runs were developed. The results shown in Table 1 combine the results of SACSIM model runs and post-processing to varying degrees, but all results for each scenario reflect both analysis approaches. This appendix provides details of how the SACSIM travel demand model runs and post-processing approaches were combined. The post-processing approaches are also described in detail.

SACSIM Travel Demand Model

For the MPO scenarios analysis presented in Table 1, SACOG performed eight unique travel demand model runs combining different land use input data, and transportation networks. The model runs are shown in Table A-1 below. All model runs were performed using SACSIM, SACOG's activity-based travel demand simulation model[1]. In total, there were four travel demand model scenarios, with two forecast years (2020 and 2035) for each.

These model runs provided the basis for the analysis of the seven planning scenarios (with 2020 and 2035 forecast years for each) presented in the table titled "SACOG Planning Scenarios: Preliminary Calculation of Benefits for Conceptual Policy Options". Based on model validation and sensitivity testing, SACSIM is capable of analyzing land use patterns at both macro- and micro-level and basic transportation system elements (roadway, transit alignments and services). Additionally, sensitivity testing has been performed for the

[1] SACOG, "Sacramento Activity-Based Travel Simulation Model (SACSIM07): Model Reference Report", November 2008. See also, for FHWA-sponsored peer review of SACSIM: http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/tmip/peer_review/sacog/sacog_report.pdf

following factors and variables: fuel prices and auto operating costs; household income; and transit fares.

Table A-1. Travel Demand Model Runs for the MPO Scenarios Analysis

Land Use Scenarios		Transportation Networks			
		Adopted MTP		Enhanced Transit	
		2020	2035	2020	2035
Adopted MTP	2020	Run 1.1 (2020)		Run 3.1 (2020)	
	2035		Run 1.2 (2035)		Run 3.2 (2035)
Blueprint / TOD Emphasis	2020	Run 2.1 (2020)		Run 6/7.1 (2020)	
	2035		Run 2.2 (2035)		Run. 6/7.2 (2035)

Source: SACOG, February 2010.

Post-Processing Techniques

For three policy categories, no validation or sensitivity-testing has been performed; equally important, techniques for fairly representing these policies in input datasets and parameters to SACSIM have not been developed and tested:

1) policy-based pricing of roadways and parking (e.g. congestion pricing, tolls, etc.)[2];
2) traffic management and incident management strategies to optimize traffic flow, a.k.a. intelligent transportation systems[3]; and
3) employer-based transportation demand management programs.

For each model run, post-processing adjustments were performed to estimate benefits for policy scenarios which cannot be modeled directly with SACSIM. Table A-1 provides an accounting of the planning scenarios, the SACSIM run which provided the basis of the benefit estimates, and the post-processing which was performed for each.

[2] SACOG has been awarded funding from the California Strategic Growth Council for enhancement of SACSIM's representation of travel costs, and development of the capability to represent pricing policies such as congestion pricing and transit fares. This work will be completed by 2012.

[3] SACOG is engaged in the Strategic Highway Research Program, Phase 2 "C10" project, which will link SACSIM to a micro-simulation assignment software package; this work is expected to be complete in 2012, and will significantly enhance SACSIM as an evaluation tool for supply-side, operations-oriented strategies.

Table A-2. Post-Processing Approches and Travel Demand Model Runs for MPO Scenarios Analysis

Planning Scenario	SACSIM Runs /1/	Type and Level of Post Processing /2/
1: Adopted MTP	1.1, 1.2	*TDM/TSM (low):* Minor post processing to account for ITS & TDM programs not explicitly modeled in SACSIM
2: Land Use Only	2.1, 2.2	*TDM/TSM (low):* Same as Scenario 1
3: Transportation Projects Only	3.1, 3.2	*TDM/TSM (low):* Same as Scenario 1
4: System & Demand Mgmt. Only	1.1, 1.2	*TDM/TSM (high):* Similar to Scenario 1approach, but larger adjustment
5: Pricing Only	1.1 1.2	*Pricing:* To account for congestion, parking, and transit fare policies not modeled in SACSIM
6: All But Pricing	6/7.1 6/7.2	*TDM/TSM (high):* Same as Scenario 4, but using different starting SACSIM run
7: All	6/7.1 6/7.2	*TDM/TSM (high) + Pricing:* Combines post-processing from Scenarios 4 and 5

Source: SACOG, February 2010.
Notes:
/1/ SACSIM run numbers correspond to those shown in Table A-1.
/2/ Shown in ***bold and italic*** are applications of post processing, which were applied uniquely to the Scenarios 1 through 5, and combined for Scenarios 6 and 7.

