AGENDA HIGHLIGHTS

- TRANSPORTATION AND LAND USE MODELING: CURRENT PRACTICE AND FUTURE TRENDS
- PROPOSED SourcePoint CONTRACT WITH CITY OF SANTEE

PLEASE TURN OFF CELL PHONES DURING THE MEETING

YOU CAN LISTEN TO THE BOARD OF DIRECTORS MEETING BY VISITING OUR WEB SITE AT WWW.SANDAG.ORG

MISSION STATEMENT
The 18 cities and county government are SANDAG serving as the forum for regional decision-making. SANDAG builds consensus, makes strategic plans, obtains and allocates resources, plans, engineers, and builds public transit, and provides information on a broad range of topics pertinent to the region’s quality of life.
Welcome to SANDAG. Members of the public may speak to the Board of Directors on any item at the time the Board is considering the item. Please complete a Speaker’s Slip, which is located in the rear of the room, and then present the slip to the Clerk of the Board seated at the front table. Also, members of the public are invited to address the Board on any issue under the agenda item entitled Public Comments/Communications/Member Comments. Public speakers are limited to three minutes or less per person. The Board of Directors may take action on any item appearing on the agenda.

This agenda and related staff reports can be accessed at www.sandag.org under Meetings on the SANDAG Web site. Public comments regarding the agenda can be forwarded to SANDAG via the e-mail comment form also available on the Web site. E-mail comments should be received no later than 12 noon, two working days prior to the Board of Directors meeting. Any handouts, presentations, or other materials from the public intended for distribution at the Board of Directors meeting should be received by the Clerk of the Board no later than 12 noon, two working days prior to the meeting.

In compliance with the Americans with Disabilities Act (ADA), SANDAG will accommodate persons who require assistance in order to participate in SANDAG meetings. If such assistance is required, please contact SANDAG at (619) 699-1900 at least 72 hours in advance of the meeting. To request this document or related reports in an alternative format, please call (619) 699-1900, (619) 699-1904 (TTY), or fax (619) 699-1905.

SANDAG offices are accessible by public transit. Phone 511 or see 511sd.com for route information.
BOARD OF DIRECTORS AGENDA
Friday, March 11, 2011

ITEM #  RECOMMENDATION

1. PUBLIC COMMENTS/COMMUNICATIONS/MEMBER COMMENTS

Public comments under this agenda item will be limited to five public speakers. Members of the public shall have the opportunity to address the Board on any issue within the jurisdiction of SANDAG that is not on this agenda. Other public comments will be heard during the items under the heading “Reports.” Anyone desiring to speak shall reserve time by completing a “Request to Speak” form and giving it to the Clerk of the Board prior to speaking. Public speakers should notify the Clerk of the Board if they have a handout for distribution to Board members. Public speakers are limited to three minutes or less per person. Board members also may provide information and announcements under this agenda item.

REPORTS (2 through 3)

+2. TRANSPORTATION AND LAND USE MODELING: CURRENT PRACTICE AND FUTURE TRENDS (First Vice Chair Jack Dale, Transportation Committee Chair; Kurt Kroninger, Clint Daniels) INFORMATION

Staff will provide a presentation on the current state of transportation and land use modeling at SANDAG. The presentation also will include an update on next generation transportation and land use model development currently underway.

+3. PROPOSED SourcePoint CONTRACT WITH CITY OF SANTEE (Renée Wasmund) APPROVE

The City of Santee has requested that SourcePoint enter into a contract to provide the City with access to SANDAG on-call engineering contracts and to have SANDAG carry out the competitive procurements and serve as the contract administrator on contracts for the construction of certain redevelopment projects in the City. The value of the project(s) is estimated at approximately $28.5 million, which exceeds the contracting authority of the Executive Committee acting as the SourcePoint Board of Directors. Pending a recommendation from the Executive Committee, the Board of Directors is asked to authorize the Executive Director to execute a contract in substantially the same form as Attachment 1 with the City of Santee and make the necessary budget modifications to accept the funds from the City.
4. CONTINUED PUBLIC COMMENTS

If the five speaker limit for public comments was exceeded at the beginning of this agenda, other public comments will be taken at this time. Subjects of previous agenda items may not again be addressed under public comment.

5. UPCOMING MEETINGS

The next Board Business meeting is scheduled for Friday, March 25, 2011, at 9 a.m. The next Board Policy meeting is scheduled for Friday, April 8, 2011, at 10 a.m.

6. ADJOURNMENT

+ next to an agenda item indicates an attachment
Transportation and Land Use Modeling: Current Practice and Future Trends

Introduction

SANDAG strives to remain at the forefront of United States transportation and land use modeling. The current SANDAG transportation and land use models are consistent with the models used throughout the country, and SANDAG along with the other major California Metropolitan Planning Organizations (MPOs) is leading the development of the next generation of transportation, land use, and economic models.

SANDAG deals with many complex issues facing the San Diego region, including the development of a long-range Regional Transportation Plan (RTP). Transportation and land use models perform a very basic yet vital set of functions. Models are the principal tools used for alternatives analysis, and they provide planners and decision makers with information to help them equitably allocate scarce resources. To many people outside of the planning profession, computer models are often little understood or viewed as some kind of mystical black box. This report intends to clear up some of the mystery surrounding models and provides an overview of the current modeling tools used by SANDAG for the 2050 RTP as well as a view of the next generation models, the Activity-Based Transportation Model (ABM) and Production, Exchange, and Consumption Allocation System (PECAS) land use and econometric model.

One important point should be kept in mind throughout this report - models do not make decisions - but they aid in measuring and evaluating alternative solutions and their implications.

Discussion

Models

Models are used to simplify complex systems into a manageable scale. For example, an aerospace engineer builds a model airplane to test aerodynamics and maneuverability before building a full-size aircraft. However, unlike a physical model airplane, planning models are often expressed in ‘nonphysical’ or mathematical terms.

For instance, economists tell us that other forces being equal, the demand for a particular product (an ice cream cone, for example) is directly related to the price that the product sells for (i.e., supply and demand). Specifically, as the price of ice cream goes down, the more cones an individual will buy. Suppose that observations of a particular individual reveal that consumption of ice cream cones per week varies with price as shown below:
<table>
<thead>
<tr>
<th>Price of Cones</th>
<th>Quantity Purchased Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3.00</td>
<td>2</td>
</tr>
<tr>
<td>$2.50</td>
<td>4</td>
</tr>
<tr>
<td>$2.00</td>
<td>6</td>
</tr>
</tbody>
</table>

With this information, a simple mathematical relationship between price and demand is apparent, and with this relationship in mind, it is possible to predict that if the cost of ice cream cones were to drop to $1.50 each, the quantity demanded would increase to eight per week.

Although this example is over-simplified, it serves to illustrate how a model can be expressed mathematically. Like the aerospace engineer’s airplane, this mathematical model is an over-simplification of the real world; however, each type of model can provide valuable information.

**Regional Modeling**

The process of developing transportation and land use models is time consuming, but these models provide a significant return on investment. Regional models provide the capability to account for the varied and complex forces that are at work within the social, economic, and physical aspects of the regional environment. The models provide valuable insights into many important questions in a short amount of time for more informed decisions. Regional models also educate planners and policymakers beyond their intuitive judgment. Regional models provide answers to questions like “If we change this policy, how might that affect the region in the years to come?” These answers can help policymakers make the important decisions that shape the region’s future.

**Transportation Modeling for the 2050 Regional Transportation Plan**

For the 2050 RTP, SANDAG uses an enhanced four-step transportation model. Four-step models have been the standard in transportation modeling since the late 1950s, and they are used by nearly every MPO in the United States for the development of transportation plans, corridor studies, Federal Transit Administration New Starts proposals, and air quality analyses. The traditional four steps of this model are:

1. Trip generation
2. Trip distribution
3. Mode choice
4. Traffic (route) assignment

The four steps are described briefly in the following sections. For more complete information, please refer to the SANDAG Transportation Model Documentation online.¹ The model is largely established from travel behavior survey data from 1995, 2001, and 2006.


This documentation was published in 2008 after the release of the 2007 RTP. SANDAG has made enhancements to the model including a truck model, pricing sensitivity, and non-motorized sensitivity, which will be fully documented at the completion of the 2050 RTP.
Trip Generation

SANDAG begins the transportation modeling process by identifying the total number of trips produced in the region. A trip is made up of two parts, an origin (production) and a destination (attraction). Trips are categorized into ten categories, which are used later in the model for matching origins and destinations as well as choosing the travel mode (mode choice).

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Description / Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home-Based Work</td>
<td>Commute</td>
</tr>
<tr>
<td>Home-Based College</td>
<td>Student Trip to College / University</td>
</tr>
<tr>
<td>Home-Based School</td>
<td>Student Trip to School</td>
</tr>
<tr>
<td>Home-Based Shopping</td>
<td>Shopping Trip</td>
</tr>
<tr>
<td>Home-Based Other</td>
<td>Doctor’s visit, visiting friends, dining out, etc.</td>
</tr>
<tr>
<td>Work Other</td>
<td>One end point is work and the other is not home. Examples: work lunch, trip from office to grocery</td>
</tr>
<tr>
<td>Other Other</td>
<td>Ends are neither work nor home. Examples: dinner-theater, grocery-dry cleaner.</td>
</tr>
<tr>
<td>Serves Passengers</td>
<td>Example: dropping child at school</td>
</tr>
<tr>
<td>Visitor</td>
<td>Any trip generated by non-San Diego residents</td>
</tr>
<tr>
<td>Regional Airport</td>
<td>Trips generated by regional airport facilities</td>
</tr>
</tbody>
</table>

Using the land use and demographic information from the 2050 Regional Growth Forecast, SANDAG estimates the number of person trips generated in each Transportation Analysis Zone (TAZ). SANDAG develops a set of TAZs (see Attachment 1) to aggregate areas of homogenous land uses and simplify the computer power needed to run the model. The TAZ system simplifies the region from nearly 1 million parcels to 4,670 zones (plus 12 external zones representing Orange, Riverside, and Imperial Counties and Baja California, Mexico) resulting in a matrix of 22 million zone combinations instead of 1 trillion combinations using parcels.

Based on the land use in each zone, SANDAG estimates the number of person trips (car, carpool, transit, walk, and bike) that are generated in the zone. In reality, some land uses will generate fewer person trips than estimated while others will generate more, but on average the rates are accurate when aggregated to the regional level. Trip rates are estimated from observed data collected by SANDAG over the last three decades, augmented by the Institute of Transportation Engineers’ Trip Generation Manual, and published in the SANDAG Traffic Generators Manual. Finally, trip rates for certain zones may be modified in order to more accurately reflect current, observed traffic counts and transit ridership.

Example: The average small-lot, single-family home in the San Diego region generates ten person trips. An example breakdown of real-world trips for a family of three in a small-lot, single-family home in Solana Beach might include: (1 and 2) mother bikes with daughter to school, (3) mother
bikes home from school, (4) mother walks to COASTER for work in downtown San Diego, (5) father drives to work in Rancho Bernardo, (6) mother returns home from work, (7) mother bikes to pick up daughter, (8 and 9) mother and daughter return via bike from school, and (10) father returns home from work. In the SANDAG model, all of the trips from homes on this fictional family's block would be aggregated into one TAZ. Similar calculations are done for each land use in the San Diego region.

**Trip Distribution**

With the number of person trips produced and attracted for each zone from the previous step, the SANDAG model matches each production to an attraction. This step will match trip ends of trips with the same purposes, so home-based college trip attractions at Cal State San Marcos will be matched with home-based college trip productions around the region.

SANDAG uses an enhanced gravity model to match productions and attractions; a transportation gravity model is loosely based on Sir Isaac Newton’s Law of Universal Gravitation using zone size, attractiveness, and the distance or travel time between the zones to match trip ends.

**Example:** Fashion Valley is one of the largest shopping centers in the San Diego region. Because of its size, Fashion Valley will attract patrons from a much larger geographic area than a neighborhood corner store. In this step, home-based shopping trip productions from all over the region will be matched with Fashion Valley trip attractions, and the local corner store will primarily be matched with trips from the immediate neighborhood.

In context of a traditional gravity model, Fashion Valley would be analogous to the sun attracting the nine planets in our solar system, while the corner store might be thought of as Mars, which is large enough to attract two moons, but not the rest of the planets.

**Mode Choice**

The mode choice step selects the most efficient transportation mode (drive alone, carpool, transit, walk, bike, etc.) for each trip, based on access, traveler's income, trip purpose, parking costs, fuel price, transit fares, travel time, and other time and pricing parameters. Mode choice assumes that travelers make logical decisions about which form of transportation to take based on accurate information about the time and cost of completing a trip by alternative modes. In reality, a driver or transit rider rarely knows every possible alternative or considers all of the costs; however, SANDAG continues to make Transportation Systems Management (TSM) investments like 5-1-1 to make improved traveler information a reality in the future.

The mode choice step also computes mode use separately for two time periods: peak and off-peak. The peak period extends from 6 to 9 a.m. and from 3 to 6 p.m. The off-peak period covers the remaining 18 hours of the day. It is important to evaluate mode use separately for the two time periods, because the quality of service can vary dramatically by mode. For example, transit operators often provide more frequent transit service during peak hours, reducing wait times for transit riders. Conversely, highway congestion is at its worst during peak hours, making auto modes less attractive relative to transit.

The mode choice model is commonly criticized for underestimating future transit use of expanded transit alternatives, because model calibration is based upon current conditions. However, the model estimates transit use for each zone-to-zone movement based upon the quality of transit service relative to other modes. Existing trolley corridors provide a basis for determining potential
transit use with high quality transit service. As more light rail, bus rapid transit (BRT), and rapid bus services are provided, the model recognizes the resulting transit service improvements and shifts travel to transit from other modes.

Example: A student living in downtown San Diego has a number of transit mode options for getting to school at San Diego State University. For example, the student could take the trolley or local bus. The trolley trip is about five minutes faster, but the trolley fare is $0.25 more than the local bus. The mode choice step will determine which tradeoff the traveler is willing to make based on trip purpose, income, mode desirability, and proximity to the proper transit stops.

Traffic Assignment

The result of the previous three steps is a set of Origin to Destination (O-D) trip tables describing the number of trips by mode by time period from one zone to another. During traffic and transit assignment, the model places each trip on the most efficient route based on the mode, network congestion, speed, and tolls. Mixed-flow transit vehicles (e.g. buses that operate on general purpose lanes/streets) are hampered by congestion on the road network while trolleys and buses on dedicated guideways operate at full speed. In the RTP base year, the SANDAG model assigns more than 17 million trips for a typical weekday.

Example: For a drive alone, home-based work trip from Carlsbad to Sorrento Mesa, the model can choose a route along Interstate 5 or use local arterials. During traffic assignment, which runs iteratively to equilibrium, the model will initially attempt to route all trips down Interstate 5. However, as a response to congestion from the initial assignment, some traffic will be routed down Coast Highway or El Camino Real. The traffic assignment model will iterate until all trips are assigned the most efficient route for their mode.

Feedback

After all of the steps are completed, the SANDAG model returns to the trip distribution step and runs through traffic assignment, updating trip information based on congestion levels and travel times from the last iteration. The SANDAG model iterates to ensure the model network reaches equilibrium.

Example: In the first model iteration, nearly all of the auto trips between western Escondido and downtown San Diego will be routed down Interstate 15. However, all of the cars travelling between Escondido and downtown San Diego would cause extreme congestion. During the second model run, some trips may be assigned to destinations closer to home in the trip distribution step to avoid congestion realized during the previous step. In the third run, some of the remaining travelers may switch modes to the Express Bus to avoid general purpose lane traffic altogether. This process continues until the process reaches equilibrium and every trip is using the most efficient mode and route possible.

