June 23, 2010

Mary Nichols, Chair
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Re: Analysis of SB 375 Target Scenarios prepared by SANDAG, SCAG, MTC and SACOG

Dear Chairman Nichols,

On behalf of ClimatePlan, please find enclosed our analyses of the SB 375 scenarios presented to ARB by the four largest Metropolitan Planning Organizations (MPOs).

In order to aid the Air Resources Board in accomplishing its mandate to set regional targets, we evaluate the land use, transportation and pricing policies included in each of the MPOs' scenarios and attempt to assess the degree to which these scenarios truly represent what is ambitious and achievable.

Both ARB and the MPOs deserve to be commended for the hard work they have done over the past several months to inform this process and for their commitment to making so much detailed information about the scenarios available and accessible to the public. This rich assembly of information helps us all to assess what is possible, not just in California, but as federal energy and transportation laws are crafted, to gain a more in depth understanding of how improved transportation and land use planning can contribute to overall environmental goals. Indeed, as with so many environmental issues, California's implementation of SB 375 will be closely watched and precedent setting.

Most MPO Scenarios Underestimate Reductions, Particularly for 2035

We are encouraged by the scenarios that have been produced for this process, and they mark an historic step in envisioning a more prosperous and sustainable future. However, most of the MPO travel models do not fully account for the good work that cities and regions have *already* been doing, and their scenarios stop short of ARB's ambitious achievable threshold for SB 375 targets.

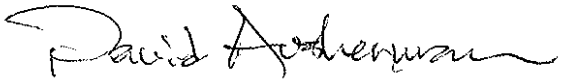
Most of the MPOs' existing travel models simply were not designed to deal with GHG emissions, and they tend to underestimate the GHG reductions from smarter land use and transportation. The regions are working hard to transition to the next generation of travel models, but only SACOG's model comes close to accounting for what is possible.

Land use and transportation changes happen slowly, but the benefits accrue over time and add up to big savings in the longer term. Therefore we should see greater reductions in 2035 than 2020, and even greater reductions in 2050. The empirical evidence from across California and around the world supports this conclusion. We understand that all of the MPOs are continuing to learn what is possible as they create additional scenarios and

refine their technical analyses over the next several months and we strongly encourage you to support this process through September.

We offer these analyses to help inform your efforts in this precedent setting action. We encourage you to consider us as a resource throughout the process and we look forward to working closely with you to make sure California succeeds with implementation of SB 375.

Sincerely,



David Ausherman
Renaissance Planning Group

Peter Hathaway
Transportation Planning Consultant

Norm Marshall
Smart Mobility

Encl: biographies

SANDAG (San Diego)

Did SANDAG study a range of scenarios to inform what is ambitious and achievable?

Summary: SANDAG's hybrid/ambitious scenario is fairly ambitious in land use, TDM, and TSM strategies, and reports ambitious results for transit. With its hybrid scenario, SANDAG reports the potential to reduce GHGs by as much as 19% by 2035. The ambitious transit results are laudable and should be supported by appropriate policies and investments. However based on the information presented we are concerned that these transit goals may not be supported. More ambitious strategies for walk and bike, land use, and pricing, plus less road expansion in outer suburban areas, SANDAG should be able to show equal or even better GHG reductions.

SANDAG examined three test scenarios, one focused on demand management (TDM), one on transit improvements, and one on pricing, each one in turn evaluated against two land use alternatives. SANDAG then created a hybrid scenario, with advice from its Board as to what to include, and this has de facto become SANDAG's most ambitious scenario:

Land Use: For SANDAG, a fully ambitious land use would enhance its Urban and Town Center growth strategy, at least for the outer years after the current housing recession has passed, to support the transit strategies discussed below and make them more realistic. San Diego's current housing stock is comprised of about 35% attached units, with that percentage gradually increasing over time. In the past decade, attached housing units have comprised 46% of new construction. For the 2007 RTP, 71% of new housing would be attached units going out to 2020 and 80% from then until 2030 (and 91% for the decade beyond, to 2040), and ten designated Urban Centers and 34 designated Town Centers would build up by absorbing much of the new growth. This represents an ambitious assumption, and the market, land supply, and land prices seem to support these trends.

SANDAG also examined an even more ambitious land use alternative, which would build out the existing eight Urban and 24 Town Centers to maximum density and put enough growth into ten designated new ones to reach at least minimum urban and town center density. This alternative would in effect accelerate attached housing unit trends and require more infill and redevelopment, and it would increase the amount of GHG reductions by about 8% for 2020 and 10% for 2035.

Road Network: SANDAG's hybrid/ambitious scenario makes no changes to rein in suburban and interregional highway expansion. A fully ambitious scenario would retract or scale back highway projects in outlying areas, particularly those designed to serve interregional commuting, in favor of interior road, transit, or walk and bicycle projects to improve accessibility to or within Urban and Town Centers. SANDAG plans to spend $21 billion for highway expansion, for 32 HOV lane, managed lane, mixed flow lane, HOT lane, toll road, and interchange projects, plus another $7 billion for arterial corridor projects, through its 2007 RTP. This represents a very aggressive highway expansion in size as well as early construction. While the Bay Area would spend more on transit than road expansion, and LA and Sacramento would spend 30%-40% more on road than transit expansion, SANDAG would spend 278% more on road expansion than transit expansion. With the addition of HOV and HOT lanes in many corridors, San Diego's freeways will have from 14 to 18 lanes on I-5 and I-15 into North County, twelve lanes on three other freeways, and ten lanes on much of the rest of the network; in comparison, twelve-lane

freeways are quite rare elsewhere in California, the standard for major urban freeways is eight lanes, and even the new Bay Bridge will have only ten lanes, so San Diego would build 20%-40% more capacity on its freeways than regions with much greater population. SANDAG's county sales tax program (TransNet) expects to complete more than $7 billion of the $21 billion in highway expansion by 2014 using bonds.