TDM and TSM Adjustments

The primary reference used for formulating the policy elements to include in the planning scenarios, and their likely effects, was the recent Urban Land Institute publication "Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emission"[4]. This reference was used for <<>> reasons:

- Its focus was transportation-generated greenhouse gas, which makes it germaine to the GHG aspect of the planning scenarios.
- The report itemizes specific policies, as well as "bundling" the policies in ways that make them very useful for the planning scenarios analysis.

[4] Cambridge Systematics, Inc., "Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions", Urban Land Institute, July 2009.

- The report also itemizes the amount of GHG reduction which could be achieved nationally through different policies, and also different deployment levels of those policies.

There were several limitations to using "Moving Cooler" as the primary source, too.

- In its essence, the report is "closed source", in that the statistical or quantitative relationships which were developed to evaluate the potential benefits are not provided, only the results. This required a certain level of "reverse engineering" to get useful adjustment factors to apply to the SACSIM model results. Fortunately, many of the results of the analysis presented in the document are sufficiently detailed to allow for this "reverse engineering".
- The report was developed as a national policy analysis—at that scale, regional differences which may relate to implementation or potential and benefits of specific policies are not as crucial as they are for a specific region. Even if the national-scale benefits are fairly analyzed, there is no guarantee that those benefits would be achieved in any specific region.
- Finally, and most importantly, the "baseline" scenario developed without reference to specific population growth. Based on the documentation in the report, the baseline was a direct adjustment to national VMT to account for many different factors, including population growth. However, those factors are not explicitly described in the documentation, and the population component is never quantified[5]. Given that SB375 GHG reduction targets will ultimately be stated as per capita reductions, population must be explicitly defined in SB375-related forecasts.

To evaluate the potential benefit for deployment of enhanced, widespread and coordinated TDM policies, some accounting of the specific programs which are included in that bundle must be defined.

"Transportation Demand Management" Policy Bundle for Planning Scenarios

For purposes of this analysis, the description of policies is provided with respect to existing conditions in the base year (2005), and in the adopted MTP for the two key forecast years (2020 and 2035). Table A-3 provides this information. The key differences between the base year deployment level, and deployment in the future based on the currently adopted MTP are:

- Current TDM policies about one dozen transportation management associations (TMAs), whose roles currently focus on education, outreach

[5] The report author did not respond to email and telephone requests for this information.

and coordination with employers in the region's largest jobs centers. The extent of programs supported varies widely, but very few TMA's have resources to administer incentives or vanpool support directly.

- The adopted MTP provides funding for expansion of current TMA-based programs. Some of this expansion will go to maintaining current program levels in the face of population and employment growth in the region. Based on the funding level included in the MTP, some level of direct incentive or support programs could theoretically be funding to expand the range of services TMAs provide.
- For Planning Scenario 4, it was assumed that TDM services would be expanded significantly to include direct incentive programs at worksites employing about one-third of the workers in the region. Direct incentives could include: partial or full subsidies transit passes; cash incentives for biking or walking; partial or full subsidies for vanpool participants (e.g. covering part or all cost of a vehicle, etc.). TMAs would be the likely administrators of these work-based programs. With additional programs would come additional program evaluation.

Very little of the program expansion described for the adopted MTP (Scenario 1), and none of the new programs in the System and Demand Management Scenario (#4) are directly modeled in SACSIM.

Transportation System Management / ITS Policy Bundle

Table A-4 provides an outline of a TSM/ITS policy bundles with an emphasis on seven program areas: ramp metering; variable message signs; active traffic management; incident management; integrated corridor management; arterial corridor management; and traveler information.