Next Generation Models

Activity-Based Modeling

Activity-based modeling (ABM) is a paradigm shift in transportation modeling allowing a more complex analysis of infrastructure investment, social equity, and traveler behavior. Unlike the zonal trip accounting system based on land use trip generation in the traditional four-step models, ABM models each individual person’s travel choices on an average weekday in the San Diego region.
MPOs have implemented an ABM, and eight MPOs (including SANDAG) are actively developing activity-based models. Activity-based models are recommended by the California Transportation Commission for the four largest MPOs in the state. SANDAG anticipates using the ABM for the development of the next update to the RTP scheduled for adoption in 2015. The activity-based transportation model allows for more complex analysis of Transportation Demand Management (TDM) policies, traffic congestion, social equity, and tolling and pricing.

Activity-based models, while significantly more complex structurally, are conceptually easier to understand than the traditional four-step models, because ABM describes daily trips like going to work and picking up dry cleaning and enforces time constraints and travel modes in a way that’s easier for lay people to understand. The following sections describe the major components of the ABM (refer to Attachment 2):

- Population Synthesis
- Long-Term Choice Models
- Mobility Choice Models
- Daily Activity Pattern Models
- Tour Models
- Trip Models
- Traffic Assignment

**Population Synthesis**

The ABM does not model the personal travel behavior of each and every San Diegan, so, in order to simulate the travel behavior of 4.5 million San Diego residents in 2050, SANDAG builds a representative population that looks like the real San Diego. For example in 2050, SANDAG projects about 55,000 people will live in 31,000 housing units with a median household income around $71,000 in the Uptown Community Planning Area. SANDAG can estimate the general characteristics of the community, but we do not know the make-up of individual households. SANDAG uses U.S. Census Bureau data to fill in the household information and create a synthetic population for 2050.

Every year the U.S. Census Bureau publishes information, collected as part of the American Community Survey, about a sample list of households within San Diego County. The Census data are a random selection of households that complete the annual survey, providing information about income, employment, education, family size, and dwelling type. SANDAG draws households at random from this list to build a population that matches the ethnic, demographic, and economic characteristics of the San Diego region. In the Uptown example above, the average household size is 1.8 and the median income is $71,000, so the population synthesizer will draw households from the Census until it has 31,000 households with an average household size of 1.8 and a median income near $71,000. The population synthesizer balances population characteristics across 34 control categories.

**Long-Term Choice Models**

Once a representative population is developed, the model assigns work or school location to each employed person or student in the population. Since work and school are considered mandatory by most people, travel decisions are often dictated by work and school schedules of people in their household. The work location is based on many of the same factors affecting trip distribution in the four-step model, including travel time, land use, pricing, and network congestion. ABM also
matches occupation types to household characteristics allowing for greater jobs / housing fit analysis.

**Example:** A household in Chula Vista is composed of five people, three adults and two children. In the long-term choice modules, ABM assigns each family member a long-term activity location. In this household, the children are 2 and 6, so the younger child is assigned preschool age, and the older child is assigned as a pre-driving age student. The adults are a mother and father and a retired grandmother. From the population synthesizer, the parents are assigned as full-time workers, and the grandparent is assigned as retired. Since the student and the two parents are assigned statuses requiring them to leave the home most days, they also are assigned a workplace or school location. The father is assigned to work at QUALCOMM, and the mother is assigned to Sharp Hospital. The student is assigned to Eastlake Elementary.

**Mobility Choice Models**

After work and school locations are set for all of the representative residents, the model determines how many cars, if any, are available to each household, workplace parking costs, and transponder ownership. The number of cars assigned to each household is based on household income, work location, number of driving age people, and transit availability. Auto ownership is a key variable in mode choice later in the model. Workplace parking costs and transponder ownership are key variables in determining whether someone will take transit to work or use toll roads.

**Example:** Continuing with the family above, based on their upper income status and three driving age adults, the household has three cars, and the father has a FasTrak transponder to use the South Bay Expressway on his way to work. Since both employed parents work outside of traditionally parking constrained areas, their realized workplace parking costs are assumed to be zero.

**Daily Activity Pattern Model**

The Daily Activity Pattern model assigns travel patterns to each modeled individual in the San Diego region for a typical day. The daily activity patterns are broken down into three components: mandatory activities, non-mandatory activities, and stay at home.

Mandatory activities such as going to work or school are assigned first by the model since most households coordinate activities around jobs and school. Each activity is time blocked, so only one activity happens at a time. For example, the model will not allow someone to go to work from 8 a.m. to 5 p.m. and also allow them to attend part-time school from 1 p.m. to 4 p.m. Once work and school times have been blocked out for each traveler, residual time is available for non-mandatory activities. If a person is not a student or member of the labor force, they will not be assigned any mandatory activities, and the whole day remains available for non-mandatory activities. Certain non-mandatory activities related to work or school are identified here as well, such as dining out at lunchtime.

Non-mandatory activities are any activity that is not related to work or school. Non-mandatory activities are assigned based upon available time and other socioeconomic characteristics of each resident. In addition to assigning non-mandatory activities, the model also reviews the time availability of other household members and determines whether activities are completed alone or jointly.
Example: Continuing the example from above, mandatory activities are established first. Of the five people living in the household, three are eligible for a mandatory activity. The father and student are assigned to go to work and school on the modeled day. The father also is assigned to eat his lunch at the Karl Strauss near QUALCOMM. The mother, however, is determined by the model to stay home on the modeled day. It could be the younger child is sick, or she only works three days a week as a nurse.

Once the mandatory activities are assigned, the model assigns non-mandatory activities. In this example, because the mother and younger child were not assigned a mandatory tour, they are assigned a trip to the zoo and grocery store. The retired grandmother is assigned a walk around the neighborhood with her friend. The student is assigned no additional trips beyond going to school. The model attempted to assign a discretionary doctor trip for the father, but there is not enough extra time in his daily schedule to drive to La Jolla for the appointment, so the model cancels the trip. The model however does assign a morning coffee stop for the father.

Tour and Trip Level Models

Once all of the activities have been assigned, the model organizes each person’s activities into a set of tours composed of the trips between each activity. All tours begin and end at home with the exception of some work tours. Once the tours are identified, the model assigns a primary mode for the tour. In concept, the ABM mode choice is similar to the four-step mode choice, but in fact, it is much more complicated using more socio-economic indicators and auto-ownership indicators from earlier model steps.

The tour level models also identify any activity-chaining based on time availability, convenience, and activity types.

The trip models are similar to the tour models, but the trip models make choices and determinations about each individual leg of the tour. For example, the tour’s primary mode may be driving for a work tour, but the traveler can walk or take transit to lunch or a meeting. Likewise, if a traveler takes transit to work, the traveler does not have a car available for lunch or work trips, but could become a carpooler or pedestrian.

Example: Once all of the trips have been assigned, the model assigns that both the mother and father will use a car for their primary travel mode while the grandmother will walk. However, the father will switch modes to walking to get his morning cup of coffee after parking his car at his office.

Traffic Assignment and Feedback

The final step of the ABM is the same as the four-step model, traffic assignment. The ABM uses the same tools and framework as the four-step model for identifying the most effective path for each trip.

The ABM also relies on feedback similar to the four-step model to ensure model equilibrium.
Land Use and Economic Modeling

Regionwide Projections

The first step in the forecast process is to develop a regionwide growth projection of population, jobs, housing, and other demographic and economic characteristics. The regionwide projections are developed using the Demographic and Economic Forecasting Model (DEFM), which has had a 40-year track record of accurate regionwide projections.

The DEFM model is comprised of both an econometric model and a demographic model, which are linked through a few key variables. The econometric component of DEFM is calibrated based on 40 years of historical economic trend data such as jobs (by industry sector), unemployment, income, prices, and construction activity. The demographic component of DEFM is a cohort-component model, meaning that the population projections are driven by the age, gender, and race/ethnic characteristics of the existing population, and by the effects of life expectancy, birth rates, and migration trends. The models are linked through labor force participation, household formation, and migration. For example, when the unemployment rate is low in the econometric model, labor force participation rates rise in the demographic model. When job growth is high in the econometric model, domestic migration increases in the demographic model. When home prices are low, more people are encouraged to enter the housing market, and average household size falls.

Subregional Projections

The regionwide projections then become one input into the subregional, or neighborhood-level, forecast. The second key component of the subregional forecast is local land use data, developed through extensive collaboration with each of the 18 cities and the County of San Diego, as well as other land use agencies such as the tribal governments and Department of Defense. The local land use inputs incorporate such information as existing development, general plans, constraints to development (e.g., floodplains, steep slopes, habitat preserves, historic districts, building height restrictions, and zoning), and permitted projects in the development pipeline. The final building blocks of the subregional forecast are proximity to existing job centers (along with travel time and commute choice information), and historical development patterns. These four key inputs influence the probability of a neighborhood’s future growth. The results of this model are then reviewed by each local jurisdiction’s staff, and the final forecast is adjusted based on local feedback.

PECAS

In conjunction with the ABM development, SANDAG staff is also working to implement the state-of-the-art land use and econometric modeling framework, Production Exchange and Consumption Allocation System (PECAS). PECAS will replace the SANDAG subregional land use forecast model for the Series 13 growth forecast (for use in the RTP scheduled for adoption in 2015). All of the four major MPOs in California are currently developing PECAS land use models to replace or enhance existing land use modeling frameworks.

PECAS has a number of advantages over the existing sub-regional Urban Development Model (UDM). First, it forecasts the level of economic activity generated by businesses, households and governments within the region by modeling the local economy. It does so by analyzing the economic relationships among internal and external producers and consumers. Part of the analysis is the estimation of the cost of transporting goods and services between producers and consumers. These costs provide an economic rationale for the location of firms and households, since both try to minimize their cost of doing business. Furthermore, this economic rationale impacts rents, since
there is a tradeoff between the cost of rent and the cost of transportation; that is, higher geographic accessibility is usually associated with lower transportation costs but higher rents. Second, PECAS directly accounts for the cost of producing space and compares that cost to the expected rents that the space will generate. Thus, only space that will return a profit is allowed to develop in areas where the cost of transportation is manageable. It is these characteristics of PECAS that make it more sensitive to both land use and transportation policies than other land use models. Furthermore, because of the importance of transportation costs to PECAS, it integrates more directly with the transportation model.

**Peer Review**

All of the SANDAG models undergo extensive peer evaluation to ensure consistency with national best practices, FTA New Starts requirements, and local data trends. In 2005, SANDAG participated in the Federal Highway Administration (FHWA) Travel Model Improvement Program (TMIP) Peer Review Program. The TMIP program ensures that technical processes are applied and developed to meet standards of professional practice as well as federal and state requirements. The TMIP Review found the SANDAG model consistent with the state of the practice (http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/tmip/peer_review/sandag/).

Additionally, the SANDAG ABM and PECAS teams regularly convene advisory panels of leading modeling experts from across North America to review and comment on the new model development.

**Next Steps**

SANDAG will be presenting the RTP model documentation and validation and sensitivity test results with the release of the draft 2050 RTP and its Environmental Impact Report.

GARY L. GALLEGOS
Executive Director

Attachments: 1. 2050 RTP Transportation Analysis Zones map
2. Activity-Based Transportation Model flowchart

Key Staff Contact: Clint Daniels, (619) 699-6946, cdan@sandag.org
2050 RTP Transportation Analysis Zones

- Transportation Analysis Zone (TAZ)

March 2011
Activity-Based Transportation Model Flowchart

1. Population Synthesis

2. Long-term
   2.1. Usual workplace/school

3. Mobility
   3.1. Free Parking Eligibility -> 3.2. Car ownership -> 3.3. Transponder Ownership

4. Daily
   - 4.1. Person pattern type
     - Mandatory
     - Non-mandatory
     - Home
     - Available time budget
     - Residual time
     - Individual Mandatory Tours
       - 4.2.1. Frequency
       - 4.2.2. TOD
       - At-work sub-tours
         - 4.6.1. Frequency
         - 4.6.2. Destination
         - 4.6.3. TOD
       - Joint Non-Mandatory Tours
         - 4.3.1. Frequency
         - 4.3.2. Party
         - 4.3.3. Participation
         - 4.3.4. Destination
         - 4.3.5. TOD
     - Allocated Tours
       - 4.4.1. Frequency
       - 4.4.2. Allocation
       - 4.4.3. Destination
       - 4.4.4. TOD
     - Individual Discretionary Tours
       - 4.5.1. Frequency
       - 4.5.2. Destination
       - 4.5.3. TOD

5. Tour level
   - 5.1. Tour mode -> 5.2. Stop frequency -> 5.3. Stop location -> 5.4. Stop Departure

6. Trip level
   - 6.1. Trip mode
   - 6.2. Auto parking
   - 6.3. Assignment
PROPOSED SourcePoint CONTRACT WITH CITY OF SANTEE

File Number 7500000

Introduction

During the week of February 28, 2011, the City of Santee requested that SourcePoint enter into a contract to provide the City with access to SANDAG on-call engineering contracts and to have SANDAG carry out the competitive procurements and serve as the contract administrator on contracts for the construction of certain projects in the City. The City of Santee believes that an expedited process for the delivery of local transportation projects would be beneficial and necessary in order to ensure that currently available funding is utilized for certain specific projects, and proposes to work with SANDAG and SourcePoint to pilot an innovative project delivery process for certain arterial improvements in Santee. The value of the project(s) to be funded with the City’s local funds is estimated at approximately $28.5 million, which exceeds the contracting authority of the Executive Committee acting as the SourcePoint Board of Directors. Due to the short time frame available to the City of Santee, this item is scheduled to be heard by the Executive Committee and Board of Directors on the same day.

Discussion

Description of Santee Projects

One of the proposed projects would widen Prospect Avenue between Cuyamaca Street on the west and Magnolia Avenue on the east, a distance of approximately one-mile. The existing street segment varies in width and lacks parking and drainage facilities. The improved road would have a consistent cross-section with two travel lanes, bicycle lanes, a two-way left turn lane, on-street parking, sidewalks, landscaping, curbs, gutters and lighting. Related actions include the acquisition of properties (partial and full) and the under-grounding of utilities. Estimated cost for this project is approximately $25million.

The City’s other project involves improvements to Town Center Parkway from Cuyamaca Street to Riverview Parkway and the extension of Riverview Parkway from its existing terminus to the Las Colinas Channel. The existing street segment on Town Center Parkway varies in width and lacks final ultimate street width improvements. The improved road sections for both segments would include travel lanes in each direction, meandering sidewalks, parkway landscaping, curbs, gutters

Recommendation

Pending a recommendation from the Executive Committee, the Board of Directors is asked to authorize the Executive Director to execute a contract in substantially the same form as Attachment 1 with the City of Santee and make the necessary budget modifications to accept the funds from the City.
and lighting. The improvement would accommodate future development in accordance with the RiverView Office Park Master Plan. The estimated cost for this project is approximately $3.5 million.