Arguably SANDAG would overbuild its freeways, but it does to some extent tend to locate its freeway expansion strategically in the right places, on corridors that connect its Urban and Town Centers. Nine of the HOV, managed lane, and mixed flow projects (on I-5, I-15, and Routes 56, 76, & 78 to the north, I-8 and Routes 52 & 67 to the east, and Route 125 toll road to the southeast, costing $11 billion) serve growth at the suburban edge; several of these projects are already committed, through Prop. 1B state bonds or the TransNet sales tax program, in particular the $2.5 billion managed lanes on I-5 to Oceanside and I-15 to Escondido. Some of the suburban highway expansions would provide too much capacity to support more low density, single use suburban development than SANDAG intends be built, and might not be needed if more of that growth were redirected into Urban and Town Centers. The Route 241 toll road extension into Orange County plus HOT lanes on I-5 & I-15 to the north county line (cost of $3.5 billion) would promote more interregional commuting and in no way fit with the spirit of SB375.

Demand Management (TDM): The main concern about SANDAG's TDM strategies is not how ambitious they are, but, as will be discussed below, whether SANDAG's model would verify them as realistic if it had the capability to do so. SANDAG proposes TDM strategies that would yield 180,000 more carpool riders (144% increase), increase of 1150 vanpools (175% more than the RTP), and a 15% reduction in white-collar work trips (compared to 5% in the RTP) as part of its hybrid/ambitious scenario. These represent ambitious objectives, and would be easier to achieve with higher growth in Urban and Town Centers.

System Management (TSM): SANDAG's TSM improvements represent a reasonably ambitious TSM approach, through investments that ensure better access to areas of higher growth, and help bus as much as auto access. SANDAG lays out seventeen additional TSM improvements in the hybrid/ambitious scenario, beyond the $500 million designated for TSM improvements in its 2007 RTP, all to be built by 2020. All are auxiliary lanes or local improvements at congested locations. Four of the 17 are in suburban North County, but fifteen of the 17 directly serve Urban or Town Center access, where better accessibility and lower congestion would support compact growth.

Walk & Bike: For SANDAG, a more ambitious walk and bike program would raise the overall investment in walk and bike projects to perhaps $2 billion (3.5% of the RTP), and change the focus to provide about $2 million per year for each Urban and Town Center, enough for one substantial project annually on a continuing basis (which could be supplemented with developer-built projects as well). SANDAG in its 2007 RTP proposes only $400 million investment in walk and bike projects, about 0.7% of the whole $57 billion financial plan. This is too modest an investment for walk and bike, which probably comprise at least 4% of all trips today. The hybrid/ambitious scenario would increase walk and bike trips to school by 30,000 (20%), using dedicated federal funds, and test full buildout of the regional bikeway network, which serves bicycle enthusiasts and recreational riding but does little to support more local travel by walk and bike. San Diego needs to foster walk and bike travel as real options, particularly for short local trips in Urban and Town Centers.

Transit: If SANDAG's model provided greater confidence that a large shift from auto to transit use were realistic, the hybrid scenario would represent a very ambitious scenario. SANDAG through its 2007 RTP would invest $9 billion for major transit expansion, for three new rail/guideway corridors, grade separations and double tracking on the four existing corridors, new bus rapid transit corridors, plus the existing 120-line express and local bus system, and then consume $11-12 billion more for operating costs for the whole system going out to 2035. The light rail lines plus fifteen bus lines would run at frequencies of 10-minutes or less. This represents substantial transit service, particularly given the extensive amount of low density, single use residential and office/light industrial park territory in San Diego.

The hybrid/ambitious scenario proposes to add twelve new bus lines (10%), increase frequency of light rail trains, and add park-and-ride garages, and reports that daily transit ridership increases by 123%. This is a laudable goal, but the results are not supported by the information provided, for three reasons: no revenue stream exists to fund the additional operating costs, there may not be room for 123% more riders on a transit system that expands by less than 20%, and the apparent success in shifting trips to transit may not be all that it seems because of quirks in SANDAG's model discussed below. If the shift is overstated, SANDAG will need to concentrate more on its Urban Area Transit Strategy in its next RTP, including redirecting or increasing revenues to expand its system.

Pricing: SANDAG needs to consider a more realistic pricing scenario to achieve a fully ambitious approach, which could in addition provide funding for transit expansion. SANDAG in its 2007 RTP proposes to extend or add managed lanes on four corridors (I -5, I-15, I-805, & Route 52), and complete or widen three toll roads around the region (Routes 125, 241, & 11), within the framework of broader system expansion. In the hybrid/ambitious scenario, SANDAG would modify the RTP to build new HOV lanes as HOT lanes on three corridors (Routes 56, 78, & 94). Presumably all these toll facilities would use variable toll rates, and the extent of this toll system is more ambitious than in the other three major metro areas. To be consistent with SB 375, revenues generated by HOT lanes should be invested in transit, bicycle and pedestrian projects that reduce VMT. This is also an important equity consideration.

Does SANDAG's modeling completely account for GHG reductions?

Summary: The problems noted here tend to overestimate auto travel and VMT, and paradoxically may overestimate the shift to transit use. If fixed or adjusted, SANDAG would gain confidence in its estimated GHG savings for the hybrid scenario, and better understanding of effects of policy and investment choices on travel behavior. SANDAG could then verify its GHG reductions, and learn more about effectiveness of current and more ambitious strategies.