- Currently, all of these systems except active traffic management and integrated corridor management are deployed to at least a limited degree. Caltrans District 3 has established a transportation management center, as well as several larger cities and counties, along with field monitoring (loops, CCTV) and control (meters & signals under TMC control). STARNET, which is a communications and data integration among the TMC's, has been established. The only programs not yet established are active traffic management and integrated corridor management.
- The adopted MTP includes significant expansion of the field monitoring and control equipment, as well as expansion of STARNET. Through its Corridor System Management Programs, Caltrans and its local agency partners have begun planning for corridor management on major freeway corridors.
- For Planning Scenario 4, it was assumed that deployment of all systems included in the adopted MTP would be accelerated and expanded.

Active traffic management would be implemented on river crossings and their approaches. Integrated corridor management would be expanded, especially on freeway corridors which include LRT and commuter buses.

Table A-3. Transportation Demand Management Policy Deployment Assumptions

Policy or Program	Deployment Level		
	2005	MTP (by 2035)	Planning Scen.4 Enhancements
Transportation Management Agencies	About one dozen functioning TMA in employment centers—focus on eduction, outreach & coordination	Support and modest expansion of existing TMA's; several new TMA's in new job centers	Expand TMA role to direct incentive-program administration, plus management of support programs
Work-Based Incentives	Spotty transit, carpool & non-motorized work incentives; emphasis on public agencies	Some additional support for work-based programs funded	Programs expanded to cover up to one-third of all workers
Vanpool Support	Limited support on an employer-by-employer basis	Some additional support funded	Comprehensive vanpool programs at about 10 jobs centers
Car-Sharing Programs	None	Market-based car shares (e.g. Zip Car) expected in at least 2 communities	Support for car-share programs in 2 additional communities or job centers
Accoutability/ Program Eval.	TMA's provide varying degrees of program effectiveness	Support for some additional evaluations by TMA's	Independent evaluation of TMA-administered programs

Table A-4. Transportation System Management / ITS Policy Deployment Assumptions

Policy or Program	Deployment Level		
	2005	MTP (by 2035)	Planning Scen.4 Enhancements
Ramp Metering	Meters in in peak periods and directions at +/- 50 locations	Expand to 100+ locations	Expand to 200+ locations
Variable Message Signs	Signs at < 10 locations	Signs at 20+ locations	Signs at 30+ locations
Active Traffic Management	n/a	n/a	Initial deployment on some freeways and river crossings
Incident Management	Loops, CCTV, service patrol, on freeways	Detection on more roadways; more service patrols	Detection on more roadways; more service patrols
Integrated Corridor Management	n/a	n/a	On freeway+LRT corridors
Arterial Management	Initial closed loop/adaptive control deployment	River crossings and approaches	All major arterials
Traveler Information	Regional 511+website	Expand 511 and website	Add personalized messages

Potential GHG Benefits of Enhanced TSM/ITS and TDM Programs

"Moving Cooler" provides assessments of GHG reduction potential for generic programs associated with TSM/ITS and TDM programs in Table 4.2 of the report. "Moving Cooler" quantifies benefit as absolute tonnage reductions, relative to a future baseline of transportation generated GHG. "Moving Cooler" specified these potential benefits for three deployment levels and future years:

- Three deployment levels were defined:
  - Expanded Current Practice Deployment
  - Aggressive Deployment
  - Maximum Deployment
- Benefits were estimate for <<four>> future years:
  - 2020
  - 2030
  - 2050

Table A-5 provides an extract of the "Moving Cooler" report GHG reductions by policy for the "Expanded Current Practice" and "Aggressive" deployment levels for 2020 and 2030. SACOG assumed that "Expanded Current Practice" corresponds generally to the adopted MTP, and "Aggressive" deployment corresponds to the "System & Demand Management" scenario.

These reductions were correlated with the "baseline" totals in order to translate them into workable percentage reductions in per capita GHG, using the following formula:

GHGR = {Sum-ij [REDij] / GHG base} - 1

Where:

GHGR = Per-Capita GHG reduction factor

REDij = Moving Cooler GHG tonnage reduction for policy I and deployment j

GHGbase = Moving Cooler baseline total GHG for deployment year j

Reductions for per capita GHG for TSM/ITS and TDM policies are also shown in Table A-5.