Summary of Proposed Contract Terms

The proposed contract between SourcePoint and the City of Santee (Attachment 1) will be provided separately to the Executive Committee and Board of Directors and posted to the SANDAG Web site on or before March 8, 2011. The main deal points in the proposed contract are as follows:

- The City will contract with SANDAG via the SANDAG nonprofit public benefit corporation, SourcePoint, in the amount of approximately $28.5 million.
- The City will enter the contract via its Community Development Commission.
- The City will provide SANDAG with a prepaid reserve account to ensure that SANDAG will not need to front the funds to pay consultants and contractors for work on the project.
- SANDAG will be reimbursed by the City for all of its staff time, direct costs, and overhead.
- The City will have the environmental documents it anticipates needing for the projects completed in accordance with the California Environmental Quality Act prior to execution of the contract with SANDAG.
- The City will be responsible for all right-of-way procurements, claims, or litigation that may be necessary.
- SANDAG will utilize its on-call engineering contracts to refine the project estimates and preliminary design work prepared by the City and perform the additional engineering and design work needed for the projects.
- SANDAG will use its staff or contract with consultants to provide construction management and construction testing.
- The projects will be built to the City’s design standards, and the City will approve all project designs and provide its own staff to review the work of the design consultants under contract with SANDAG.
- SANDAG will prepare one or more invitations for bid, with input from the City, and SANDAG will contract with one or more contractors to construct the projects.
- The City will provide a resident engineer and project manager to oversee and approve the work.
- The main role of SANDAG will be to serve as an administrator and contract manager for the projects on behalf of the City.
- A dispute resolution clause will be included to ensure relations between the City and SANDAG are safeguarded in the event of project claims or budget shortfalls.
- SANDAG will not be required to continue working on the City’s projects if it is unable to continue providing the necessary funding.
Approvals Needed

The proposed contract provided as Attachment 1 is scheduled to be presented to the Santee City Council on March 7, 2011, for approval. Staff will report to the Executive Committee and Board of Directors on March 11 regarding the outcome of that meeting.

The SourcePoint Bylaws give the SourcePoint Chief Executive Officer (the SANDAG Executive Director) authority to approve routine SourcePoint contracts that are not part of the approved SourcePoint budget up to $100,000 in value. Contracts that exceed $100,000 and are not part of the approved SourcePoint budget must be approved by the SourcePoint Board of Directors (the SANDAG Executive Committee).

However, Board Policy No. 001: Operations Policy - Board and Policy Advisory Committees Responsibilities, limits the Executive Committee’s authority to approve financial/contracting transactions and any resulting budget amendment to $500,000. Contracts and budget amendments in excess of $500,000 must be approved by the Board of Directors. Accordingly, due to the short time frame available to the City, approval of the potential contract with the City of Santee has been scheduled for action at the SANDAG Board of Directors meeting immediately following the Executive Committee meeting and pending Executive Committee recommendation.

GARY L. GALLEGOS
Executive Director

Attachment: 1. Proposed Contract with City of Santee (mailed separately)

Key Staff Contact: Renée Wasmund, (619) 699-1940, rwa@sandag.org
PROPOSED AGREEMENT WITH SANTEE APPROVED BY SANTEE CITY COUNCIL ON MARCH 7, 2011

THIS AGREEMENT IS ENTERED INTO by and among the City of Santee, a charter city in the state of California and the Santee Community Development Commission, a redevelopment agency organized under the Community Redevelopment Law, Health and Safety Code section 33000 et seq., referred to herein collectively as “SANTEE,” and the San Diego Association of Governments, a legislatively created regional government agency in the state of California, acting by and through its nonprofit public benefit corporation SourcePoint, referred to herein as “SOURCEPOINT.” SANTEE and SOURCEPOINT are referred to herein collectively as the parties and individually as a party.

RECITALS

1. SANTEE is authorized to enter into an agreement with SOURCEPOINT to carry out the financing, development, design and construction of transportation and public infrastructure improvements within Redevelopment Project Areas in the City of Santee.

2. SOURCEPOINT does not maintain its own staff. The staff of the San Diego Association of Governments (“SANDAG”) serves as the staff of SOURCEPOINT and the SANDAG Executive Committee serves as the SOURCEPOINT Board of Directors. Hereinafter, references to SOURCEPOINT staff, consultants or contractors are to be treated as references to SANDAG staff, consultants or contractors.

3. SANTEE intends to use redevelopment funds, traffic mitigation funds, and other local funding sources to develop certain transportation and public infrastructure improvements generally described in Exhibit A and referred to herein in collectively as “PROJECT.”

4. SANTEE has obtained approximately $23.8 million in bond funds by financing local redevelopment fund revenues in order to develop the PROJECT.

5. As further specified herein, SANTEE is willing to use or has already used SANTEE staff resources or consultants to prepare the Project Approval & Environmental Document (PA&ED), right-of-way, the Independent Quality Assurance (IQA) of PROJECT, and the necessary California Environmental Quality Act (CEQA) documents all of which are referred to herein as “SANTEE WORK.”

6. To expedite delivery of PROJECT, SANTEE desires SOURCEPOINT, through SOURCEPOINT CONSULTANTS and CONTRACTORS to prepare and implement the PROJECT design and construction, subject to SANTEE oversight as provided in this AGREEMENT, including but not limited to preliminary Plans, Specifications, and Estimates (PS&E), utility design, construction and construction management services, referred to herein as “SOURCEPOINT WORK” in order to bring about construction of PROJECT. A SOURCEPOINT CONSULTANT is a prime or subcontractor firm under contract with SANDAG that provides Architecture & Engineering (A&E) services. A SOURCEPOINT CONTRACTOR is a prime or subcontractor firm that SOURCEPOINT has procured using a low bid process to perform construction services.

7. SANTEE is willing to fund one hundred percent (100%) of all capital outlay and support costs, including the costs of the SANTEE WORK and the SOURCEPOINT WORK, as PROJECT COSTS.
8. SANTEE is agreeable to reimbursing SOURCEPOINT the actual reasonable cost of the SOURCEPOINT WORK performed using SOURCEPOINT staff or SOURCEPOINT CONSULTANTS or CONTRACTORS, including but not limited to applicable SOURCEPOINT administrative costs, as PROJECT COSTS.

9. SANTEE is willing to serve as the PROJECT SPONSOR for the PROJECT. The PROJECT SPONSOR is the party who, determines the scope of work and accepts the obligation to provide the committed funds, as well as using good faith efforts to secure any additional financial resources mutually determined by SANTEE and SOURCEPOINT after consultation to be necessary to fully fund the PROJECT. This includes efforts to secure any additional funds beyond those committed by the SPONSOR necessary to complete the full scope of work for the PROJECT and settle contractual claims arising directly from the PROJECT.

10. SOURCEPOINT and SANTEE mutually desire to specify the terms and conditions under which the SOURCEPOINT WORK is to be prepared and financed.

**ROLES OF THE PARTIES**

11. The parties intend that SANTEE shall have the role of overseeing and approving all work on the PROJECT, whether performed with SOURCEPOINT, SOURCEPOINT CONSULTANTS or CONTRACTORS, or SANTEE staff, consultants or contractors. SANTEE shall have responsibility for the quality control, oversight, and approvals of the PROJECT as further described herein.

12. As the PROJECT SPONSOR, SANTEE will be responsible for paying all PROJECT COSTS up to the MAXIMUM PROJECT AMOUNT.

13. The parties intend that SOURCEPOINT serve as the implementing agency for the PROJECT on behalf of SANTEE by providing administrative and contract management services.

14. All obligations of SOURCEPOINT under the terms of this Agreement are subject to the provision of resources by SANTEE.

15. Neither of the parties have authority to bind or commit each other to any obligation or course of action beyond the commitments of this Agreement without express written consent. For purposes of this Agreement, the relationship of the parties is that of independent entities and not as agents of each other or as joint venture or partners.

16. The parties acknowledge and agree that the City of Santee is the entity authorized to act on behalf of SANTEE for all purposes relating to this Agreement.

**FINANCE**

17. SANTEE has secured funding for the PROJECT from various local sources up to the amount of $28.5 million (“MAXIMUM PROJECT AMOUNT”). The total of all PROJECT COSTS shall not exceed the MAXIMUM PROJECT COST unless this AGREEMENT is amended in writing as provided herein. The payment obligations of SANTEE under this AGREEMENT constitute an indebtedness of the Santee Community Development Commission for the purposes of carrying out its Redevelopment Plan, which indebtedness is payable out of bond funds described herein and taxes that are levied by or for the benefit of taxing agencies in the Project Area(s) and which are allocated to the Santee Community Development Commission pursuant to Health and Safety Code section 33670(b).
18. Should a party determine that the MAXIMUM PROJECT AMOUNT may be exceeded it will immediately notify the other party. Should such a notification occur, SANTEE will meet with SOURCEPOINT as soon as reasonably possible to discuss whether an amendment to this AGREEMENT and/or to SOURCEPOINT’s agreements with SOURCEPOINT CONSULTANTS or CONTRACTORS, including but not limited to amendment(s) to downsize the PROJECT so that the MAXIMUM PROJECT AMOUNT is not exceeded, is appropriate. SOURCEPOINT may direct SOURCEPOINT CONSULTANTS or CONTRACTORS to suspend WORK on the PROJECT until the parties are able to identify sufficient funds to complete the WORK.

19. SOURCEPOINT will invoice SANTEE no more often than bi-weekly for SOURCEPOINT staff and SOURCEPOINT CONSULTANT or CONTRACTOR expenditures for SOURCEPOINT WORK, as PROJECT COSTS. SANTEE will make payments to SOURCEPOINT by wire transfer within ten (10) business days of receipt of an invoice submitted by SOURCEPOINT. Invoices submitted to SANTEE shall be accompanied by supporting documentation, such as copies of original invoices for all amounts charged to SANTEE.

20. All direct expenses incurred by SOURCEPOINT for SOURCEPOINT WORK, including CLAIMS as defined in this Agreement, shall be reimbursed by SANTEE as a PROJECT COST.

21. SOURCEPOINT shall not mark up the rates charged by SOURCEPOINT CONSULTANTS or CONTRACTORS to carry out the SOURCEPOINT WORK; however, all SANDAG direct costs and overhead for the PROJECT shall be PROJECT COSTS.

22. Prior to the initial request by SANTEE to utilize SOURCEPOINT CONSULTANTS or CONTRACTORS, SANTEE shall cause to be provided to SOURCEPOINT $500,000.00, which SOURCEPOINT shall place in an interest-bearing account (RESERVE ACCOUNT). The RESERVE ACCOUNT may be used by SOURCEPOINT in order to pay PROJECT COSTS in the event payments are due for PROJECT COSTS incurred by SOURCEPOINT and SANTEE has not yet reimbursed SOURCEPOINT for those costs. SOURCEPOINT will notify SANTEE when it makes a deduction from the RESERVE ACCOUNT and within ten (10) days SANTEE will provide funds to SOURCEPOINT sufficient to replenish the RESERVE ACCOUNT to its original amount. SOURCEPOINT will use RESERVE ACCOUNT funds solely for PROJECT COSTS and will refund any remaining balance in the RESERVE ACCOUNT to SANTEE at the time this Agreement terminates pursuant to the Dispute Resolution Process or Section 59 of this Agreement.

23. SOURCEPOINT will retain or cause to be retained for audit by SANTEE or other government auditors for a period of four (4) years from date of final payment under this Agreement, all records and accounts relating to the PROJECT.

ENVIRONMENTAL AND RIGHT-OF-WAY

24. SANTEE will be the CEQA Lead Agency and Responsible Agency

25. At the time of execution of this Agreement, SANTEE believes that all CEQA Lead Agency and Responsible Agency functions for the PROJECT are complete.

26. In the event that additional environmental studies or documentation is mutually determined by SANTEE and SOURCEPOINT after consultation to be necessary, such costs will be a PROJECT COST and SANTEE will direct SANTEE CONSULTANTS working on the PROJECT to ensure that the environmental documentation and necessary associated supporting investigative studies and technical environmental reports are prepared in order to meet the requirements of CEQA. If requested by SANTEE, and if on-call consultant capacity is available, SOURCEPOINT may utilize
SOURCEPOINT CONSULTANTS to carry out any such additional environmental work as may be necessary and incorporate such work into the SOURCEPOINT WORK. SANTEE will have responsibility for determining the type of environmental documentation required for the PROJECT whether it is SANTEE WORK or SOURCEPOINT WORK.

27. If work on PROJECT is suspended for any reason, the parties will still be obligated to implement all applicable environmental commitments and all conditions of permits which were issued, as applicable, to the PROJECT in order to maintain environmental commitments and conditions of approval during suspension until work resumes. The cost to implement the commitments included in the PROJECT’s environmental compliance documentation, permits, agreements, or approvals shall be a PROJECT COST.

28. Costs to remediate hazardous waste shall be a PROJECT COST.

29. SANTEE agrees to complete acquisition of all necessary right-of-way for the PROJECT, prior to the time an IFB is advertised. In the event SANTEE desires additional right-of-way, it shall have responsibility for acquiring all necessary real property through negotiated purchases or carrying out any eminent domain actions that may be necessary, or shall cause the PROJECT to be redesigned to exclude properties SANTEE is unable to acquire. Redesign of the PROJECT pursuant to this Paragraph 29 may be performed, at SANTEE’s option, either as SANTEE WORK or as SOURCEPOINT WORK through SOURCEPOINT CONSULTANTS and all costs relating thereto shall be PROJECT COSTS.

30. SANTEE shall be responsible for clearly identifying its right-of-way to SOURCEPOINT to design or construct the PROJECT. SANTEE shall also be responsible for obtaining any easements or permits, either as SANTEE WORK, or as SOURCEPOINT WORK through SOURCEPOINT CONSULTANTS, that may be necessary for SOURCEPOINT staff, CONSULTANTS or CONTRACTORS to enter the property and carry out the SOURCEPOINT WORK. All costs relating to obtaining easements or permits necessary for the SOURCEPOINT WORK shall be PROJECT COSTS.

**DESIGN & CONSTRUCTION**

31. Prior to the start of construction work, SOURCEPOINT and SANTEE shall develop a Project Management Plan (PMP) that will define the roles and responsibilities of SOURCEPOINT and SANTEE and their key representatives. The PMP will also include, but not be limited to, defining the process in which information is to be transmitted between the parties, what information is to be transmitted, approval process for submittals, requests for information, change orders, schedules, and inspections. Unless an emergency situation in which an imminent threat to persons or property exists, any and all requests for extra work or proposed change orders submitted by any SOURCEPOINT CONSULTANTS or CONTRACTORS, which would incur any additional PROJECT COSTS shall be subject to the prior written approval of SANTEE.

32. SOURCEPOINT will provide SANTEE access to SOURCEPOINT CONSULTANTS who will work with SANTEE’s representatives to complete the SOURCEPOINT WORK. SOURCEPOINT warrants that SOURCEPOINT CONSULTANT contracts have been awarded through a competitive process consistent with SANDAG procurement policies.

33. All WORK performed by SOURCEPOINT CONSULTANTS shall be performed in accordance with all State and Federal laws, regulations, policies, procedures, and standards that SOURCEPOINT would normally follow. All such SOURCEPOINT WORK shall be submitted to SANTEE for SANTEE’s review and approval.
34. SOURCEPOINT will direct SOURCEPOINT CONSULTANTS to furnish SANTEE with progress reports during the period when SOURCEPOINT WORK is being prepared.

35. SOURCEPOINT CONSULTANTS and staff will rely upon the PA&ED prepared by SANTEE or SANTEE CONSULTANTS. If requested by SANTEE, SOURCEPOINT will update, supplement or redo SANTEE WORK as a PROJECT COST.

36. Design and other preliminary services SANTEE expects to request SOURCEPOINT to carry out as PROJECT COSTS, include but are not limited to PS&E, construction testing, utility undergrounding and relocation design, topography and mapping.

37. SOURCEPOINT shall submit the PROJECT design, including special provisions, to SANTEE for review and comments at the 60 and 90 percent completion levels of design and for approval at the 100 percent completion level of design. SANTEE shall review and provide comments or approval within 20 working days of receipt of a complete submittal. SOURCEPOINT shall cause all SANTEE comments and revisions to be incorporated into the SOURCEPOINT WORK to SANTEE’s approval. SANTEE shall provide one or more qualified SANTEE representatives who shall have authority to accept or reject SOURCEPOINT WORK.