SANDAG uses a traditional 4-Step Transportation Model, which represented the state-of-the-art from about 1960 to the mid-1990s. The 4-Step Model analyzes: 1) trip generation (what trips do people need or want to make?); 2) trip distribution (where do they go for those activities?); 3) mode choice (do they travel by driving, riding, taking transit, bicycling, or walking?); and 4) trip assignment (what route do they take, with feedback that considers other routes during congestion). The typical 4-Step Model is based on traffic analysis zones, which provide an

average behavior for the people within them. The 4-Step Model was designed to assess mobility and forecast congestion, and it can do those things adequately.

However, the 4-Step Model cannot assess very well, or at all, policy questions of today: How do demographics (age, income, household size) affect travel behavior? How do household size and land uses affect auto ownership and use? Why and how do people decide to chain activities together? To what extent do travel time and out-of-pocket cost affect travel choices? What would variable pricing of auto travel do to travel choices? How does people's travel behavior respond to TDM signals for carpooling, walking, bicycling, and telecommuting? How does local geography affect walking, bicycling, and walk-to-transit? What do local land use details, particularly mixed uses, mean to travel behavior? The 4-Step Model must use a post-processor, typically involving extrapolation, to estimate answers to these kinds of questions.

SANDAG's 4-Step Model encounters at least four problems in looking at these issues, which limit RTP analysis and have become critical to SB375 planning:

- The model exaggerates the value of travel time. In assessing travel choices, the model trades off travel time versus out-of-pocket cost. This obviously affects whether a driver will use a HOT lane or toll road instead of free lanes, but it also affects the choice to travel by faster auto instead of slower but cheaper transit. SANDAG's model allows for three values of travel time, for lower (<$39,200), middle ($39,200-$78,400), and higher (>$78,400) income households. The income ratio among these groups is about 1:2:3, but the ratio of value of travel time among the same groups is about 1:5:20. For the middle group, value of travel time is reasonable at $5-$11 per hour; that means that for the lower income group, value of travel time is way too low, resulting in artificially high use of transit, and for the higher income group, value of travel time is way too high, resulting in almost no use of transit and excessive willingness to pay road tolls. This may explain the why so many trips shift from driving to transit in the hybrid scenario. SANDAG should reexamine and adjust its coefficients for value of time in its model.
- The model assumes some results without calculating them. The 15% TDM reduction in white collar work trips, walk and bike trips, and carpooling are all predetermined inputs to the model rather than outputs based on travel behavior calculations. With no signal from the model about travel behavior choices, SANDAG does not really know whether its policies and investments are as effective as it thinks they are, and it appears that the model may not remove the auto trips that are no longer made because of TDM, thus overstating traffic and congestion levels. SANDAG cannot get its model to do things it is not capable of, but it should consider a post-processor to make appropriate adjustments.
- The model fails to replicate actual use of HOT lanes. SANDAG seems to have adjusted its value of travel time to get I-15 managed lane use results more in line with what it expected, but the revenue comes out six times higher for 2006-2009 than was actually collected. It is interesting to observe that revenue forecasts for the Route 125 toll road were three times actual receipts, leading the toll road owner to file for bankruptcy. The model also allows for unlimited use of managed lanes, rather than preferential use for HOVs, so the managed lanes de facto perform as mixed flow lanes. Adjusting the value of time should fix this issue too.
- The model uses employment by acre, rather than actual number of employees or workplace square footage in calculations. This seriously limits the ability to analyze higher density employment areas or mixed use areas, and misrepresents employment in

certain zones such as Urban and Town Centers, which in turn implies continuance of single use medium density suburban land uses, contrary to the Urban and Town Center concept.

San Francisco Bay Area (MTC)

Did MTC study a range of scenarios to inform what is ambitious and achievable?

For years, MTC has been a state and national leader in developing innovative programs to link transportation and land use. MTC's Regional Transportation Plan also has the largest share dedicated to public transportation. Yet, the scenarios that MTC staff have been using to assess potential greenhouse gas emission reduction targets for the Bay Area do not do justice to the good work that cities and the region have *already* been doing in terms of land use changes and progressive transportation policy. MTC's targets should be higher, especially for 2035.

MTC has been using three scenarios created for its previous Regional Transportation Plan (RTP). One followed a conservative approach, relying mostly on existing plans and current financial constraints. The other two scenarios each incorporated one specific change - automobile pricing and a shift in the location of housing units to infill areas, primarily described by an additional 200,000 homes in San Francisco - to show another possibility.

These scenarios are insufficient for the following reasons:

- Neither scenario plans for a jobs/housing balance, as required by SB375
- Both scenarios assume an unrealistically high number of employed residents per household – 15% higher than any other region, 35% higher than the Sacramento region, and above any historic jobs/housing ratio other than at the height of the dot-com boom. What this means is that not enough housing is realistically provided for the amount of projected job growth.
- The alternative scenario assumes an ambitious 200,000 new homes in San Francisco but actually *decreases* the number of homes in Santa Clara County, another major job center, and leaves housing growth constant in Alameda County, a transit-rich area, missing a readily available opportunity to reduce commuting and GHGs.
- The pricing scenario is being represented as more ambitious than it actually is. The largest part of the price increase, congestion pricing, was only applied to a small fraction of overall vehicle travel – most car trips would not experience this congestion pricing. MTC should either actually test the impacts of the scenario it describes publicly, or talk about this scenario more accurately.
- At the same time, some less politically or logistically challenging pricing policy changes may have been omitted. For example, it is not clear that bridge tolls were increased in either scenario to keep pace with inflation.
- Neither scenario reflects the Bay Area's leadership in innovative transportation demand management programs, such as Safe Routes to Schools, Safe Routes to Transit, and the recent climate innovation grants.
- Both scenarios hold the transportation network relatively constant, especially regarding infrastructure investments. An ambitious scenario would revisit whether all projects in the transportation network, particularly those that facilitate additional interregional commuting, are necessary.