Factoring of GHG Reductions to Other Transportation Indicators

The reductions in GHG estimated using the "Moving Cooler" report could come from a number of different changes:

- Employer-based commute programs:
  - Reduce vehicle trips and VMT by shifting single occupant vehicle trips to carpools and vanpools, or to non-motorized trips.
  - Reduce travel during the most congested periods, and therefore reduce vehicle hours of travel, by shifting or flexing work hours.
- Car sharing programs:
  - At places of residence, reduce auto ownership and increase non-vehicle travel.
  - At workplaces, facilitate carpooling, vanpooling, transit, and non-motorized commute modes by allowing work-based trips to be made with shared vehicles.
- Incident management reduces congestion and vehicle hours of travel by minimizing disruptions on major roadways.

The complex interplay of these various factors cannot be easily modeled or estimated. For this analysis, simple factors were applied to the GHG reduction percentage to estimate the changes to other travel indicators show in Table 1:

- VMT per capita: 0.9

- Transit trips per capita: 0.5
- Bike+walk trips per capita: 0.5
- Congested VMT: 0.5

Table A-5. GHG Tonnage Reductions for Various TSM / ITS and TDM Policies, Based on "Moving Cooler" Report /1/

	Deployment Level / Horizon Year			
	Expanded Current Practice		Aggressive Deployment	
Policy	2020	2030	2020	2030
Systems Operation and Management Strategies				
Ramp Metering	< 0.5	< 0.5	< 0.5	< 0.5
Variable Message Signs	< 0.5	< 0.5	< 0.5	< 0.5
Active Traffic maangement		< 0.5	< 0.5	< 0.5
Integrated Corridor Management		< 0.5	< 0.5	< 0.5
Incident management	< 0.5	< 0.5	< 0.5	1.0
Road Weather Management	< 0.5	< 0.5	< 0.5	< 0.5
Signal Control Management	< 0.5	< 0.5	< 0.5	< 0.5
Traveler Information	< 0.5	< 0.5	< 0.5	< 0.5
Vehicle Infrastructure Integration	< 0.5	< 0.5	< 0.5	< 0.5
Cumulative Reduction /2/	1.2	1.5	2.3	3.0
Carpool/Vanpool/Commute Strategies				
Car-Sharing	1.0	1.0	2.0	2.0
Employer-Based Commute Prog.	7.0	7.0	15.0	14.0
Cumulative Reduction	8.0	8.0	17.0	16.0
Computation of Reductions				
Combined Reductions	9.2	9.5	19.3	19.0
Baseline GHG /3/	1,700	1,675	1,700	1,675
GHG Reduction from Total	-0.54%	-0.57%	-1.13%	-1.13%

Source: SACOG, February 2010. Based on ULI "Moving Cooler" report, Table 4.2.
Notes:
/1/ All figures in millions of metric tonnes per year. One metric tonne = 2,204.6 pounds.
/2/ Cumulative reduction assumes "<0.5" tonnes averages to 0.165 for "Expanded Current Practice" and 0.25 for "Aggressive Deployment" across all policies.
/3/ From baseline graph Figure 1.6 in "Moving Cooler" report.

Pricing Adjustments

SACSIM does not have the capacity to analyze key pricing policies which attach prices to specific roadway facilities, such as: toll roads; congestion pricing; and HOT lanes. SACSIM does have the ability to reflect some, but not all, pricing policies for parking and transit fares. Filling in some of these key gaps in analysis capabilities was the subject of a recent proposal to the Strategic Growth Council. This proposal was approved for funding, but at this stage, the funding has not been authorized for SACOG use. Making the necessary improvements to SACSIM will take one or two years after the project is funded.