38. SOURCEPOINT shall prepare the construction documents required for the PROJECT using documents provided by SANTEE CONSULTANTS and staff, documents provided by SOURCEPOINT CONSULTANTS, and other additional SOURCEPOINT WORK that SANTEE may request. Said documents shall include, but not be limited to: PS&E; special provisions; and a project schedule. SOURCEPOINT shall prepare one or more Invitation(s) for Bids (“IFB”) and other documents as necessary for the execution of the construction contract(s). SANTEE shall provide information needed to prepare the construction documents to SOURCEPOINT upon request by SOURCEPOINT.

39. SOURCEPOINT shall advertise for, solicit, and accept bids for the PROJECT construction. The IFB(s) shall include contractor qualifications that shall be prepared by SOURCEPOINT with additional requirements provided by SANTEE. Prior to issuing a Notice of Intent to Award, SOURCEPOINT shall submit the qualifications of the lowest responsive and responsible bidder to SANTEE for review and consent prior to the award of the contract. Any SANTEE comments regarding the qualifications shall be provided to SOURCEPOINT within three days of having received the qualifications. SOURCEPOINT requirements shall be followed with regard to determinations of responsibility and responsiveness of the bidders. Following the award of the construction contract, SOURCEPOINT shall administer the construction contract pursuant the provisions set forth herein and unless otherwise noted, shall provide construction management services for the PROJECT.

40. SOURCEPOINT may perform construction management services for SANTEE at SANTEE’s request by utilizing SOURCEPOINT CONSULTANTS or staff as a PROJECT COST.

41. SANTEE will actively oversee the SANTEE WORK and SOURCEPOINT WORK. SANTEE shall identify the SANTEE employees that will participate in assisting SOURCEPOINT with the SOURCEPOINT WORK, which shall at a minimum include the names of the project manager and resident engineer that will oversee the PROJECT. SANTEE will provide one or more qualified SANTEE representatives who shall have authority to accept or reject SOURCEPOINT WORK. All costs of SANTEE WORK are PROJECT COSTS.

42. SANTEE will provide Independent Quality Assurance (IQA) over the SOURCEPOINT WORK to assure that the SOURCEPOINT WORK is in accordance with SANTEE ordinances, permit requirements, policies, procedures, standards, and practices. This IQA function includes both the obligation and authority to reject non-compliant SOURCEPOINT WORK. SOURCEPOINT shall ensure
that all contracts with SOURCEPOINT CONSULTANTS and CONTRACTORS for performance of the 
SOURCEPOINT WORK provide that work rejected due to it not meeting the CONSULTANT’s or 
CONTRACTOR’s applicable standard of care shall be corrected at the CONSULTANT’s or 
CONTRACTOR’s sole expense and shall not constitute PROJECT COSTS.

43. Prior to admittance onto City of Santee right-of-way, SOURCEPOINT CONTRACTORS and 
CONSULTANTS shall obtain a right-of-entry permit from the City of Santee, which will address the 
City’s conditions for the construction of the PROJECT, including adherence to laws and regulations, 
safety, work plans, schedules, flag protection, work windows, staging and material storage areas, 
site access, insurance, indemnity provisions and any other requirements therein listed. SANTEE shall 
pay any fee for issuance of the right-of-entry permit as a PROJECT COST so that SOURCEPOINT 
CONSULTANTS or CONTRACTORS are not charged. During construction, SANTEE shall allow 
SOURCEPOINT CONSULTANTS or CONTRACTORS reasonable accommodation to accomplish work 
during agreed upon working hours, work windows and in construction staging and storage areas as 
specified in the IFB.

OWNERSHIP AND MAINTENANCE

44. Before SOURCEPOINT grants relief of maintenance for any portion of the PROJECT or contract 
acceptance for the entire PROJECT to a SOURCEPOINT CONTRACTOR, SANTEE shall conduct an 
inspection, in whole or part thereof, of the PROJECT. Once the particular portion of the PROJECT is 
deemed to be acceptable by SANTEE, SANTEE shall inform SOURCEPOINT in writing that said 
portion of the PROJECT has been accepted and is complete. Such acceptance by SANTEE shall not be 
unreasonably withheld. Upon issuance of contract acceptance by SOURCEPOINT for the entire 
PROJECT or part thereof, the responsibility and maintenance for PROJECT or relevant portion 
thereof shall transfer to SANTEE. SANTEE acknowledges that it will be the owner of the PROJECT 
and right of way. SANTEE shall have responsibility for the quality and oversight of the PROJECT and 
for operations and maintenance of the PROJECT after acceptance by SANTEE.

45. SANTEE acknowledges that it will be the owner of the PROJECT and right-of-way and will 
therefore at all times be responsible for any CLAIMS arising from property ownership and for 
providing sufficient insurance or self-insurance for the PROJECT property.

CLAIMS AND INDEMNIFICATION

46. Parties acknowledge that decisions inherent in the delivery of the PROJECT under this 
Agreement may result in delay or other liability. It is the intent of the parties that any liability that 
may be created by the decision-making inherent in PROJECT delivery will be assumed to be a 
PROJECT COST as long as the decision was an exercise of reasonable discretion based on industry 
standards and the information known at the time of the decision. SANTEE agrees to indemnify and 
save SOURCEPOINT, SANDAG and their officers and employees harmless against all claims, litigation, 
or actions of every name, kind, and description brought forth under tortuous, contractual, inverse 
condemnation, or other theories or assertions of liability (collectively, CLAIMS) arising out of 
execution of the SOURCEPOINT WORK, if the CLAIM arises from a decision by SOURCEPOINT that 
was an exercise of reasonable discretion based on industry standards and the information known at 
the time of the decision.

47. Neither SOURCEPOINT, SANDAG nor any officer or employee thereof shall be responsible for 
any injury, damage, or liability occurring by reason of anything done or omitted to be done by 
SANTEE or the City of Santee under or in connection with any work, authority, or jurisdiction 
conferred upon SANTEE or the City of Santee or arising under this Agreement. SANTEE will fully 
defend, indemnify, and save harmless SOURCEPOINT, SANDAG and all of their officers and
employees from all CLAIMS arising under this Agreement except to the extent such claims were caused by reckless or willful misconduct by SOURCEPOINT. SOURCEPOINT shall defend and indemnify SANTEE, the City of Santee and each of their respective officers and employees from all CLAIMS arising solely from the reckless or willful misconduct of SOURCEPOINT, SAN DAG, or SOURCEPOINT CONSULTANTS or CONTRACTORS.

48. SANTEE further agrees that all fines, interest, or penalties levied against the PROJECT arising from the SOURCEPOINT WORK shall be a PROJECT COST for which SOURCEPOINT will not be responsible and will be funded by SANTEE as the PROJECT SPONSOR, except to the extent such fines, interest or penalties arise from the sole negligence or willful misconduct of SOURCEPOINT or SOURCEPOINT CONSULTANTS. SOURCEPOINT shall ensure that all contracts with SOURCEPOINT CONSULTANTS and CONTRACTORS for performance of SOURCEPOINT WORK require SOURCEPOINT CONSULTANTS or CONTRACTORS to pay all such fines, interest or penalties and/or to indemnify and defend SANTEE from and against all such fines, interest or penalties to the extent they arise from the sole negligence or willful misconduct of such CONSULTANT or CONTRACTOR.

49. If either party becomes engaged in a third-party CLAIM regarding the PROJECT it will keep the other party informed during the dispute process, including during any arbitration or judicial review. The party engaged in the third-party CLAIM will not propose or agree to a settlement without the other party's prior concurrence if the settlement will exceed $25,000 or would cause the MAXIMUM PROJECT AMOUNT to be exceeded. The parties must notify each other early enough in the CLAIMS process for the notified party to conduct a meaningful investigation and provide input.

50. When developing the PROJECT, it is generally anticipated that the parties will have a common interest and defense in the event a dispute arises involving a third-party CLAIM. The party engaged in the third-party CLAIM will therefore confer with the other party during the dispute process, including during any arbitration or judicial review. Any and all communications relating to pending or actual CLAIMS with third parties shall be treated as if prepared under the common interest doctrine, which may cause said communications to be privileged unless otherwise requested in writing by a party. The parties agree to conduct themselves and to implement reasonable policies such that no applicable privilege is waived.

51. Should any CLAIMS arising out of PROJECT be asserted against SOURCEPOINT, the parties agree to extend the fixed termination date of this Agreement, until such time as the CLAIMS are settled, dismissed or paid.

DISPUTE RESOLUTION

52. The parties will first attempt in good faith to resolve Agreement disputes at the project staff, resident engineer and project manager level. If they cannot resolve the dispute, the following hierarchy of informal dispute resolution personnel will be utilized until the conflict is resolved.

   Step 1. Santee Deputy City Manager/ Director of Development Services, and SANDAG Director of Mobility Management & Project Implementation;

   Step 2. City of Santee City Manager (or designee) and SANDAG Executive Director (or designee).

53. If the informal dispute resolution process above fails to lead to a resolution of the disputed matter, the parties agree to submit their dispute to mediation. Any dispute or claim in law or equity arising out of this Agreement or any resulting transaction, including disputes or claims involving the parties, their officers, agents, or employees, shall be submitted to neutral, nonbinding mediation.
prior to the commencement of arbitration, litigation, or any other proceeding before a trier of fact. The parties agree to act in good faith to participate in mediation and to identify a mutually acceptable mediator. If a mediator cannot be agreed upon by the parties, each party shall designate a mediator and those mediators shall select a third mediator who shall act as the neutral mediator, assisting the parties in attempting to reach a resolution. The parties shall share equally in the costs of mediation, and the mediation shall take place in San Diego County. If the dispute or claim is resolved successfully through the mediation, the resolution will be documented by a written agreement executed by the parties.

54. If the mediation does not successfully resolve the dispute or claim, the mediator shall provide written notice to the parties reflecting the same, and the parties may then proceed to seek an alternative form of resolution of the dispute or claim, in accordance with the remaining terms of this Agreement and other rights and remedies afforded to them by law.

55. If a potential conflict of interest arises between parties, parties will discuss the issue, and either party may involve outside counsel at their own expense, and/or enter into a separate agreement concerning any appropriate waiver or method for reducing the potential conflict. This Agreement does not, nor is it intended to, constitute a waiver of any conflict of interest which may apply to a given situation, but merely offers a method of addressing potential conflicts of interest.

**MISCELLANEOUS**

56. Nothing in the provision of this Agreement is intended to create duties or obligations to or rights in third parties not party to this Agreement or affect the legal liability of either party to this Agreement by imposing any standard of care different from the standard of care imposed by law.

57. **SOURCEPOINT** Point of Contact for Agreement Notices: Gary L. Gallegos
401 B Street, Suite 800
San Diego, CA 92101
Tel: (619) 699-1900

**SANTEE** Point of Contact:
Keith Till
10601 Magnolia Avenue
Santee, CA 92071
Tel: (619) 258-4100

58. No alteration or variation of the terms of this Agreement shall be valid unless made in writing and signed by SOURCEPOINT and the City of Santee on behalf of SANTEE, and no oral understanding or agreement not incorporated herein shall be binding on any of the parties hereto.

59. This Agreement shall terminate upon satisfactory completion of the SOURCEPOINT WORK or on December 31, 2014, whichever is earlier in time, except that the indemnification, environmental commitments, legal challenges, dispute resolution and CLAIMS articles shall remain in effect until terminated or modified, in writing, by mutual agreement. In addition, SANTEE may terminate this Agreement upon thirty (30) days written notice to SOURCEPOINT in the event the parties have utilized the process in Section 18 of this Agreement, PROJECT COSTS are expected to exceed the MAXIMUM PROJECT AMOUNT and SANTEE is unable to procure sufficient additional resources to complete the PROJECT (EARLY TERMINATION). If EARLY TERMINATION is utilized, SANTEE shall be responsible for all PROJECT COSTS incurred by SANDAG prior to the date it receives notice from SANTEE and any costs necessary to implement the EARLY TERMINATION, including but not limited to costs to safely secure a construction site or close out contracts shall be a PROJECT COST.
60. If any provisions in this Agreement are deemed to be illegal, inoperative, or unenforceable, those provisions shall be deemed to be severed from this Agreement.

61. Both parties have actively participated in the drafting of this Agreement. Any ambiguity contained in this Agreement will not be interpreted against either party. The parties waive the provisions of California Civil Code section 1654.

62. This Agreement is intended to be parties' final and only expression and supersedes all other oral understandings or writings covered by this Agreement.

63. This Agreement will be understood in accordance with and governed by the Constitution and laws of the State of California. This Agreement will be enforceable in the State of California. Any legal action arising from this Agreement will be filed and maintained in the Superior Court of San Diego County unless that court orders otherwise.

**SANTEE CDC**
Keith Till  
Executive Director

**SOURCEPOINT**
Gary L. Gallegos  
Chief Executive Officer

By: ___________________________  By: ___________________________

**CITY OF SANTTEE**

Keith Till  
City Manager

By: ___________________________

Approved as to form:  
Approved as to form:

______________________________  By: ___________________________

Shawn Hagerty, City Attorney  
General Counsel
EXHIBIT A

The PROJECT includes the following improvements:

Widening of Prospect Avenue between Cuyamaca Street on the west and Magnolia Avenue on the east, a distance of approximately one mile. The existing street segment varies in width and lacks parking and drainage facilities. The improved road would have a consistent cross-section with two travel lanes, bicycle lanes, a two-way left turn lane, on-street parking, sidewalks, landscaping, curbs, gutters, and lighting. Related actions include the acquisition of properties (partial and full) and the undergrounding of utilities. Estimated cost for this project is $20 million to $25 million.