We applaud MTC staff for their commitment to study additional scenarios in the coming weeks that include some of the great work that is already happening in the region, including cities

planning for smart growth and innovative programs to reduce driving like the Safe Routes to Schools program.

In the coming weeks, MTC should study scenarios that:

- *Achieve a jobs/housing balance* by planning for enough homes in the region for all projected job growth, as required by SB375.

- *Make realistic assumptions about the number of employed residents per household.* A more realistic ratio would consider both historical trends in the regi*on and* future demographic shifts, such as an aging population, which would lead to fewer employed workers per household.

- *Change land use patterns to show more growth in areas near job centers and along transit networks,* like in Silicon Valley and the inner East Bay, not *just* in San Francisco.

- *Use a variety of different possible pricing mechanisms,* for example, ensure that bridge tolls are increased to keep up with inflation.

- *Build on and extend the innovative Transportation Demand Management (TDM) and non-motorized transportation strategies* that already are underway in the region, such as ridesharing, vanpooling, Safe Routes to Schools, and the regional bike network.

Does MTC's modeling completely account for GHG reductions?

We commend MTC for their current efforts to update their scenario modeling software to a more modern model which uses up-to-date research and techniques, and will provide a more accurate measurement of the impacts of different policy choices on travel and emissions. Unfortunately, this model will not be ready in time to affect the target-setting process, and MTC's current modeling software is outdated and significantly underestimates potential GHG reductions.

Specifically:

- People in walkable neighborhoods near transit are more likely to choose to walk, bike, or take transit rather than drive than those in auto-oriented areas. The current model is not sufficiently sensitive to land use differences. It overestimates auto ownership, auto mode share, and trip length in transit-oriented, dense urban areas, and underestimates walk and bike trips.
- The model does not estimate emission reductions from Transportation Demand Management (TDM) measures such as Safe Routes to Schools.
- When the cost of a trip goes up, people are more likely to avoid the trip, link the trip with other travel, or choose another destination or mode of travel. Previous model runs failed to capture the impacts of pricing because the model did not allow trip lengths to change as a result of price, so the model did not accurately capture the GHG emission reductions that would likely result from pricing policies.
- When congestion goes down in a given area, more people are likely to drive in that area, eventually increasing total vehicle travel as well as congestion in the long term. The model notes short-term decreases in emissions due to congestion-reducing measures such

as freeway ramp metering, but does not take into account the long term effects of induced traffic from short-term speed and capacity increases.

- People's choices about where to live depend on how easily and conveniently they can get around from a given location – e.g. if an area has less traffic, more people are likely to move there. The land use and transportation models are not integrated so cannot take into account this interrelatedness.

CARB needs to make decisions based on the best, most up-to-date tools and data. In the absence of the best tools, we appreciate MTC's commitments to:

- *Be transparent about the shortcomings of the current model* and clarify whether the results the model is showing are really the most ambitious and achievable reductions.

- *Use off-model tools, including post-processors*, to calculate benefits of land use changes, pricing changes, and Transportation Demand Management (TDM) measures.

- Where off-model tools are not easily available, *estimate emissions reductions using factors derived from the empirical literature*.

SACOG (Sacramento)

Did SACOG study a range of scenarios to inform what is ambitious and achievable?

Summary: SACOG's RTP of 2008 presents a fairly ambitious scenario that is already adopted; it is the only RTP in the state that achieves even a modest reduction in per capita VMT. SACOG supports the spirit of SB375 by testing various ambitious strategies, demonstrating potential effectiveness for each strategy alone and in combination. With a hybrid scenario, SACOG reports the potential to reduce GHGs by as much as 8% by 2020 and 17.4% by 2035. SACOG admits publicly that even their most ambitious submitted scenario does not represent their most ambitious-achievable target since they intend to examine an improved land use scenario, but SACOG also needs to accept pricing as achievable as part of a fully ambitious scenario.

SACOG examined six test scenarios, four of them focused individually on land use, demand and system management (TDM & TSM), transit improvements, and pricing, plus two combination scenarios that considered the first three factors together (excluding pricing) and then all four factors together. SACOG's RTP from 2008 was already linked to a 2005 Blueprint land use plan and showed modest reduction in VMT per capita, and each test scenario would do more. Over the summer, SACOG intends to assemble another hybrid scenario representing the most ambitious measures that would be politically achievable:

Land Use: SACOG's current land use test scenario is admirably ambitious, and it intends to test another even more ambitious land use scenario this summer. This scenario alone would increase the amount of GHG reductions from 4% (RTP) to 5.9% for 2020 and from 12.6% (RTP) to 13.8% for 2035, and in combination with the other measures could get to 7.9% for 2020 and 17.4% for 2035. Sacramento's current housing stock is comprised predominantly of detached housing, 67% on large lots and 3% on small lots, with 30% attached higher-density housing units. For the Blueprint and 2008 RTP, the mix of new housing would shift to 41% large-lot and 26% small-lot detached housing, with 34% attached units, in effect higher density suburbs with more mixed use and new town centers with only 36% of growth in transit priority areas. The Sacramento region's housing construction market has already shifted nearly to the Blueprint mix in just five years, albeit in an atypical slow-growth economy.