Pricing Policy Bundle

The pricing policy bundle for the planning scenario analysis includes four components:

- Congestion pricing on freeways—these would be tolls charged during on roadways and at times when demand is highest, and when the delays imposed on other auto drivers and passengers added by each new vehicle are the highest.
- A general VMT charge—these are general charges miles traveled, irrespective of the time of day or facility. Recently, VMT charges were recommended by the National Surface Transportation Infrastructure Finance Commission[6]. It is recognized that implementation of a VMT charge is not a purely regional issue.
- Policy-based parking pricing—these are additional charges to off-street parking, over-and-above the market-based prices which are charged.
- Additional transit fare subsidies—these are subsidies over-and-above the public subsidies which are normally provided to urban public transit, for the purposes of reducing the fares paid out-of-pocket by passengers.

Table A-6 outlines the general deployment levels for each of these pricing components. None of these components are included in the adopted MTP.

Effects of Pricing Programs on VMT

In order to evaluate the potential effects of pricing, a post-processing approach was developed which essentially "translates" pricing policies into changes to average auto operating costs or average transit fares, and applying elasticities to estimate effects on number of vehicle trips, VMT, transit ridership, and bike-or-walk trips.

[6] The final report of the NSTIFC was published in February 2009, and is available online at http://financecommission.dot.gov/

Table A-6. Pricing Policy Deployment Assumptions

Policy or Program	Deployment Level		
	2005	MTP (by 2035)	Planning Scen.5 Enhancements
Congestion Pricing	None	None	Congestion pricing on freeways: $0.15 per congested mile traveled by 2020, $0.25 by 2035
VMT fee	None	None	$0.01 per mile traveled in 2020, $0.03 by 2035
Policy-based Parking Pricing	None	None	+25% increase in market-based charges for off-street parking by 2020; +50% by 2035
Additional Transit Fare Subsidy	n/a	n/a	-10% reduction in average fares by 2020; -25% by 2035

Source: SACOG, February 2010.

Elasticities of transportation demand with respect to cost variables are widely reported in econometric literature. For purposes of this analysis, the following elasticities were used:

- VMT w.r.t. auto operating cost: -0.20
- Transit ridership w.r.t. transit fare: -0.30

Congestion pricing and policy-based parking charges were computed to net changes to auto operating costs for the charged travelers, and changes were computed to VMT based the auto operating cost elasticity.

Table A-7 outlines the approach for estimating change due to congestion pricing. Estimates of congested VMT on freeways, which determines the potential market for congested pricing, came directly from the relevant travel demand model runs (column 1). The congestion prices range from $0.10 to $0.25 per mile (column 2). The "loss" factor (column 3) is an assumed percentage of the total estimate of congested VMT which would not be tolled, for any of a number of reasons (re-routed or re-scheduled trips; changed trip destinations; congested locations on freeways where tolling is impractical). The total amount of congestion fees generated is computed (column 4); and average increment to auto operating costs is computed by distributing these

congestion charges to all VMT (columns 5 through 9). The VMT/auto operating cost elasticity is used to compute the change to VMT (column 10).

Table A-8 outlines the approach for estimating change due to a VMT charge. Daily VMT and the assumed VMT fee ($0.01 to $0.03) are shown in columns 1 and 2. A "loss" factor of 10% was assumed (column 3). Columns 4 through 7 show the change in average auto operating cost due to the VMT fee. Column 8 shows the VMT change, based on the VMT/auto operating cost elasticity.

Table A-9 provides the approach used to compute the effect of a policy-based charge for off-street parking, which was assumed to apply to a share of workers in the region (column 1). The average daily parking price paid and incremental charge are shown in columns 2 and 3. The change to average auto operating costs for the affected workers is shown in columns 4 through 8. In columns 9 through 12, the impact of these changes on VMT by the affected workers, which is then normalized to total VMT is shown.

Table A-10 provides an accounting for the effects of reducing transit fares through additional subsidies. The percent fare change, and the expected percent change to ridership based on the fare/ridership elasticity, are shown in columns 1 and 2. Columns 3 through 5 show the "base" or starting transit ridership, and the expected increase and total ridership with the fare change. Columns 6 through 9 translate the ridership change into a percent change to VMT.