Improvements to Town Center Parkway from Cuyamaca Street to Riverview Parkway and the extension of Riverview Parkway from its existing terminus to the Las Colinas Channel. The existing street segment on Town Center Parkway varies in width and lacks final ultimate improvements. The improved road sections for both segments include travel lanes in each direction, meandering sidewalks, parkway landscaping, curbs, gutters and lighting. Estimated Cost is $3.5 million. The improvement would accommodate future development in accordance with the Riverview Office Park Master Plan.
SANDAG Model Types

- Four Step Model
  - Land Use Driven Transportation Model
- Activity Based Model (ABM)
  - Modeling Individual Travel Behavior
- PECAS
  - Economic Based Land Use Forecasting

*Models don’t make decisions, models inform decision-makers.*

Purpose of SANDAG Modeling
Modeling User Community

- Caltrans
- CARB
- APCD
- SANDAG
- MTS
- NCTD
- Local Jurisdictions
- Private Developers

Modeling

- Main Lanes
- Ramp Metering
- Managed Lanes
- Parking
- Walk Distance
- Local Arterial Traffic Signals
- Direct Access Ramp (DAR)
- Transit BRT Station
- CMS
SANDAG Modeling (Mode Choice)

\[ auu(m,p,i) = (auivt(m,t,i,z,j) * tcoef(1,p,i) + (termp(i,z) + terma(j,z)) * tcoef(2,p,i) + \left(p \cos(t(p,j,z)) + \text{toll}(m,t,i,z,j) + \text{audist}(m,t,i,z,j) * \text{cpm}\right) * \text{ccoef}(p,i)) \]

where:
\( auu \) = auto utility for mode “m” purpose “p” and income group “i”
\( auivt \) = auto in-vehicle travel time between zones for mode and time period “t”
\( tcoef \) = time coefficient for purpose from Table 20
\( termp \) = terminal time at production end
\( terma \) = terminal time at attraction end
\( pcost \) = parking cost at attraction end
\( toll \) = toll facility cost (if any)
\( audist \) = auto distance between zones
\( cpm \) = cost per mile to operate an automobile
\( nclow \) = nesting coefficient at lowest level of nest (0.55)
\( ncmid \) = nesting coefficient at middle level of nest (0.65)
\( nctop \) = nesting coefficient at top level of nest (0.85)

SANDAG Model Types

- **Four Step Model**
  - Land Use Driven Transportation Model
- **Activity Based Model (ABM)**
  - Modeling Individual Travel Behavior
- **PECAS**
  - Economic Based Land Use Forecasting

*Models don’t make decisions, models inform decision-makers.*
Four Step Transportation Model

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Trip Assignment

SANDAG Four Step Model

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Trip Assignment

Feedback

Growth Forecast
Traffic Analysis Zones
Traffic Census
Travel Surveys
Highway Network
Transit Network

Truck Trip Generation
Truck Trip Distribution

Air Quality
Post-Processing
Trip Assignment
Mode Choice
Trip Distribution
Trip Generation
Traffic Census
Travel Surveys
Highway Network
Transit Network

Feedback
Modeling Starts With Local Inputs

Local Traffic Census
Local Jurisdiction Network Review

Step 1: Trip Generation

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
<th>Non-Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Residential</td>
<td>3,000</td>
<td>4,600</td>
</tr>
<tr>
<td>Residential</td>
<td>3,400</td>
<td>700</td>
</tr>
<tr>
<td>Non-Residential</td>
<td>2,200</td>
<td>2,000</td>
</tr>
<tr>
<td>Residential</td>
<td>3,300</td>
<td>1,300</td>
</tr>
<tr>
<td>Non-Residential</td>
<td>3,300</td>
<td>500</td>
</tr>
<tr>
<td>Residential</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Non-Residential</td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>
Step 2: Trip Distribution

Trip Flows

300

1300

700

1000

Step 3: Mode Choice

Trips By Mode

00 = Auto
00 = Transit
00 = Bike, Walk
Step 4: Trip Assignment

Traffic Volumes

1. Zone 1 to Zone 2
2. Zone 1 to Zone 3
3. Zone 1 to Zone 7

SANDAG Four Step Model

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Trip Assignment
5. Post-Processing
6. Air Quality
Growth Forecasts

Phase 1
Regionwide Forecast (DEFM)

Phase 2
Transportation Model
Allocation (UDM)
Land Use Plans and Policies
Cities/County Forecast

Linking Land Use and Transportation

2008
Urban Development Model
Employment Forecast → Residential Forecast
Land Use Characteristics
Transportation Model

2020
Urban Development Model
Employment Forecast → Residential Forecast
Land Use Characteristics
Transportation Model
Next Increment
Legacy Applications

SB 375 GHG Reduction Targets

<table>
<thead>
<tr>
<th></th>
<th>CARB Target</th>
<th>RTP Hybrid</th>
<th>Draft RTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>7%</td>
<td>13%</td>
<td>12-15%</td>
</tr>
<tr>
<td>2035</td>
<td>13%</td>
<td>18%</td>
<td>13-15%</td>
</tr>
</tbody>
</table>

2050 Draft RTP
- Calibration Report
- Sensitivity Analysis
- Software Standards
Historical Projections of VMT

- Observed
- Series 5
- Series 6
- Series 7
- Series 8
- Series 9
- Series 10

Transit Estimates

- Transit Counts
- 1980 RTP
- 1986 RTP
- 1989 RTP
- 1994 RTP
- 2000 RTP
SANDAG Model Types

- Four Step Model
  - Land Use Driven Transportation Model

- Activity Based Model (ABM)
  - Modeling Individual Travel Behavior

- PECAS
  - Economic Based Land Use Forecasting

*Models don’t make decisions, models inform decision-makers.*
Mandatory tours are scheduled. Non-mandatory travel is generated. Destinations for non-mandatory tours are selected. Non-mandatory tours are scheduled.

- **Joint Tours**
  - 8 to 11; 3 to 4

- **At-work Tour**
  - Karl Strauss
  - 12 to 1

- **Non-mandatory Tour**
  - Jimmy’s House
  - 5 to 6

- **Joint Tours**
  - 8 to 11; 3 to 4

**Trip mode choice**

- Drive to zoo; walk to market
- Drive to work; drive to lunch
- Transit to school; bike to Jimmy’s
- Ride to zoo; walk to market

**Stop frequency; stop location; stop time**

**Mode choice for all tours**

**Shared ride 2; Walk**

**No stops**
SANDAG Model Types

- **Four Step Model**
  - Land Use Driven Transportation Model

- **Activity Based Model (ABM)**
  - Modeling Individual Travel Behavior

- **PECAS**
  - Economic Based Land Use Forecasting

*Models don’t make decisions, models inform decision-makers.*

PECAS

Region wide aggregate demographic & economic conditions → Economic and demographic changes → Region wide aggregate demographic & economic conditions

Activity Allocation → Space Development

Transportation Model

Changes in transportation infrastructure → Activity Allocation

Regional level

Sub-regional level
SANDAG Model Types

- Four Step Model
  - Land Use Driven Transportation Model

- Activity Based Model (ABM)
  - Modeling Individual Travel Behavior

- Land Use and Econometric Models
  - 2050 Regional Growth Forecast
  - PECAS

Models don’t make decisions, models inform decision-makers.
March 10, 2011

Honorable Jerome Stocks and
Members of the SANDAG Board of Directors
401 B St. Suite 800
San Diego, CA 92101

RE: March 11, Item 2 on Board Agenda

Honorable Chairman Stocks and Boardmembers:

On behalf of Move San Diego, I am submitting to you comments regarding the SANDAG model. For over a year, our independent consultant, Smart Mobility, has been reviewing components of the SANDAG Regional Travel Model.

We believe the model contains serious errors and biases that negatively impact the region’s future planning. Our core concerns are inextricably linked to SANDAG’s ability to design transit projects that will greatly increase ridership, and be time competitive with driving. This is illustrated by SANDAG’s inability to meet or exceed its own transit ridership goals in key corridors. Some of our concerns about the model include:

- **Value of Time**-
  - Underestimating the need of lower income residents for good transit service by assuming that travel time means almost nothing to them, and
  - Underestimating the potential for higher income people to use transit because the model assumes that time is so valuable to them that they wouldn’t walk to a transit station or wait to transfer between vehicles.

- **Trip Generation**- Calculating trip generation by acre rather than employee or square footage. This is unusual, very imprecise, and poorly suited for analyses of higher density mixed-use land use.

- **HOT lanes**- Inaccurate modeling by grossly overestimating current and future toll lane usage and revenues,

Additionally, there are biases that have become generally accepted in SANDAG’s model that present issues for smart growth planning and increasing multi-modality. These biases include:

- High income people are willing to pay high tolls for minimal time savings,
• freeway congestion is much more important than non-freeway congestion,
• freeway expansion will not increase regional vehicle miles traveled (VMT),
• only low income people will use transit in any significant numbers (particularly buses), and
• buses are less attractive than railcars.

It is the goal of Move San Diego to assist the SANDAG Board in achieving the region’s Board adopted 2050 RTP goals by providing information about the details incorporated into the model that is not readily available to the general public. I am attaching two white papers from Smart Mobility, the expert consultant retained by Move San Diego to evaluate the SANDAG Regional Travel Model. These papers are:

1. “Why is the model important”, Nov. 2010, Smart Mobility
2. “SANDAG model issues”, July 2010, Smart Mobility

During the SB 375 CARB Target Setting process, Move San Diego, Smart Mobility and other experts spent time reviewing models of the big 4 MPO’s in the state. To illustrate an example of where SANDAG’s model has a Value of Time discrepancy, we can use the counterintuitive result from SANDAG modeling done for CARB relative to transit ridership in the no-build scenario.

“…When SANDAG modeled scenarios as part of the S.B. 375 greenhouse gas reduction process, SANDAG modeled a 123 percent increase in transit ridership without any increase in transit service, achieving this increase with only an 8 cent per mile auto fee and higher parking prices. In contrast, the other large California MPOs achieved only 15-25 percent increases in modeled transit ridership, and in two out of three cases, those scenarios involved significant transit expansion. The 123 percent increase in SANDAG appears to result directly from the low VOT for lower income residents.”

Move San Diego recognizes the draft 2050 RTP provides a much larger percentage of funding for transit, smart growth and transportation options than in previous years (hence our public support for the Hybrid scenario). However, we believe that if the model issues outlined in our attachments were to have been resolved prior to the RTP network scenario development, the outcomes on projects would have been gravely different.

Move San Diego has utilized a private consulting team with expertise in transit planning to develop strategies for future transit projects designed to increase ridership, reduce trip times and lower operating costs. The BRT projects in the strategy are mostly designed to run on grade separated transitways (“Quickways”) where transit does not have to compete with an automobile. The theory behind using Quickways is that cost savings will be achieved by covering more ground in less time, thus raising transit productivity, and increasing the taxpayer return on investment. However, SANDAG’s
model showed that the projects suggested by Move San Diego would not raise projected transit ridership.

If these transit projects, designed to provide a high quality trip for transit riders of all income levels, to run in the urban corridor where the population density is the highest, to connect to the largest employment centers, are not going to increase ridership, then what projects will? If high income riders will NEVER use transit regardless of the quality of the trip provided, is that accurate? The quality of the trip provided should be reflected in the modeling results. Even SANDAG’s own projects are not meeting the Board’s ridership goals in key corridors. This illustrates there are issues with the model and its transit ridership projections.

In anticipation of the next RTP update in four years, and the new PECAS, activity based open-source model that is being developed by SANDAG, we ask that all of our outlined model issues be resolved this year in a timely manner so that the 2050 RTP can be modeled with these changes. We request transparency and a model that is useable and understandable. We ask that all current and future model files be made open to the public without a Board policy decision required for each public information request. We also request that SANDAG’s Peer Recommendations on the model are followed by SANDAG.

Sincerely,

Elyse Lowe
Executive Director
Move San Diego

Attachments

1. “Why is the model important”, Nov. 2010, Smart Mobility
2. “SANDAG model issues”, July 2010, Smart Mobility
Memorandum
To: Elyse Lowe, Move San Diego
From: Norm Marshall
Subject: Why Getting Access to the SANDAG Model Files is Critical
Date: November 19, 2010

Summary

The model is important because it underlies every quantitative performance measure in the Regional Transportation Plan and also is the foundation of every roadway and transit project environmental document. Although both SANDAG and Caltrans treat the model outputs as accurate indications of the future, the model contains serious errors that are distorting the planning process. These problems include:

- Grossly overestimating current and future toll lane usage and revenues,
- Underestimating the need of lower income residents for good transit service by assuming that travel time means almost nothing to them, and
- Underestimating the potential for higher income people to use transit because the model assumes that time is so valuable to them that they wouldn’t walk to a transit station or wait to transfer between vehicles.

By maintaining the model as a “black box”, both SANDAG can have “the model” be anything they say it is. The traffic forecasts in the Interstate I-5 North Coast Project DEIR/DEIS are completely inconsistent with those in SANDAG’s 2007 RTP. Nevertheless, both sets of traffic forecasts are supposedly derived from the SANDAG model.

By keeping the public in the dark about the workings of the model, both SANDAG and Caltrans routinely “spin” the model results. For example, both routinely emphasize the benefits of freeway widening projects on freeway travel speeds, while failing to adequately disclose the negative impacts of the widening projects on other roadways.

These three types of problems – 1) model errors, 2) inconsistent and incorrect model application, and 3) misrepresentation of model results – make it impossible to trust SANDAG to properly model transportation alternatives without transparency and oversight. Therefore it is essential that Move San Diego be able to examine any alternatives modeling done by SANDAG, be able to run alternatives independent of SANDAG, and if necessary, even to fix the model.
Why is the model important?

The model is important because it underlies every quantitative performance measure in the *Regional Transportation Plan* and also is the foundation of every roadway and transit project environmental document. Here are some of the regional performance measures listed in the *Regional Transportation Plan (RTP)*:

<table>
<thead>
<tr>
<th>Table 6.8—Comparison of Regional Performance Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goals and Performance Measures</strong></td>
</tr>
<tr>
<td><strong>MOBILITY</strong></td>
</tr>
<tr>
<td>Average work trip travel time (in minutes)</td>
</tr>
<tr>
<td>Average daily travel time (in minutes)</td>
</tr>
<tr>
<td>Average work trip travel speed by mode (in m.p.h.)</td>
</tr>
<tr>
<td>Auto</td>
</tr>
<tr>
<td>Carpool</td>
</tr>
<tr>
<td>Transit</td>
</tr>
<tr>
<td><strong>ACCESSIBILITY</strong></td>
</tr>
<tr>
<td>Work/school trips within 30 minutes in peak periods</td>
</tr>
<tr>
<td>Non-work trips within 15 minutes</td>
</tr>
<tr>
<td><strong>RELIABILITY</strong></td>
</tr>
<tr>
<td>Annual weekday projected number of accidents/ fatalities per capita</td>
</tr>
<tr>
<td>Congested peak period travel conditions (freeway network)</td>
</tr>
<tr>
<td>Congested daily travel conditions (freeway network)</td>
</tr>
<tr>
<td>Daily vehicle delay per capita (minutes)</td>
</tr>
<tr>
<td>Daily hours of delay on the regional freight network (hours per 1000 VMT)</td>
</tr>
<tr>
<td><strong>LIVABILITY</strong></td>
</tr>
<tr>
<td>Percent of peak-period trips within 1/4 mile of a transit stop</td>
</tr>
<tr>
<td>Percent of daily trips within 1/4 mile of a transit stop</td>
</tr>
<tr>
<td>Work trip mode split (peak periods)</td>
</tr>
<tr>
<td>Drive Alone</td>
</tr>
<tr>
<td>Carpool</td>
</tr>
<tr>
<td>Transit</td>
</tr>
<tr>
<td>Bike/Walk</td>
</tr>
<tr>
<td>Average trip distance (miles)</td>
</tr>
<tr>
<td><strong>SUSTAINABILITY</strong></td>
</tr>
<tr>
<td>Smog forming pollutants (tons per year) per capita</td>
</tr>
<tr>
<td>Total on-road fuel consumption (all day) per capita (gallons)</td>
</tr>
<tr>
<td>Systemwide VMT (all day) per capita</td>
</tr>
<tr>
<td>Transit Passenger Miles (all day) per capita</td>
</tr>
<tr>
<td>Gross acres of constrained lands consumed for transit and highway infrastructure (2006 to 2030)</td>
</tr>
</tbody>
</table>

---

The indicators in the table above are all from the transportation model. The messages that SANDAG is taking from the model and reporting in the RTP include:

1) **Mobility** – There will be greater congestion in the future than the present even if the planned projects are constructed.
2) **Accessibility** – Accessibility will decline in the future relative to the present even if the planned projects are constructed.
3) **Reliability** – The planned projects will be sufficient to avoid increases in freeway congestion. Combined with the results under Mobility that regional congestion will get worse, this implies that congestion on the non-freeway street system will be much worse. This important result is not highlighted in the table.
4) **Transit** – The planned projects will increase the transit mode share over existing conditions.
5) **Sustainability** – Vehicle miles traveled (VMT) per capita will increase in the future but will increase less if the planned projects are built than if they are not.

Taken together, these modeling results represent a **plan for failure**. After spending many billions of dollars, the model indicates that congestion in the region will be worse than it is today, and much worse outside the freeway system. Furthermore, the picture painted actually is too rosy. The modeling results that suggest that VMT will be lower with the planned projects than without violate both economic theory and experience throughout the U.S. Freeway expansion always leads to an increase in VMT. That the model isn’t showing this is evidence of a serious problem with the model.

SANDAG assures us that the model tells us that this is the best plan possible, but this should not be trusted blindly, particularly since they have been refusing to release the underlying modeling files for over a year? Regional transportation modeling is extremely complicated and errors are common. When I first started reviewing models in the 1990s, a prominent modeler questioned me about it, saying: “Isn’t reviewing models like hunting in a game preserve?” He was suggesting that it was too easy to find problems.