The Blueprint Plan represents quite an ambitious starting assumption, but the existing market seems to indicate that more could be achievable going out 25 years into the future. SACOG's more ambitious SB375 land use scenario would shift the mix of new housing to 33% large-lot and 29% small-lot detached housing, with 38% attached units. This scenario would rely more on infill and redevelopment, yields 84% of new development at higher than current densities, and puts 46% of growth into transit priority areas, but Sacramento does contain extensive areas of aging post-World War II suburbs that would expect redevelopment by 2035.

Road Network: SACOG proposes no changes in its road expansion in any of its scenarios, even for outer-edge suburban expressways and HOV lanes. A fully ambitious scenario with more infill would reconsider some of the far suburban road projects and substitute interior road, transit, or walk and bicycle improvements. SACOG in its 2008 RTP plans to spend just over $5 billion for road expansion, with $4 billion going for seven HOV lane projects, the Route 65 Lincoln bypass, three new long-distance cross-suburban arterial expressways, and two new bridges.

SACOG's RTP also contains nearly $6 billion for local access streets and arterial improvements built and funded as part of developments; no other RTPs include this category of road expansion. Not counting the developer-built projects, SACOG invests about 15% of its RTP in road expansion, compared to 33% for road maintenance, 11% for transit expansion, and 28% for transit operations. Work has started on all but two of the HOV lanes plus the Lincoln bypass and all should be complete before 2020; environmental work has begun for the three expressways, but they will be funded and built incrementally using federal and state funds, sales taxes, and development fees. Nearly half of SACOG's road expansion investment goes to support infill development directly, for arterial widening, interchange, and freeway bottleneck projects plus four large HOV lane projects in interior areas.

A couple of suburban edge HOV lane projects are already committed, through Prop. 1B state bonds and local funds, and the $300 million+ Lincoln bypass is under construction. Some of the suburban highway expansions would be funded by and provide access to greenfields development, but SACOG expects this development to be built as small-lot compact areas with mixed uses and new town centers rather than the traditional low density, single use suburban development.

Demand Management (TDM): SACOG's TDM measures go in the right direction, but it is unclear how ambitious they really are. Policies in SACOG's 2008 RTP emphasize TDM, noting the varying effectiveness of strategies in different urban environments, and synergy between various strategies such as bike to transit and guaranteed ride home. The RTP, however, describes strategies indistinctly, with a focus to ensure that all employers come under a transportation management association (which promotes, manages, and sponsors TDM activities), and does not specify a level of investment. SACOG's TDM/TSM test scenario proposes to increase TDM effort so that it expands faster than population growth and set up public car sharing programs in two communities infeasible for the private market alone; the car sharing proposal would be a good fit with redevelopment in transit priority areas, to enable less auto ownership. TDM programs offer promise in Sacramento, where the commute mode split today is 82% drive alone, 10% ride in carpools, 5% walk or bike, and 3% ride transit.

System Management (TSM): SACOG's TDM/TSM test scenario alone would increase the amount of GHG reductions from 4% (RTP) to 4.5% for 2020 and from 12.6% (RTP) to 13.1% for 2035, less effective than land use or pricing. SACOG lays out a TSM program in its 2008 RTP that centers on signal timing, incident response, and motorist information, costing an estimated $500 million. This represents a reasonably ambitious TSM approach, and does not add capacity for congestion relief in suburban edge areas that could support more growth there than SACOG wants.

Walk & Bike: SACOG's walk and bike commitment qualifies as fully ambitious, starting at the current RTP level. SACOG in its 2008 RTP proposes $1.4 billion investment in walk and bike projects, almost 4% of the whole $36 billion financial plan (excluding developer-built roads), and includes "complete streets" policies to ensure that arterial road expansion projects typically will also include bike and walk features beyond the $1.4 billion of direct investment. This represents a strong commitment for walk and bike, in line with walk and bike's 7% mode share of all trips today, and proportionally much more than the other three major metro regions do. SACOG's model estimates that 10% of trip growth for 2035 goes to walk and bike. None of the

test scenarios propose to increase walk and bike trips specifically. Success with a more ambitious land use scenario will depend to some extent on ability to foster walk and bike travel as real options, particularly for short local trips in infill and compact development areas.

Transit: SACOG's transit scenario seems fairly ambitious given the context of the region and funding, and synergy with other strategies is important. Sacramento today starts with minimal transit service, offering mainly lifeline service for those without autos, with only two light rail and five bus lines offering better than half-hour frequency. It carries 1% of all trips, but 20% of commute trips to the denser, transit-friendlier central business district where it costs $8-$20 daily to park. SACOG through its 2008 RTP would invest $4 billion for major transit expansion, for four new rail corridors, 16 new bus rapid transit corridors, express bus expansion on HOV lanes, plus more frequent service on significant parts of the local bus system, and expands $10 billion more for operating costs for the whole system going out to 2035. The three main rail lines plus 24 bus lines would run at frequencies of 10-minutes or less. Overall transit ridership would triple by 2035. The amount of service the RTP can propose is capped by the amount of funding available to operate it, because 80% of operating cost must come from public funds beyond fares. The RTP represents substantial transit service that must evolve as a predominantly low density, single use residential and office/light industrial park region adds more compact, mixed use, town-center-oriented growth.

The transit test scenario proposes to add 15% more transit service, mostly as higher frequency on lines in the RTP. The transit test scenario alone would increase the amount of GHG reductions from 4% (RTP) to 4.1% for 2020 and from 12.6% (RTP) to 12.7% for 2035, less effective in isolation than any other strategy, but in combination with the other measures could get to 7.9% for 2020 and 17.4% for 2035.

Pricing: SACOG tests a very ambitious pricing proposal. The pricing scenario gets results, particularly in the longer horizon: the pricing test scenario alone would increase the amount of GHG reductions from 4% (RTP) to 4.7% for 2020 and from 12.6% (RTP) to 15.1% for 2035, and in combination with the other measures it provides more than half the boost to get to 7.9% for 2020 and 17.4% for 2035.