Factoring of VMT Reductions to Other Transportation Indicators

The reductions in VMT estimated above could come from a number of different changes:

- Congestion pricing would make carpooling, vanpooling, transit and non-motorized travel more attractive, relative to driving alone.
- Parking pricing focuses on areas in which off-street parking charges are prevalent; in general, those areas are employment centers which also have relatively good transit. This would make transit a more attractive option.
- All of the pricing options cited would reduce congestion to a certain degree by causing travelers to avoid the most congested time periods, or by shifting travelers to non-auto modes.

The complex interplay of these various factors cannot be easily modeled or estimated. For this analysis, simple factors were applied to the VMT reduction percentage to estimate the changes to other travel indicators show in Table 1:

- GHG per capita: 1.1 (this is the general scaling between GHG per capita and VMT per capita for the scenarios modeled)

- Transit trips per capita: 0.5
- Bike+walk trips per capita: 0.5
- Congested VMT: 0.5

Combining Percentage Changes for Application to Model Runs and Scenarios

Table 11 and 12 provide an accounting of how the VMT and GHG post processing adjustments were combined and applied to the SACOG model runs, to compute the final changes for the planning scenarios.

Scenarios 1, 2 and 3 had minimal post-processing adjustment. The only post-processing to the basic SACSIM model runs were to account for expansion of system and demand management strategies which were included in the adopted MTP, but not modeled explicitly. For GHG, the reductions were about 0.5%.

Scenario 4 (System and Demand Management) was also based on the MTP model runs (SACSIM runs 1.1 and 1.2), but because a higher deployment level was assumed, the reductions to GHG were about 1.1%.

Scenario 5 (Pricing) was also based on the MTP model runs, but the pricing post-processing adjustment was bigger than the Systems and Demand Management adjustment. For 2020, the VMT reduction was 1.4%; for 2035, it was 3.7%. The 2035 adjustment was greater, because all of the pricing was higher.

Scenarios 6 and 7 were based on SACSIM runs 6/7.1 and 6/7.2. Only the System and Demand Management adjustments were applied to Scenario 6 (about 1.1% in GHG reduction, and 1.0% in VMT reduction), and the combined System and Demand Management and Pricing adjustment were applied to the base model run for Scenario 7 (2.4 to 4.9% reductions in VMT, 2.7 to 5.4% reduction in GHG).

Table A-7. Congestion Pricing Post-Processing Calculation: Change to VMT

SACSIM Model Run "Base"		/1/ Cong. VMT on Freeways (000's)	/2/ Price per Cong. Frwy. VMT	/3/ Loss Factor	/4/ Total Cong. ('00 $)	/5/ Total Wkdy. VMT (000's)	/6/ Cong. Fees Per VMT ('00 $)	/7/ Base A.O. Cost Per Mile ('00 $)	/8/ Base+ Cong. $ Per Mile ('00 $)	/9/ % Delta In A.O. Cost	/10/ % Delta In VMT
Runs 1.1 and 1.2	2020	2,442	$0.10	25%	$183,188	71,267	$0.003	$0.180	$0.183	+1.43%	-0.29%
	2035	3,252	$0.25	25%	$609,711	84,690	$0.007	$0.200	$0.207	+3.60%	-0.72%
Runs 6/7.1 and 6/7.2	2020	2,355	$0.10	25%	$176,605	68,435	$0.003	$0.180	$0.183	+1.43%	-0.29%
	2035	3,118	$0.25	25%	$584,578	81,461	$0.007	$0.200	$0.207	+3.59%	-0.72%

Source: SACOG, February 2010.

Notes for Table A-7:

/1/ Congested vehicle miles traveled on general purpose freeways, from SACSIM model runs.

/2/ Price per congested freeway VMT—this is the actual per mile charge assumed in the pricing policy.

/3/ "Loss Factor" is factor to quantify the % of VMT which avoids the congestion charge be some means (re-routing, re-scheduling, or choosing a different destination).

/4/ This is the total congestion prices charged, with "rebound".

/5/ Total weekday VMT, from SACSIM model runs.

/6/ This is column 4 divided by column 5—it represents the amount that the charge adds to average auto operating costs regionwide.