Lack of transparency in modeling is a primary reason why there are so many model errors. Good modeling takes a great deal of time and effort, and staff modelers never have enough time and money to do everything they would like to do. MPO managers are not modelers and offer little oversight. The modelers’ incentives lead them to do just enough modeling to produce numbers that satisfy their managers and then stop. This process will not reliably produce good modeling. SANDAG argues that the peer review process provides quality assurance. It does not. The 2005 peer review was prior to model changes of most concern. In 2005, the peer reviewers never “looked under the hood” at the actual modeling files. Based on model documentation and discussions with SANDAG staff, they made a small number of “softball” recommendations – which SANDAG generally has not followed.

Modeling is a human endeavor, and the computer outputs will only be as good as the work done by the modelers. Until SANDAG releases their model files, we should not be willing to trust the men behind the curtain.
Problems that Result from Lack of Model Transparency

The problems that result from lack of model transparency include:

1) model errors,
2) inconsistent and incorrect model application,
3) misrepresentation of model results, and
4) failure to properly model alternatives.

Model Errors

The problems described below all refer to the model used in developing the 2007 Regional Transportation Plan. SANDAG refuses to provide any information about its latest model, saying only that no information about it will be released until the next Regional Transportation Plan is released.

1) Failure to Model Managed Lanes Properly – The central focus of SANDAG’s RTP is adding freeway managed lanes. Despite their importance in the RTP, the SANDAG model grossly overestimates both managed lane revenue and usage. In 2006, the base model year for the RTP, the region had operated the FasTrak lanes on I-15 for a number of years, so modeled values can be compared to actual data. The model 2006 daily revenue is $10,797 during the morning peak period, $9,148 during the afternoon peak period, and $0 during the off-peak period.\(^2\) The total is $19,945 in 1999 dollars\(^3\) which is equivalent to $24,000 in model year 2006 dollars or $26,000 in 2010 dollars. SANDAG does not appear to publish usage and revenue data on the internet, and an email request through the FasTrak site went unanswered.\(^4\) So far, the only data I have found regarding I-15 FasTrak performance is in a news article. Last year, the North County Times reported:

The uptick in FasTrak usage ... follows the opening of eight additional miles of I-15 Express Lanes since September 2008...
FasTrak’s revenue increased to nearly $10,000 per average weekday in September. That’s more than twice what it was averaging the same time a year before.\(^5\)

The article doesn’t provide exact numbers, but if “nearly $10,000” is “more than twice” the number before the new section was opened; it suggests an earlier number of around $4,000. This is only about one sixth of the modeled revenue. If the model is off by a factor of six in 2006, what confidence is there in 2030 forecasts?

---

\(^2\) Calculated from RTP model output files that were provided by SANDAG.
\(^3\) The SANDAG model does all monetary accounting in 1999 dollars. These values are adjusted to 2010 dollars using a multiplier of 1.32 derived from the Consumer Price Index.
\(^4\) These data should be public and generally are. See, for example, the Orange County Transportation Authority (OCTA) reporting concerning the SR-91 managed lanes at http://www.91expresslanes.com/learnabout/trafficrevenue.asp.
This problem with modeling revenues is only part of the problem in the model. While High Occupancy Toll (HOT) lanes are intended to serve HOV customers first and toll customers second, up to a maximum total traffic volume that maintains high-speed traffic flow, the SANDAG model allows unlimited usage of the HOT lanes by both groups. Therefore the HOT lanes become almost as congested as the general purpose lanes in the model, and the modeled travel time savings are extremely small (generally less than one minute). In reality, such small time savings would not justify paying a significant toll. An accurate model would not keep assigning so many toll payers to the managed lanes without any significant travel time savings.

These errors appear to have resulted from the modelers consciously overriding estimated model coefficients to artificially boost modeled traffic volumes and revenues in the HOT lanes. The model documentation states:

After applying the model it was felt that higher income trips were not sensitive enough to time as indicated by:
- Too few high income trips on the COASTER which has high fares but offers travel times competitive with the automobile
- Too many transit trips from high income areas
- Too few peak period managed lane trips when tolls are higher than the off-peak period but travel time savings are more significant

Subsequently time coefficients were stratified by income level in addition to cost coefficients, which had the desired effect of reducing the severity of these problems.

The wording used here gives some insight into the validity of the changes – “it was felt that ...” The word “felt” is a very weak basis for overriding statistically estimated modeling parameters. The documentation states that the adjustment was needed, in part, because there were “too few peak period managed lane trips.” However, as documented above, the model (with the adjustments) produces six times the actual managed toll revenue in the 2006 model for the only such facility operating. What, therefore, can be meant by the statement “too few”? Does it mean that future usage and revenues were “too few”, and if so, relative to what standard? The model is supposed to be an independent forecaster of future traffic, not a tool that is jiggered to achieve some predetermined forecast.

The adjustments that overrode the statistically estimated model coefficients involve “values of time” (VOT). Transportation models assume that travelers with a choice between a faster roadway and a slower one will be willing to pay a toll provided that the time savings justify the toll. For example, if a traveler is willing to pay a $2 toll to save 10 minutes, but is unwilling to pay more than that, the traveler

---

6 SANDAG 2008, p. 82.
7 To date, SANDAG has refused to make the consultant report describing the statistical estimation process because they think it may have been finalized after the 2007 RTP was released, even though these parameters were used in the preparation of the RTP.
can be aid to have a value of time of $12/hour.\(^8\) The SANDAG model has three income groups with different VOTs. In 2010 dollars, these groups are households with income below $39,200, households with incomes between $39,200 and $78,400 and households with incomes greater than $78,400.\(^9\)

It is useful to look at the SANDAG model VOTs both before and after the statistically estimated parameters were overridden. We will focus on commuting trips as they are an especially important transit market, and also are a primary contributor to peak period congestion. Prior to overriding the statistically estimated coefficients, the VOTs for the three groups for work commutes were $2.74, $7.32 and $21.95 for the three groups in 2010 dollars.\(^10\) For work trips, U.S. Department of Transportation guidance is to use a value of time equal to 100 percent of the median wage rate.\(^11\) Relative to this guidance, the estimated VOTs appear to be low for the lower two groups and especially for the lowest income group. The $2.74 value is only 34% of the California minimum wage. In contrast the $21.95 value translates into $46,000 a year or 59% of the lower end of the higher household income range. Given that a large fraction of the higher income households include multiple workers, this value appears to be consistent with the Federal guidance.

After the overriding adjustments, the revised VOTs are $2.74, $14.63 and $65.86 per hour. These are much less consistent with U.S. DOT. The problem of the low income group was not addressed, and the high income value that appeared to be correct has been tripled. The adjusted SANDAG model assumes that the top 43 percent have a VOT of time that is 24 times the VOT of the bottom 27 percent and would be willing to pay a toll that is 24 times as high for the same time savings. These VOTs imply that the three groups would be willing to pay $0.46, $2.44 and $10.98 to save 10 minutes. The $0.46 number is too low and the $11 to save 10 minutes is incredibly high. This obviously causes the model to over-assign traffic to toll lanes.

The $65.86 value is much higher than has been measured with local data. A study of I-15 FasTrak customers in 1998 concluded:

> Our estimate of median willingness to pay to reduce commute time is roughly $ 30 per hour, although this may be biased upward by drivers’ perception that the toll facility provides safer driving conditions. Drivers also use the posted toll as an indicator of

\(^8\) Calculated as ($2/10 minutes) x (60 minutes/1 hour) = $12/hour

\(^9\) In 1999 dollars, the breakpoints are $30,000 and $60,000.

\(^10\) Calculated from San Diego Association of Governments. 2030 Regional Growth Forecast Update: Process and Model Documentation, p. 82, April 2008., The time coefficients are in minutes and the cost coefficients in cents, therefore VOT($/hr.) = .((time coeff. ( per min.) * (60 min./hr.)) / ((cost coeff. (per cent) * (100 cents/$)) and then adjusted to 2010 dollars using multiplier of 1.32.

abnormal congestion and increase their usage of the toll facility when tolls are higher than normal.\textsuperscript{12}

The VOTs in the SANDAG model override statistically estimated parameters, are contrary to Federal guidance, are inconsistent with local data, and cause the model to grossly overestimate toll usage and revenues relative to observed data.\textsuperscript{13} These problems pervade all regional analyses that involve toll roads including the RTP and the I-5 DEIR/DEIS. In 2010, the South Bay Expressway filed for bankruptcy because traffic volumes have only been about one third of projections.\textsuperscript{14} It is unclear what the projections were based on, but it is probable that they were based, at least in part, on the SANDAG model.

\textbf{Failure to Model Transit Correctly} – In a regional transportation model, everything is connected to everything else. While I suspect that the VOT adjustments were done primarily to inflate toll usage and revenue, they have an enormous effect on transit modeling. When SANDAG modeled scenarios as part of the S.B. 375 greenhouse gas reduction process, SANDAG modeled a 123 percent increase in transit ridership without any increase in transit service, achieving this increase with only an 8 cent per mile auto fee and higher parking prices.\textsuperscript{15} In contrast, the other large California MPOs achieved only 15-25 percent increases in modeled transit ridership, and in two out of three cases, those scenarios involved significant transit expansion. The 123 percent increase in SANDAG appears to result directly from the low VOT for lower income residents. At a VOT of $2.74, modeled travelers would prefer to spend an extra hour on a poor transit option than to pay $2.74 additional in auto cost. This assumption has huge environmental justice implications, because it implies that there is little need to provide lower income transit customers with better service transit.

The high income group is modeled in an exactly opposite way. This group, the largest of the three groups – particularly in suburban areas – has such a high VOT that it is virtually impossible to attract them to transit. The basic VOT is $65.86 per hour. However, transfer time is accounted for at three times the normal VOT – almost $200 per hour. Walking and wait time are valued at $100 or more. For the high income group, the SANDAG model assumes a 5-minute transfer to cost the equivalent of $16.46. As most efficient suburban transit designs will require transfers for many users, the model assumes that high income households are not transit customers.


\textsuperscript{13} In a response to comments I prepared for Climate Plan raising this VOT issue, SANDAG denied there was a problem (www.arb.ca.gov/cc/sb375/mpo/sandag/sandag.response.80510.pdf). If the model documentation were the only basis for concern, I might think the documentation was wrong. However, as documented here, problems with the roadway and transit modeling are both consistent with the VOT documentation.


\textsuperscript{15} http://www.arb.ca.gov/cc/sb375/data/data.htm, prelimreport.mtc.sacog.sandag.scag.pdf, May 19, 2010.
In general, the VOT adjustments that appear to have been introduced primarily to artificially boost toll lane usage and revenue\(^\text{16}\) have pushed the transit modeling into a condition where it is insensitive to the level of transit service provided. Low income households will use transit in the model no matter how poor the level of service is, and high income households will not use transit in the model no matter how good the service is. In the model, the way to boost transit is to put some form of transit where there are lower income households and then to price them out of their cars. This model is inconsistent with reality and provides an extremely poor platform for transit planning, as it fails to distinguish properly between good transit service and poor transit service.

**Unsupported Assumption that Rail will Attract More Riders than Bus Given Same Service Characteristics**

– The SANDAG model includes “modal constants”\(^\text{17}\) that make modeled ridership higher for a rail service than a bus service when the service characteristics including travel time and cost are identical. The model assumes that “BRT” will have attractiveness halfway between bus and rail. Rather than this simplistic model based on the type of vehicle, the model should make more of an effort to distinguish services by their level of amenities. The existing rail services have many features largely absent from the current bus system including stations, boarding platforms, prepayment and parking facilities. BRT that has similar amenities should attract similar ridership.

\(^\text{16}\) The model documentation also suggests that the VOT changes also were introduced to reduce modeled transit from high income travelers and to boost Coaster ridership in the model. If there were model problems in these areas before the VOTS were overridden, they should have been addressed in other ways. For example, MPO models often overestimate suburban transit ridership because they fail to account for the hostile pedestrian environments than deter usage. The model should not assume that high income people will not use transit; it should carefully identify the conditions required to attract high income riders, and part of that is a good pedestrian environment.

\(^\text{17}\) SANDAG 2008, Table 23, p. 89.
Failure to Model Travel Patterns Correctly – The SANDAG model and most other MPO transportation travel models use “gravity models” to join origins and destinations. The general concept is that destinations that can be reached more quickly are more likely to be chosen than those farther away, but that there is some probability of traveling even to the most distant destinations. In general, MPO transportation model documentation includes comparisons of modeled trip length frequency to observed trip length frequency (as recorded in household travel surveys and Census data). For example, the Southern California Association of Governments (SCAG) model documentation includes this figure.  

The graphic shows that the SCAG model matches the trip length distribution very closely, especially for the Census data ("CTPP") which has a much larger sample size than the household travel survey.

---

**FIGURE 5-3**

TRIP LENGTH FREQUENCY DISTRIBUTION - HOME-BASE WORK TRIPS
(MODEL, SURVEY, AND CTPP)

---

SANDAG’s model documentation has no such comparison, but I was able to put one together from RTP output files provided by SANDAG. Compared to the SCAG model and other good models I am familiar with, the model fit is extremely poor.

The SANDAG model greatly overestimates very short work trips that are poor candidates for transit, and greatly underestimates mid-length trips that are good candidates for transit use. The model should fit work trip patterns much better.

Nonresidential trip generation calculated by acre – Outside the CBD, the SANDAG model calculates trip generation by acre rather than employee or square footage. This is unusual, very imprecise, and poorly suited for analyses of higher density mixed-use land use. It implicitly assumes the predominance of suburban, single use nonresidential land uses. Although the documentation suggests that “acre-based forecasts are … subject to less uncertainty than employment forecasts”, SANDAG’s Urban Development Model is really allocating employees which are then translated into acres. The peer review panel recommended changing this process. Given changes in thinking about density, there certainly is less uncertainty about growth in jobs than growth in land consumption, and this should be changed.

Unidentified Problems – Without full access to the model, it is impossible to know whether there are other serious problems with the model.

20 SANDAG 2008,, p. 49.
Inconsistent and Incorrect Model Application

The SANDAG model is used in developing project Environmental Impact Reports including the recently-released DEIR/DEIS for the Interstate I-5 North Coast Project. Although the DEIR/DEIS purportedly relies on the Caltrans application of the SANDAG model for the traffic forecasts, the forecasts are much higher than those reported in the RTP.

Forecast I-5 Traffic Growth between Base Year and 2030

Caltrans apparently thinks that models can be manipulated to achieve results that are more consistent with their mental models. Earlier this year, a Caltrans employee was looking for validation for an improper modeling procedure on the FHWA-sponsored Travel Model Improvement Program (TMIP) listserv, writing:

According to knowledgeable people in the field the gravity model is overly sensitive to travel times which therefore in the feedback loop process may lead to more VMT increase due to a highway project than is actually the case.” Tony Van Haagen, Caltrans, District 7 Los Angeles

I replied:

There is evidence that gravity models do realistically replicate the induced travel impacts of roadway capacity. See Caroline Rodier, “A Review of the Representation of

---

21 RTP Figures 1.4 and 1.5, p. 1-13 and p. 1-14 vs. DEIR/DEIS Table 3.6-1, p. 3.6-4.

22 The references to “gravity model” and “feedback” are technical terms related to the captured of induced travel effects.

The results indicate that when travel times are fed back to a land use model and/or the trip distribution step, then (1) models can represent induced travel within the range documented in the empirical literature and (2) the effect of new highway capacity on land use and trip distribution can significantly contribute to the model’s representation of induced travel. If induced travel is not represented in travel and land use models, then the need for, and the benefit of, a highway project will tend to be overstated...