Does SACOG's modeling completely account for GHG reductions?

Summary: SACOG's model encounters shortcomings mainly around the margins, but it accounts for GHG reductions as well as any model can do today. In fact, SACOG's model is powerful enough that it bumps up against the ability to provide accurate enough inputs for future year demographics, behavior, and land uses. In other words, model outputs are only as good as today's limited ability to estimate location and timing of housing and job development or to understand behavior choices involving the cost of driving.

SACOG has replaced its traditional 4-Step Transportation Model with a state-of-the-art Activity-Based Model. Activity-Based Models assess behavioral decisions about where to go and how and when to travel, the kinds of policy questions important to SB375 planning. In addition, SACOG's model estimates household travel demand based on 800,000 parcels, which eliminates much of the averaging that takes place in describing zone behavior and allows walk, bicycle, and walk-to-transit modes to be assessed on a more equal footing with drive, ride in auto, and ride on

transit.

SACOG can model better than anyone else key policy questions of today: How do demographics (age, income, household size) affect travel behavior? How do household size and land uses affect auto ownership and use? Why and how do people decide to chain activities together? To what extent do travel time and out-of-pocket cost affect travel choices? What would variable pricing of auto travel do to travel choices? How does people's travel behavior respond to TDM signals for carpooling, walking, bicycling, and telecommuting? How does local geography affect walking, bicycling, and walk-to-transit? What do local land use details, particularly mixed uses, mean to travel behavior? SACOG's model does not yet incorporate all behavioral decision factors that one might like, and so still must use a post-processor to estimate answers to some questions.

SACOG's Activity-Based Model needs further development or faces challenges in five areas:

- The model's vehicle ownership module is not sophisticated enough to match the rest of the model's capabilities. It needs to be able to assess not only total vehicle ownership by household but also what type(s) of vehicles people are likely to own, when to change those vehicles for other models, and who uses which vehicles for which trips. The model needs these capabilities for both SB375 analysis and to help CARB modernize the vehicle fleet mix component in its EMFAC emissions model to minimize fleet mix forecast variations from county to county.
- The model cannot assess variable pricing as a decision factor. It does consider both travel time and out-of-pocket trip cost (including VMT or parking fees) in choosing where and when to travel and what mode to use, but cannot adjust that choice once the trip starts. SACOG's post-processor estimates pricing effects to a reasonable order of magnitude, but the model does not calculate behavior choices for variable congestion fees and HOT lanes.
- The model cannot yet estimate traffic queuing. Traffic queuing, particularly on a road network that depends on arterials with lots of turning moves, is a real world factor in driver route choice. In fact, in Sacramento traffic diversion through neighborhoods in response to traffic queuing delays has become an issue that hampers road improvements needed to reduce congestion, support infill development, and keep bus routes running on time.
- SACOG's economic land use model is not ready to forecast interim year land uses, so that interim year data about pace and timing of development must be hand interpolated before the model can examine years such as 2020, 2025, and 2030 efficiently and with confidence.
- The model is data hungry. Data input and updating, particularly for land use parcels and transit service (where all stops must be geographically identified), requires considerable effort, and data needs will increase once a traffic queuing module comes on line.

SCAG (Greater Los Angeles)

Did SCAG study a range of scenarios to inform what is ambitious and achievable?

Summary: Except possibly for TDM, SCAG's most ambitious scenario is not particularly ambitious in land use, in customizing road, transit, walk and bike investment, and in pricing. Even so, SCAG reports the potential to reduce GHGs by 10% by 2020 and 12% by 2035. With more focused strategies designed to work together, and packages of strategies that get increasingly aggressive beyond 2020, SCAG should be able to show significantly better GHG reductions.

The five SCAG scenarios combine seven elements:

Land Use: In representing that its achievable scenario consists of nothing more than what is already going to happen and describing an ambitious scenario that allows current conditions to worsen, SCAG's scenarios fall well short in both direction and result. SCAG modeled three land use scenarios ranging from achievable to ambitious. The most achievable and least ambitious is a business-as-usual land use package for its 2008 RTP. For the next three scenarios SCAG used its Compass Blueprint 1 package which represents "the expected growth distribution by applying current general plans and recent local land use policies," and for its fifth scenario used a Blueprint 2 package built with densities around priority transit stations described as plausible but that "have not occurred in most parts of the SCAG region to date." SCAG dismisses the fifth scenario as too ambitious to achieve, and settles on its expected growth distribution as its ambitious-achievable scenario. In all scenarios, SCAG distributes more than 2 million of population growth, about 40% of its total population growth by 2035, at or beyond the urban edge, in the High Desert, Coachella Valley, and the valleys southeast of Riverside.

SCAG's most ambitious scenario results in a decrease in the percentage of housing located in transit priority areas from 59% today to 58% in 2035. It also decreases the jobs/housing ratio in housing-rich Riverside and San Bernardino Counties, increases it in jobs-heavy Orange County by 5%, and decreases it by 6% in Los Angeles County, requiring more long distance commuting into areas where the opportunity for walk and transit access to work is less than in Los Angeles. SCAG should test a scenario that builds more housing into job-rich areas combined with transportation investment targeted to these areas.