/7/ This is the base auto operating cost per mile for each model run.

/8/ This is the column 6 plus column 7.

/9/ This is the percent change in auto operating cost (column 6 divided by column 7).

/10/ This is the change in VMT which would result from the change in auto operating cost, using an elasticity of -0.2.

Table A-8. VMT Fee Post-Processing Calculation: Change to VMT

SACSIM Model Run "Base"		/1/ Total Weekday VMT (000's)	/2/ Avg. VMT Charge ('00 $)	/3/ Loss Factor	/4/ Adj Incr. $/VMT ('00 $)	/5/ Base A.O. $ / Mile ('00 $)	/6/ Base + VMT $ / Mile ('00 $)	/7/ Delta in A.0. Cost	/8/ Delta in VMT
Runs 1.1 and 1.2	2020	71,267	$0.01	10%	$0.009	$0.180	$0.189	+5.00%	-1.00%
	2035	84,690	$0.03	10%	$0.027	$0.200	$0.227	+13.50%	-2.70%
Runs 6/7.1 and 6/7.2	2020	68,435	$0.01	10%	$0.009	$0.180	$0.189	+5.00%	-1.00%
	2035	81,461	$0.03	10%	$0.027	$0.200	$0.227	+13.50%	-2.70%

Source: SACOG, February 2010.

Notes for Table A-8:

/1/ Total weekday VMT, from SACSIM model runs.

/2/ VMT fee per VMT—this is the actual per mile charge assumed in the pricing policy.

/3/"Loss Factor" is factor to quantify the % of VMT which avoids the fee be some means.

/4/ VMT charge, adjusted for "rebound".

/5/ This is the base auto operating cost per mile for each model run.

/6/ This is the column 4 plus column 5.

/7/ This is the percent change in auto operating cost (column 4 divided by column 5).

/8/ This is the change in VMT which would result from the change in auto operating cost, using an elasticity of -0.2.

Table A-9. Policy-Based Off-Street Parking Charge Post-Processing Calculation: Change to VMT

SACSIM Model Run "Base"		/1/ Workers Paying for Parking	/2/ Avg. Pkg. Chrg. ('00$)	/3/ Incr. in Off-St. Pkg.	/4/ Avg. Com-Mute Miles Per Day	/5/ Off-St. Pkg. Chrg. Per Mile	/6/ Incr. In Pkg. Chrg. Per Mile	/7/ Base A.O. Cost Per Mile	/8/ Total A.O. Cost Per Mile	/9/ VMT For Pkg. Com-Muters (000's)	/10/ Delta in Cost For Pkg. Com-muters	/11/ Delta In VMT For Pkg. Com-muters	/12/ Delta In Total VMT
Runs 1.1 and 1.2	2020	50,000	$5	+25%	20	$0.25	$0.06	$0.18	$0.49	1,000	+14.5%	-2.9%	-0.04%
	2035	75,000	$7	+50%	20	$0.35	$0.18	$0.20	$0.73	1,500	+31.8%	-6.4%	-0.11%
Runs 6/7.1& 6/7.2	2020	50,000	$5	+25%	20	$0.25	$0.06	$0.18	$0.49	1,000	+14.5%	-2.9%	-0.04%
	2035	75,000	$7	+50%	20	$0.35	$0.18	$0.20	$0.73	1,500	+31.8%	-6.4%	-0.12%

Source: SACOG, February 2010.

Notes for Table A-9:

/1/ Assumption by SACOG regarding the # of workers who would pay for off-street parking at work.
/2/ Assumption by SACOG regarding the average daily rate paid by workers in column 1.
/3/ Policy-based increase in parking charge.
/4/ Average miles commuted by workers in column 1.
/5/ Base per-mile cost of parking (column 2 divided by colum 4).
/6/ Increase in cost of parking per mile (column 3 times column 5).
/7/ This is the base auto operating cost per mile for each model run, without parking costs.
/8/ Column 5 plus column 6 plus column 7.
/9/ Column 4 times column 1.
/10/ % change in per-mile costs for workers in column 1.
/11/ This is the change in VMT which would result from the change in per mile cost for workers in column 1, using an elasticity of -0.2.
/2/ This is a calculation of the change in TOTAL VMT which would be represented by the % change in column 11.