Where is there evidence that gravity models overestimate the induced travel effect?

Mr. Van Haagen’s response to me (directly and outside list):

Thank you for bringing the paper by Rodier to my attention. It makes a strong case that the gravity model with a feedback process does produce realistic outcomes regarding induced traffic. The paper by Waddell et al. makes a good case for feedback through land use for the long term impact of highway projects. Fortunately, these ideas are slowly being incorporated in models now. Tony Van Haagen Caltrans, District 7 Los Angeles

Mr. Van Haagen’s response that model feedback is “slowly being incorporated in models now” is an understatement. The use of a “gravity model with a feedback process” has been required by the Federal Clean Air Act Conformity modeling regulations in air basins that have been identified as being in nonattainment and maintenance of the ozone and carbon monoxide ambient air quality standards since 1993. 23

It is important to emphasize that Van Haagen’s initial position was that including distribution feedback would make the project appear to perform worse. It would appear worse because it would properly account for the induced traffic that would result from the project. This induced traffic obviously would reduce the benefits of widening on I-5. Even more importantly, it also causes increased peak period congestion for other roadways intersecting I-5. No trip begins or ends on I-5. Increasing peak period traffic throughput on I-5 necessarily would increase peak period traffic on intersecting roadways.

Without disclosure of the modeling files, it is impossible for the public to know how the modeling was done and whether it was done correctly.

Misrepresentation of Model Results

Both California’s CEQA and the Federal NEPA laws governing EIR and EIS documents were intended to foster transparency. The intent is that all impacts be presented without bias. However, the process has evolved to the point where public agencies routinely “spin” model results to put their plans in the best possible light. For example, and as discussed above, both SANDAG in its RTP and Caltrans in the DEIR/DEIS are spinning the modeling results by narrowly focusing congestion performance measures on

23 http://www.fhwa.dot.gov/environment/conformity/ref_guid/chap6.htm#determin
I-5 and other freeways and not disclosing the negative congestion impacts on other roadways. If the modeling files are released to the public, these and other negative impacts of the projects can be uncovered.

In general, environmental documentation should shift away from producing hundreds of precise numbers (such as the peak hour delays for a specific intersection in 2030) towards an analysis of the big picture including how the big picture would be affected by different future conditions – e.g. what would happen with different levels of growth, different future energy prices, and so forth. The current practice of producing a single highly-detailed and precise set of traffic forecasts gives a false impression of accuracy. The model should be demystified and represented as a useful but not infallible tool.

**Failure to Properly Model Alternatives**

Transportation/land use systems are extremely complex, and models that properly forecast future transportation behavior also are complex. Over time, working with complex models should lead to both better models and smarter modelers. Both our mental models and our computer models rely on a marriage of theory and data. We test both our mental models and our computer models against data and against each other. If there is a discrepancy between our mental models and our computer models, then we depend on data to help us sort out which of the models is correct. If the computer model is correct, we refine our mental models. If the mental model is correct, we need to fix the computer model. This feedback process leads to learning as illustrated in the diagram below.

*Organization Learning Through Modeling*

However, when modelers become too entrenched in their computer models, they sometimes suffer from a unique malady that I call “learned dumbness.” This occurs when the testing and feedback is eliminated, and the modeler just accepts the outputs of the model as correct as shown in the figure below.
Learned Dumbness through Modeling

I first became aware of this problem 15 years ago when I commented that the Atlanta MPO was wrong when it said that daily freeway speeds in that region averaged about 35 m.p.h. when data showed that they averaged 65-70 m.p.h. The MPO staff said that the data were wrong because their model told them it was impossible that such high traffic flows could be sustained at such high speeds. Pushed to explain the discrepancy, the MPO ended up spending hundreds of thousands of dollars on additional data collection which confirmed that the previous data were correct, and that the model was wrong.

Since this time, I have run into this problem of “learned dumbness” in many forms. In the case of SANDAG and Caltrans, I see symptoms of this condition including the following assumptions:

- high income people are willing to pay high tolls for minimal time savings,
- freeway congestion is much more important than non-freeway congestion,
- freeway expansion will not increase regional vehicle miles traveled (VMT),
- only low income people will use transit in any significant numbers (particularly buses), and
- buses are less attractive than railcars.

Combining these modeler biases with the three problems discussed above – 1) model errors, 2) inconsistent and incorrect model application, and 3) misrepresentation of model results – it is impossible to trust SANDAG to properly model transportation alternatives without transparency and oversight. Therefore it is essential that Move San Diego be able to examine any alternatives modeling done by SANDAG, be able to run alternatives independent of SANDAG, and if necessary, even to fix the model. An MPO committed to its public mission should welcome these contributions. In work we did for Douglas County Colorado, we were able to make improvements to the Denver Regional Council of Governments (DRCOG) model which they planned to apply in their other modeling work. More transparency can only lead to better modeling, to better planning, and ultimately to stronger and more livable region.

This broader agenda goes well beyond the current model we have been trying to get access to for over a year. While we have focused on one model – the model used in developing the 2007 RTP – there probably are really at least three models. First, there is the 2007 model underlying current plans.
Second, there is the latest incarnation of that model which they are preparing for application within the 2011 RTP process, and which they refuse to tell us anything about. Third, there is a much more complex activity model that is under development and where they are spending hundreds of thousands of dollars. There is no way they will go back and spend any significant money on the old model and that probably makes sense. The important thing is that they correct problems in the newer models and change their whole way of doing business toward transparency and collaboration.
Resume

NORMAN L. MARSHALL, Principal
nmarshall@smartmobility.com

EDUCATION:

Master of Science in Engineering Sciences, Dartmouth College, Hanover, NH, 1982
Bachelor of Science in Mathematics, Worcester Polytechnic Institute, Worcester, MA, 1977

PROFESSIONAL EXPERIENCE:

Norm Marshall helped found Smart Mobility, Inc. in 2001. Prior to this, he was at Resource Systems Group, Inc. for 14 years where he developed a national practice in travel demand modeling. He specializes in analyzing the relationships between the built environment and travel behavior, and doing planning that coordinates multi-modal transportation with land use and community needs.

Regional Land Use/Transportation Scenario Planning

Climate Plan (California statewide) – Assisted large coalition of groups in reviewing and participating in the target setting process required by Senate Bill 375 and administered by the California Air Resources Board to reduce future greenhouse gas emissions through land use measures and other regional initiatives. This work including reviewing the transportation models of the four largest Metropolitan Planning Organizations (MPOs) and less detailed analyses of the planning efforts of the smaller MPOs.

Chicago Metropolis Plan and Chicago Metropolis Freight Plan (6-county region) — developed alternative transportation scenarios, made enhancements in the regional travel demand model, and used the enhanced model to evaluate alternative scenarios including development of alternative regional transit concepts. Developed multi-class assignment model and used it to analyze freight alternatives including congestion pricing and other peak shifting strategies. Chicago Metropolis 2020 was awarded the Daniel Burnham Award for regional planning in 2004 by the American Planning Association, based in part on this work.

Envision Central Texas Vision (5-county region) — implemented many enhancements in regional model including multiple time periods, feedback from congestion to trip distribution and mode choice, new life style trip production rates, auto availability model sensitive to urban design variables, non-motorized trip model sensitive to urban design variables, and mode choice model sensitive to urban design variables and with higher values of time (more accurate for “choice” riders). Analyzed set land use/transportation scenarios including developing transit concepts to match the different land use scenarios.
Mid-Ohio Regional Planning Commission Regional Growth Strategy (7-county Columbus region)—developed alternative future land use scenarios and calculated performance measures for use in a large public regional visioning project.

Baltimore Vision 2030—working with the Baltimore Metropolitan Council and the Baltimore Regional Partnership, increased regional travel demand model’s sensitivity to land use and transportation infrastructure. Enhanced model was used to test alternative land use and transportation scenarios including different levels of public transit.

Chittenden County (2060 Land use and Transportation Vision Burlington Vermont region) – leading extensive public visioning project as part of MPO’s long-range transportation plan update.

Burlington (Vermont ) Transportation Plan – Leading team developing Transportation Plan focused on supporting increased population and employment without increases in traffic by focusing investments and policies on transit, walking, biking and Transportation Demand Management.

**Transit Planning**

Regional Transportation Authority (Chicago) and Chicago Metropolis 2020 – evaluating alternative 2020 and 2030 system-wide transit scenarios including deterioration and enhance/expand under alternative land use and energy pricing assumptions in support of initiatives for increased public funding.

Capital Metropolitan Transportation Authority (Austin, TX) Transit Vision – analyzed the regional effects of implementing the transit vision in concert with an aggressive transit-oriented development plan developed by Calthorpe Associates. Transit vision includes commuter rail and BRT.

Bus Rapid Transit for Northern Virginia HOT Lanes (Breakthrough Technologies, Inc and Environmental Defense.) – analyzed alternative Bus Rapid Transit (BRT) strategies for proposed privately-developing High Occupancy Toll lanes on I-95 and I-495 (Capital Beltway) including different service alternatives (point-to-point services, trunk lines intersecting connecting routes at in-line stations, and hybrid).

Central Ohio Transportation Authority (Columbus) – analyzed the regional effects of implementing a rail vision plan on transit-oriented development potential and possible regional benefits that would result.

Essex (VT) Commuter Rail Environmental Assessment (Vermont Agency of Transportation and Chittenden County Metropolitan Planning Organization)—estimated transit ridership for commuter rail and enhanced bus scenarios, as well as traffic volumes.

Georgia Intercity Rail Plan (Georgia DOT)—developed statewide travel demand model for the Georgia Department of Transportation including auto, air, bus and rail modes. Work included estimating travel demand and mode split models, and building the Departments ARC/INFO database for a model running with a GIS user interface.

**Roadway Corridor Planning**

Hudson River Crossing Study (Capital District Transportation Committee and NYSDOT) – Analyzing long term capacity needs for Hudson River bridges which a special focus on the I-90 Patroon Island Bridge where a microsimulation VISSIM model was developed and applied.
State Routes 5 & 92 Scoping Phase (NYSDOT) — evaluated TSM, TDM, transit and highway widening alternatives for the New York State Department of Transportation using local and national data, and a linkage between a regional network model and a detailed subarea CORSIM model.

Twin Cities Minnesota Area and Corridor Studies (MinnDOT)—improved regional demand model to better match observed traffic volumes, particularly in suburban growth areas. Applied enhanced model in a series of subarea and corridor studies.

**Developing Regional Transportation Model**

Pease Area Transportation and Air Quality Planning (New Hampshire DOT)—developed an integrated land use allocation, transportation, and air quality model for a three-county New Hampshire and Maine seacoast region that covers two New Hampshire MPOs, the Seacoast MPO and the Salem-Plaistow MPO.

Syracuse Intermodal Model (Syracuse Metropolitan Transportation Council)—developed custom trip generation, trip distribution, and mode split models for the Syracuse Metropolitan Transportation Council. All of the new models were developed on a person-trip basis, with the trip distribution model and mode split models based on one estimated logit model formulation.

Portland Area Comprehensive Travel Study (Portland Area Comprehensive Transportation Study)—Travel Demand Model Upgrade—enhanced the Portland Maine regional model (TRIPS software). Estimated person-based trip generation and distribution, and a mode split model including drive alone, shared ride, bus, and walk/bike modes.

**Research**

Obesity and the Built Environment (National Institutes of Health and Robert Wood Johnston Foundation) – Working with the Dartmouth Medical School to study the influence of local land use on middle school students in Vermont and New Hampshire, with a focus on physical activity and obesity.

The Future of Transportation Modeling (New Jersey DOT)—Member of Advisory Board on project for State of New Jersey researching trends and directions and making recommendations for future practice.

Trip Generation Characteristics of Multi-Use Development (Florida DOT)—estimated internal vehicle trips, internal pedestrian trips, and trip-making characteristics of residents at large multi-use developments in Fort Lauderdale, Florida.

Improved Transportation Models for the Future—assisted Sandia National Laboratories in developing a prototype model of the future linking ARC/INFO to the EMME/2 Albuquerque model and adding a land use allocation model and auto ownership model including alternative vehicle types.

**Critiques**

C-470 (Denver region) – Reviewed express toll lane proposal for Douglas County, Colorado and prepared reports on operations, safety, finances, and alternatives.

**Intercounty Connector (Maryland)** – Reviewed proposed toll road and modeled alternatives with different combinations of roadway capacity, transit capacity (both on and off Intercounty Connector) and pricing.
Foothills South Toll Road (Orange County, CA) – Reviewed modeling of proposed toll road.

I-93 Widening (New Hampshire) – Reviewed Environment Impact Statement and modeling, with a particular focus on induced travel and secondary impacts, and also a detailed look at transit potential in the corridor.

Stillwater Bridge – Participated in 4-person expert panel assembled by Minnesota DOT to review modeling of proposed replacement bridge in Stillwater, with special attention to land use, induced travel, pricing, and transit use.

Ohio River Bridges Projects – Reviewed Environmental Impact Statement for proposed new freeway bridge east of Louisville Kentucky for River Fields, a local land trust and historic preservation not-for-profit organization.

**PUBLICATIONS AND PRESENTATIONS** *(partial list)*

Understanding the Transportation Models and Asking the Right Questions. Lead presenter on national Webinar put on by the Surface Policy Planning Partnership (STTP) and the Center for Neighborhood Technologies (CNT) with partial funding by the Federal Transit Administration, 2007.


Chicago Metropolis 2020: the Business Community Develops an Integrated Land Use/Transportation Plan with Lucinda Gibson, P.E., Frank Beal and John Fregonese, presented at the Institute of Transportation Engineers Technical Conference on Transportation’s Role in Successful Communities, Fort Lauderdale FL, March 2003.

Evidence of Induced Travel with Bill Cowart, presented in association with the Ninth Session of the Commission on Sustainable Development, United Nations, New York City, April 2001.


Multimodal Statewide Travel Demand Modeling Within a GIS with S. Lawe, Transportation Research Board Annual Meeting, Washington DC: January 1996.

Linking a GIS and a Statewide Transportation Planning Model, with L. Barbour and Judith LaFavor, Urban and Regional Information Systems Association (URISA) Annual Conference, San Antonio, TX, July 1995.


Forecasting Land Use Changes for Transportation Alternatives, with S. Lawe, Fifth National Conference on the Application of Transportation Planning Methods (Transportation Research Board), Seattle WA, April 1995.


MEMBERSHIPS/AFFILIATIONS
Member, Institute of Transportation Engineers

Member, American Planning Association

Member, Congress for the New Urbanism
Memorandum

To: Move San Diego
From: Norm Marshall
Subject: SANDAG Model Issues
Date: July 23, 2010

I have serious concerns about the validity of SANDAG’s travel demand model, especially when applied transit modeling. Without being able to “look under the hood” and inspect the equations and coefficients, it is impossible to fully document the issues. Attached is a list of questions that cover the areas of concern. Below, I discuss three areas where I am certain there are problems.

1) **Nonresidential trip generation calculated by acre** – Outside the CBD, the SANDAG model calculates trip generation by acre rather than employee or square footage.¹ This is unusual, very imprecise, and poorly suited for analyses of higher density mixed-use land use. It implicitly assumes the predominance of suburban, single use nonresidential land uses. Although the documentation suggests that “acre-based forecasts are … subject to less uncertainty than employment forecasts”, SANDAG’s Urban Development Model is really allocating employees which are then translated into acres.² Given changes in thinking about density, there certainly is less uncertainty about growth in jobs than growth in land consumption.

2) **Value of Time** – One of the most counter-intuitive results in the large MPO’s submission to the recent RTAC meeting was the level of transit ridership increase that SANDAG achieved through pricing along, i.e. no increased transit service. SANDAG modeled a 123 percent increase in ridership which the other MPOs achieved only 15-25 percent increases, and in two out of three cases, those scenarios involved significant transit expansion.