Road Network: SCAG's road network, the same for all five scenarios, does not meet the test of ambitious-achievable. SCAG would invest $100 billion in highway expansion, for 55 HOV lane, mixed flow lane, HOT lane, toll road, and interchange projects, plus another $35 billion for 55 arterial corridor projects, through its 2008 RTP. Twelve of the HOV and mixed flow projects (on I-5, Route 14, & I-15 to the north, I-210, I-10, & Route 60 to the east, I-215 & I-15 to the southeast, and I-5 to the south, costing $15 billion) plus five new toll roads (in the High Desert and between Riverside & Orange Counties, to cost $25 billion) will fuel suburban growth in semi-rural areas in outlying parts of the region. The HOV lane, HOT lane, and interchange projects in the urban interior serve to connect missing links on a map rather than improve access specifically to transit priority areas.

None of SCAG's five scenarios change anything, let alone do anything ambitious, from its RTP road investment package. SCAG neither pulls back nor shifts its investment in any road

expansion projects, even in the most ambitious scenario. Some of these projects are already committed, through Prop. 1B state bonds or county sales tax programs, but surely even part of $15 billion or more redirected to transit priority areas would improve accessibility and support more growth in places dense enough for frequent transit service connecting to multiple other areas. SCAG should test a scenario that focuses on interior road, transit, or walk and bicycle projects close to job centers and reconsiders growth-inducing suburban highway projects that are not yet committed, and customize its investment in the HOV and HOT lane system specifically for access to areas targeted for dense development.

Demand Management (TDM): In its 2008 RTP, SCAG emphasizes TDM strategies, such as carpool programs, flexible work hours, telecommuting, and parking management. As a starting point, Los Angeles already has one of the highest work-from-home rates of any large metro area in the country. The RTP would spend $3 billion on TDM strategies, in addition to $18 billion to expand HOV lanes noted above.

SCAG's most ambitious scenario proposes to increase work-at-home rates by 2% of total employment, or 200,000 jobs. This represents an ambitious objective, but appears less ambitious because it does not include shifts to walk, bike, carpools, and transit that should follow higher growth in compact transit priority areas and that SCAG's model cannot discern. In a region where 28% of non-work trips travel less than one mile and 50% less than three miles, more opportunity to reduce driving remains, and TDM should be able to realize better results.

System Management (TSM): It is unclear whether SCAG's TSM program will in fact reduce GHG emissions in the long term. SCAG lays out $22 billion in TSM improvements (not including HOV lanes) in its 2008 RTP, but then finds that $8 billion of those are lower priorities that need to be funded from new revenue sources such as road tolls. SCAG's most ambitious scenario seeks a "7% speed and capacity increase" for the whole road system, with lesser increases of 5% and 3% for less ambitious scenarios, without explaining clearly how it intends to accomplish this. A global increase in road speed would be good for bus service but also for driving, but a widespread increase in road capacity, based on past experience, would eventually provide room for more VMT, helping to explain why VMT per capita in SCAG decreases by 2020 but then resumes its increase by 2035. A more ambitious TSM program would target investment to transit priority areas, to ensure that buses gain particular benefit rather than mostly autos, and to ensure better access to those areas that will take on more growth.

Walk & Bike: Given the strong potential for walk and bike to play a major role in SCAG's overall transportation strategy, its investments in non-motorized strategies fall short of ambitious. SCAG in its 2008 RTP proposes $1.8 billion investment in walk and bike projects, about 0.35% of the whole $530 billion financial plan. This is a modest investment at best where the mode split for walk and bike exceeds 12% today based on household travel surveys. The most ambitious scenario would increase this investment by $500 million, to 0.45% of the whole. SCAG notes that walk and bike investments give disproportionate benefits compared to road and transit, and much of the LA region is dense enough that walk and bike are real options for many non-work trips today, becoming truer with increased growth in transit priority areas. A more ambitious walk and bike program would shift investment from peripheral road expansion to interior walk and bike projects, in an amount of several billion dollars, and target those investments to support moderate to high density redevelopment and infill projects in transit priority areas.

Transit: SCAG's transit scenarios do not meet the test of strategically ambitious. SCAG through its 2008 RTP would invest $55 billion for major transit expansion, in 13 rail plus 14 bus rapid transit corridors, plus another $47 billion for a 5-line high speed rail system, and then consume $164 billion in operating costs for the whole system going out to 2035. This represents substantial transit service, but it is concentrated in urban Los Angeles County and is considerably thinner in suburban counties where most future growth is slated to go.

The most ambitious scenarios propose to make up the current shortfalls and expand service to shorten headways by a further 20%, expressed as a global average. The ambitious scenarios are described by SCAG as unachievable, in this case because no revenue stream exists to fund the additional operating costs. SCAG should examine ways to shorten transit headways that would be more realistically fundable, focusing on transit priority areas where ridership should increase disproportionately. It could also consider using funds shifted from suburban road expansion to build one or more additional rail corridors connecting high-growth transit priority areas.

Pricing: SCAG's pricing scenarios are far from ambitious. SCAG in its 2008 RTP proposes expansion of four existing toll roads, four HOT lane projects, and four new toll roads around the region, seemingly chosen mainly as a way to fund large otherwise-unaffordable projects. In the most ambitious scenarios, SCAG would convert existing HOV lanes on I-10 and I-110 to HOT lanes (relatively easy from an engineering and cost standpoint) but the size of the fee does not contribute to the GHG performance of the more ambitious scenario.

Does SCAG's modeling completely account for GHG reductions?

Summary: All of the problems noted below tend to overestimate auto travel and VMT, and underestimate walk, bike, and walk-to-transit trips. If fixed, SCAG would realize greater GHG savings in its baseline, and thus could reach a higher target. SCAG also would realize more GHG reductions from the seven types of measures discussed above, which would technically serve a higher GHG reduction target as well as politically demonstrate greater value from pursuing admittedly-difficult choices more aggressively.