Table A-10: Additional Transit Fare Subsidy Post-Processing Calculation: Ridership and VMT Change

SACSIM Model Run "Base"		/1/ Fare Change	/2/ Rider-ship Change	/3/ Base Rider-ship	/4/ Delta In Rider-ship	/5/ Total Rider-ship	/6/ VMT Saved Per New Rider	/7/ Total Saved VMT (000's)	/8/ Total VMT (000's)	/9/ % Change in Total VMT
Runs 1.1 and 1.2	2020	-10.0%	+3.0%	277,193	+8,316	285,509	5	-42	71,267	-0.06%
	2035	-25.0%	+7.5%	536,202	+40,215	576,417	5	-201	84,690	-0.24%
Runs 6/7.1& 6/7.2	2020	-10.0%	+3.0%	432,818	+12,985	445,803	5	-65	68,435	-0.09%
	2035	-25.0%	+7.5%	771,446	+57,858	829,304	5	-289	81,461	-0.36%

Source: SACOG, February 2010.

Notes for Table A-10:

/1/ Policy-based decrease in average transit fares (e.g. increasing current subsidy level).
/2/ Transit ridership change resulting from the fare change, assuming a ridership/fare elasticity of -0.30.
/3/ Total weekday transit trips, from SACSIM model runs.
/4/ Increase in transit trips (column 2 times column 3).
/5/ Total transit ridership with fare reduction (column 3 plus column 4).
/6/ Assumed VMT saved per new rider.
/7/ Total VMT saved (column 4 times column 6).
/8/ Total weekday VMT, from SACSIM model runs.
/9/ Percent change in VMT (column 7 divided by column 8 times 100).

Table A-11. Combined Reductions to VMT

SACSIM Model Run "Base"		Cong Pricing	VMT Fee	Parking Pricing	Transit Fare Subsidy	All Pricing	TDM/TSM	Pricing + TDM/TSM
Applied to Run 1.1+1.2, 2.1+2.2, 3.1+3.2 to create Scenarios 1, 2 and 3	2020						**-0.46%**	
	2020						**-0.46%**	
Applied to Run 1.1 and 1.2 to Create Scenario 4	2020						**-1.03%**	
	2035						**-1.03%**	
Applied to Run 1.1 and 1.2 to Create Scenario 5	2020	-0.29%	-1.00%	-0.04%	-0.06%	**-1.38%**		
	2035	-0.72%	-2.70%	-0.11%	-0.24%	**-3.74%**		
Applied to Run 6/7.1 and 6/7.2 to Create Scenarios 6 and 7	2020	-0.29%	-1.00%	-0.04%	-0.09%		**-1.03%**	**-2.43%**
	2035	-0.72%	-2.70%	-0.12%	-0.36%		**-1.03%**	**-4.85%**

Source: SACOG, February 2010.

Table A-12. Combined Reductions to GHG

SACSIM Model Run "Base"		Cong Pricing	VMT Fee	Parking Pricing	Transit Fare Subsidy	All Pricing	TDM/TSM	Pricing + TDM/TSM
Applied to Run 1.1+1.2, 2.1+2.2, 3.1+3.2 to create Scenarios 1, 2 and 3	2020						**-0.57%**	
	2035						**-0.57%**	
Applied to Run 1.1 and 1.2 to Create Scenario 4	2020						**-1.13%**	
	2035						**-1.13%**	
Applied to Run 1.1 and 1.2 to Create Scenario 5	2020	-0.32%	-1.11%	-0.05%	-0.06%	**-1.53%**		
	2035	-0.80%	-3.00%	-0.13%	-0.26%	**-4.15%**		
Applied to Run 6/7.1 and 6/7.2 to Create Scenarios 6 and 7	2020	-0.32%	-1.11%	-0.05%	-0.11%		**-1.14%**	**-2.70%**
	2035	-0.80%	-3.00%	-0.13%	-0.39%		**-1.15%**	**-5.38%**

Source: SACOG, February 2010.