SCAG uses a traditional 4-Step Transportation Model, which represented the state-of-the-art from about 1960 to the mid-1990s. The 4-Step Model analyzes: 1) trip generation (what trips do people need or want to make?); 2) trip distribution (where do they go for those activities?); 3) mode choice (do they travel by driving, riding, taking transit, bicycling, or walking?); and 4) trip assignment (what route do they take, with feedback that considers other routes during congestion). The typical 4-Step Model is based on traffic analysis zones, which calculate and use average behavior for the people within them. The 4-Step Model was designed to assess mobility and forecast congestion, and it can do those things adequately.

However, the 4-Step Model cannot assess very well, or at all, policy questions of today: How do demographics (age, income, household size) affect travel behavior? How do household size and land uses affect auto ownership and use? Why and how do people decide to chain activities together? To what extent do travel time and out-of-pocket cost affect travel choices? What would variable pricing of auto travel do to travel choices? How does people's travel behavior respond to TDM signals for carpooling, walking, bicycling, and telecommuting? How does local

geography affect walking, bicycling, and walk-to-transit? What do local land use details, particularly mixed uses, mean to travel behavior? The 4-Step Model must use a post-processor, typically involving extrapolation, to estimate answers to these kinds of questions.

SCAG's 4-Step Model encounters at least five problems in looking at these issues, which limit RTP analysis and have become critical to SB375 planning:

- The zone system is too coarse. SCAG uses about 4000 zones. In the urbanized area, that means a typical zone would contain nearly 5000 people and about a square mile of area. That is far too large to examine walk and bike travel effectively, and too much variation within a zone gets lost in the whole-zone average. SCAG needs to be able to discriminate and consider land uses, demographics, and zone behavior on a finer grain, such as via an internal grid or census blocks.
- The model is not sensitive enough to different kinds of land use patterns. It allows for two: a highly dense Central Business District, and everything else. The SCAG region is much more diverse than this, for example with multi-generational ethnic neighborhoods with low auto ownership, medium density apartment communities, and suburban towns designed for walk access. The model contains a 0-or-1 switch for the two allowed land uses. The model probably contains a field of code that would allow up to ten land uses (0-through-9), and SCAG needs to make use of this flexibility.
- The model is not sensitive to trip cost; it chooses and assigns trips based only on travel time. Thus it does not respond to pricing. The model could be coded to calculate based, say, on 80% travel time/20% out-of-pocket trip cost. SCAG should seek such a modification.
- The model is not sensitive to walk, bike, or walk-to-transit trips as a mode choice. This problem stems from the large zone structure, yet these mode choices are realistic options in many zones. The model actually chooses trip origins and destinations before mode choice, and if the trip chosen goes between two zones (> 1.5 miles), it will be too long for walk or bike. SCAG could work around the large zone problem by designating walk or bike as the mode of travel before choosing trip origin and destination, thus it would come up with an accurate number of walk and bike trips that would then stay within one zone.
- SCAG has no auto ownership feature for its model. Trip behavior varies significantly by number of autos in a household, so the model cannot accurately predict travel behavior without this key information. The transit priority areas presumably offer good enough transit access that some households could choose to own fewer autos, and thus travel differently, and some other areas already have lower auto ownership that SCAG's zones do not pick up. SCAG could attach an auto ownership variable to its allowed land uses, and adjust to some extent for this shortcoming.

Biographies

David Ausherman, Principal of Planning and Design
Renaissance Planning Group
David has extensive experience in large scale design, urban and regional planning and computer modeling. His experience includes both public and private sector design projects from site to regional scales. Most notably, David has been involved in several large-scale regional scenario planning and visioning initiatives including Region 2040, a plan for the Portland region that included land use, transportation and open space planning for a 50-year forecast, Envision Utah, Chicago Metropolis 2020, Envision Central Texas. David completed his master's degree in Design Studies from Harvard University and his undergraduate degree in Landscape Architecture from the University of Florida.

Peter Hathaway, Transportation Planning Consultant
Peter Hathaway has a career in transportation planning and finance spanning 40 years. Most recently he was Director of Transportation Planning at the Sacramento Area Council of Governments (SACOG). Previously, Mr. Hathaway worked for 16 years at the California Transportation Commission (CTC), four years at the Governor's Office of Planning and Research and seven years at the California Department of Transportation (Caltrans). A graduate of Union College, Schenectady, New York, he is a veteran of the United States Army. At SACOG, Hathaway managed transportation planning, programming and project delivery programs. He supervised two groundbreaking Metropolitan Transportation Plans: in 2002, the "Bold First Step" prepared by a broad-based Transportation Roundtable that included the establishment of four new regional funding programs including Community Design, and in 2008, "A Creative New Vision" directly linking the region's Blueprint to transportation planning and setting new standards for congestion, vehicle miles traveled and air quality performance.

Norm Marshall, Principal
Smart Mobility Inc.
Norm Marshall is a founder and principal of Smart Mobility Inc, a consulting firm based in Norwich, Vermont that integrates transportation and land use modeling, engineering, and planning. Before co-founding SMI in 2001, Mr. Marshall worked at Resource Systems Group, Inc. from 1987-2001. During his 14 years at Resource Systems Group, Mr. Marshall developed a national reputation for innovative work in regional travel demand modeling and transportation/land use interactions. His experience includes developing travel demand models for Burlington Vermont, Portland Maine, Syracuse New York, the New Hampshire Seacoast region, and a statewide model for Georgia. He has completed many projects in Vermont covering areas including estimating traffic volumes, traffic operations, traffic impact studies parking, transit needs, and transit operations. Mr. Marshall received his B.S. in Mathematics at Worcester Polytechnic and completed his M.S. in Engineering Sciences at Dartmouth College.