We have a theory about why this occurred, and if the theory is valid, it illuminates a serious modeling issue. One of the most critical relationships in travel demand models involves how travelers will trade off time and cost. This applies to all travel, but is particularly important in toll analyses and transit analyses. For toll analyses, the importance is obvious. How much is a traveler willing spend on tolls to save 10 minutes? If they have a higher “value of time” (VOT), they are more likely to choose the toll option. For transit, there sometimes is a similar choice available – i.e. fast higher-price transit vs. slower lower-priced transit. However, the more common choice is between faster auto and slower transit. Auto often will cost more, sometimes in out-of-pocket costs including parking, but often implicitly through the requirement of paying for an auto that will be available for the trip. Whether transit is chosen, will depend in part on how much value the traveler’s VOT.

---

² SANDAG 2008,, p. 49.
VOT is strongly correlated with income, and the SANDAG travel demand model segments households into three income categories:

- Households with incomes less than $30,000 (constant 1999 dollars)
- Households with incomes between $30,000 and $60,000 (constant 1999 dollars)
- Households with incomes greater than $60,000 (constant 1999 dollars)\(^3\)

Adjusted for inflation the $30,000 and $60,000 household income breakpoints are equivalent to $39,200 and $78,400 in 2010 dollars. SANDAG refers to these categories as “low”, “middle” and “high” income households. In the 2006 base model, 27 percent of all households were in the “low” category, 30 percent in the “middle” category, and 43 percent in the “high” category. The “high” category is the largest category and includes many households that would not normally be considered “high income.”

SANDAG properly assigns separate VOTs to the different income groups but the differences in the model are extreme.

\textit{SANDAG Model VOT}\(^4\) (1999 $)\(^5\)

<table>
<thead>
<tr>
<th></th>
<th>“Low” income</th>
<th>“Middle” income</th>
<th>“High” income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home to work or college</td>
<td>$2.10</td>
<td>$11.20</td>
<td>$50.40</td>
</tr>
<tr>
<td>Home to other</td>
<td>$1.07</td>
<td>$4.80</td>
<td>$14.40</td>
</tr>
<tr>
<td>Other to other</td>
<td>$1.02</td>
<td>$5.28</td>
<td>$19.80</td>
</tr>
</tbody>
</table>

In an email to Elyse Lowe on July 8, 2010, Rob Rundle of SANDAG stated: “The SANDAG commute value of times are $2.00 for low-income, $5.40 for mid-income, and $12.90 for high-income.” This is inconsistent with SANDAG’s model documentation. At this point in time, I am assuming that the model documentation is correct because it is in a recently-added section:

After applying the model it was felt that higher income trips were not sensitive enough to time as indicated by:

- Too few high income trips on the COASTER which has high fares but offers travel times competitive with the automobile

\(^3\) San Diego Association of Governments. 2030 Regional Growth Forecast Update: Process and Model Documentation, p. 82, April 2008.

\(^4\) Calculated from SANDAG 2008, The time coefficients are in minutes and the cost coefficients in cents, therefore VOT($/hr.) = (.((time coeff. (per min.) * (60 min./hr.)) / ((cost coeff. (per cent) * (100 cents/$))

\(^5\)
- Too many transit trips from high income areas
- Too few peak period managed lane trips when tolls are higher than the off-peak period but travel time savings are more significant

Subsequently time coefficients were stratified by income level in addition to cost coefficients, which had the desired effect of reducing the severity of these problems.

The issues described above could of and should have been addressed in the model in other ways. The two transit issues point to poor model specification of the transit service including the attractiveness of access to and from the transit stations and stops. The issue about managed toll lanes would require better modeling of managed toll lanes (discussed below). The changes made create systemic model biases that are more problematic than the issues that the changes were addressing.

The difference in VOT by group should be approximately equivalent to the difference in wage rates. U.S. Department of Transportation guidance is to use a value of time equal to 100 percent of the median wage rate for work trips and 50 percent of the median wage rate for non-work trips. The model assumes that “high income” have 24 times the value of time as “low-income” workers even though the average income in the “high” group probably is only about 4 times as great as the “low” group, and possibly even less because a higher percentage of higher income households have more than one worker.

The $50.40 value for “high” income work trips is much higher than has been measured with local data (and of course is absurd for college trips). A study of I-15 FasTrak customers in 1998 concluded:

Our estimate of median willingness to pay to reduce commute time is roughly $30 per hour, although this may be biased upward by drivers’ perception that the toll facility provides safer driving conditions. Drivers also use the posted toll as an indicator of abnormal congestion and increase their usage of the toll facility when tolls are higher than normal.

The very high VOT for the high-income group (43% of total households) makes it very unlikely that they will be attracted to suburban transit. The $50.40 in 1999 $ is equivalent $67/hour in 2010. The model assumes that transit time is 3 times as onerous as in-vehicle time or $197/hour in 2010 $. At that price, a 5-minute transfer is equivalent to $16, and two 5-minute transfers a day would total $32/day – plus

---

6 SANDAG 2008, p. 82.


similarly high equivalent costs for walking to and from transit, and for any additional time on transit as compared to the same trip on auto.

On the other hand, the VOT for the low income group appears to be too low. Our theory about the large transit increase in response to pricing is that low-income travelers are being pushed to transit even when service is poor because their time is not important in the model. If the VOT for this population is too low, the model is overstating this effect.

3) **Crude Modeling of HOT Lanes** – A central component of both the SANDAG’s RTP and hybrid scenario is a reliance on HOT Lanes. The SANDAG model is incapable of modeling them with any accuracy. The base model is for 2006. In 2006, the region had operated the FasTrak lanes on I-15 for a number of years, and the I-15 FasTrak lanes are modeled in the model. One of the rationales for boosting the high-income VOT, is that it was “felt that” there were “too few peak period managed lane trips ....”

This text suggests that the increased VOT were needed to boost the model usage to match observed usage and revenues. However, the 2006 modeled usage and revenues with the adjusted coefficients are much higher than the actual usage. The model 2006 daily revenue is $10,797 during the morning peak period, $9,148 during the afternoon peak period, and $0 during the off-peak period. The total is $19,945 in 1999 which is equivalent to $24,000 in model year 2006 $ or $26,000 in 2010 $. SANDAG does not appear to publish usage and revenue data on the internet, and an email request through the FasTrak site has so far gone unanswered. In contrast, the Orange County Transportation Authority (OCTA) does an excellent job of making data available concerning the SR-91 managed lanes. So far, the only data we have found regarding I-15 FasTrak performance is in a news article. Last year, the North County Times reported:

> The uptick in FasTrak usage ... follows the opening of eight additional miles of I-15 Express Lanes since September 2008...

> FasTrak's revenue increased to nearly $10,000 per average weekday in September.
> That's more than twice what it was averaging the same time a year before.

The article doesn’t provide exact numbers, but if “nearly $10,000” is “more than twice” the number before the new section was opened; it suggests an earlier number of around $4,000. This is only about one sixth of the modeled revenue. Therefore, the adjustments cannot be viewed as a calibration measure to match observed data. There may be a larger problem with toll road forecasts in the SANDAG

---

9 SANDAG 2008, p. 82.

10 Calculated from model outputs provided by SANDAG.

11 http://www.91expresslanes.com/learnabout/trafficrevenue.asp

region. In 2010, the South Bay Expressway filed for bankruptcy because traffic volumes have only been about one third of projections.\textsuperscript{13}

SANDAG is not modeling HOT lanes with any accuracy. While HOT lanes are intended to serve HOV customers first, and HOT customers second, up to a maximum desired volume to maintain high-speed traffic flow, the SANDAG model allows unlimited usage of the HOT lanes by both groups. Therefore the HOT lanes become almost as congested as the general purpose lanes in the model, and the small travel time savings (generally less than one minute) require high VOTs for users to choose them. As discussed above, SANDAG's assumptions about increases in carpooling and vanpooling are “off model.” In the model, the performance of added HOT lanes is almost indistinguishable from adding general purpose lanes.

Questions about the SANDAG Travel Demand Model

I have reviewed the documentation which has been provided to us by SANDAG on the Regional Travel Model. We understand that we have been provided with whatever documentation is available. However, the SANDAG model documentation\textsuperscript{14} leaves many questions about the Regional Travel Model unanswered.

Interregional Commute Model

1) What are the county-to-county outputs of the Interregional Commute Model for both the base year and for 2035?

2) How well do the base year numbers match Census journey to work data?

Growth Forecast Inputs

3) The documentation describes “12 external zones ... used to represent travel between the San Diego region and other areas, such as Riverside County, Orange County, and Mexico” (p. 62). What are based and future assumptions regarding the volume and trip types for external-to-external, internal-to-external, and external-to-internal trips? Specially, what are the number of person trips and/or vehicle trips for each trip type for each year, and how were these numbers (and in particular, the growth rates) determined?

Trip Generation

4) The documentation describes the trip generation structure (p. 71-73) but does not include production and attraction coefficients. What are the coefficients?

5) The 2005 Peer Review panel concluded: “trip attractions should be based on the number of employees for most land use types.”\textsuperscript{15} The documentation states: “acre-based forecasts ...are subject to less uncertainty than employment forecasts” (p. 73). However, SANDAG's Urban Development Model is really allocating employees which are then translated into acres (p. 49). So aren't the employment numbers really more certain than acreage numbers?

6) How is higher-density land use modeled using this acres methodology – i.e. when a smaller number of acres is expected to generate the same amount of trips?

7) The Peer Review panel recommended: “modifying home based production rates to use households and persons rather than structure type” and” HBW demographic stratifications by, for example, income or auto ownership.” Have any of these changes been implemented.


\textsuperscript{15} U.S. DOT Volpe Center. “Report on Findings of the Peer Review Panel of the San Diego Association of Governments Travel Demand Model”, 2005
8) The documentation describes how attractions are balanced to productions (p. 73). What are the balancing multipliers for each trip type for the base and future model years?

**Trip Distribution**

9) The Peer Review report states: “For trip distribution, the panel recommended that the model carry over the market segmentation from trip generation, at least for the work trip purpose. It also felt that the model should run all trip purposes to convergence.” Have any of these changes been made?

10) What are the parameters of the gamma function for each trip type? These parameters should normally be included in model documentation, but were not.

11) What are all the K factors used (providing full details concerning the value and the range of zone pairs)? These factors should normally be included in model documentation, but were not.

12) How well does the final trip length distribution fit observed data for each trip type (provide trip length distributions for both model and data)?

**Mode Choice**

13) The Peer Review panel “was uncomfortable with the dramatic forecasted increase in transit ridership,” given the nature of planned transit improvements. Has this concern been addressed? If so, how?

14) Is the mode choice model applied to only interzonal trips or to both interzonal and intrazonal trips? In particular, are non-motorized intrazonal trips modeled?

15) To what extent are land use form variables including the 3 Ds – density, diversity and design – incorporated into the mode choice model?

16) What are all the mode choice model coefficients and constants for all trip types, modes and income groups?

17) The values of time implied in Table 20 (p. 83) are extraordinarily different by income group, e.g. $2.10 for “low” home-based work trips vs. $50.40 for “high” income (both in 1999$). Have these values been peer reviewed? Have they been approved by FTA for New Starts analyses? Were they derived from statistical analysis of existing data, or were they chosen through some other methodology?

18) What is the cause for the extremely low value of time for “low” income travelers a primary cause for the strong transit response (+123 percent ridership) for the future pricing-only scenario recently submitted to the CARB? What portion of this increase comes from each of the three income groups?
19) The value of time coefficients were modified from those estimated. One of the justifications given is that otherwise the model forecast “too few peak period managed lane trips” (p. 82). However, examination of base year model outputs shows that the model with the final coefficients greatly overestimates toll usage. If the high value of time is not calibrated to base year toll usage, what is it calibrated to?

20) We understand that transfer time is modeled as equivalent to 3 times in-vehicle time. Is it correct that transfer time for the “high” income group is $151 (1999$) or about $197 in 2010? Is this figure applied to the Coaster Connection shuttles?

21) In general, transfer time is calculated at half the headway (p. 75). What are the service assumptions for the express buses with transfers to connecting routes at HOT lane in-line stations? Doesn’t the extremely high values placed on transfer time for “high” income residents severely limit modeled ridership on these routes? And are timed transfers modeled to take into account actual transfer time?

22) Are the transit trip tables completely determined by the procedures described in the documentation (road and transit skims, distribution including K factors, and the mode choice model coefficients and constants) or are there other procedures or adjustments in mode choice that are not published in the documentation?

23) What mode choice validation statistics were developed – for entire area, subarea, and/or transit route?

24) Why are 2035 RTP HOT lanes modeled tolls lower per mile than base year tolls? Wouldn’t higher tolls be justified and also needed to balance toll demand with available non-HOV capacity?

25) According to the documentation provided, for those variables for which we have coefficients, the ratio among coefficients for In-vehicle travel time, wait time, access to transit time, and transfer time are identical across the three income groups. The market research conducted by MTDB in 2000 suggested that different groups place different relative values on these variables. Furthermore, since the ratios are generally whole numbers (or simple fractions), it does not appear that the variables have been individually tested and calibrated for each income group. Can you confirm this understanding?

Highway Assignment

26) How is the feedback process implemented, i.e. how many feedback iterations are there and how are the final values traffic volumes and times calculated, e.g. is the Method of Successive Averages (MSA) used?

27) The model uses multi-class assignment. What are the classes and how are they segmented? Are different income groups segmented? If so, is segmentation for all trip types or only for some trip types? Are “toll” users (from mode choice) forced to choose toll roads in the model even if the
toll roads offer little or no time savings? What about HOV trips from mode choice – are they always assigned to managed lanes?

28) Is there any capacity constraint that prevents managed lanes from becoming overly congested with a combination of HOV and toll traffic? And if there isn’t, what happens in the model, i.e. will HOV traffic or toll traffic or both be diverted from managed lane links?

29) How do congested managed lanes affect distribution and mode choice through the model feedback process? In particular, if the managed lanes modeled as congested are not much faster than general purpose lanes in the model, does this limit the attractiveness of HOV and Toll in the mode choice model?

30) What are the base year assignment validation statistics including percent error by functional class and Root Mean Squared Error (RMSE)?

**Post-assignment Processing**

31) The Peer Review panel “expressed concern about the post-processing volume adjustment procedures.” Have these concerns been addressed? If so, how?

32) The documentation states: “procedures simulate optimal managed lane operation by: (1) shifting traffic from over-capacity main freeway lanes to adjacent managed lanes that have excess capacity; and (2) shifting traffic from over-capacity managed lanes to adjacent freeway main lanes” (p. 95). How much traffic is moved? How much do the modeled speeds change from the speeds in the feedback structure of the travel demand model? What are the total vehicle hours of travel (VHT) by functional class (with managed lanes separated) both before and after post-processing for both the base and future RTP scenarios?

33) In previous models, calibration factors were applied among major divisions of the region to better match transit outputs to observed numbers. The documentation that was provided to us does not explain how transit mode calibrations are currently performed, nor does it provide a table of calibration factors. Can we please be supplied with these?
March 9, 2011

Via E-mail

Honorable Jerome Stocks and Members of
the SANDAG Board
401 B Street
San Diego, CA 92101
E-Mail: webmaster@sandag.org

Re: March 11, 2011 Board Meeting, Agenda Item 2 - Transportation and Land Use Modeling: Current Practice and Future Trends

Dear Honorable Stocks and Members of the Board:

On behalf of the Cleveland National Forest Foundation (CNFF), we submit this letter to supplement the information SANDAG staff has provided to the Board with regard to SANDAG’s transportation and land use modeling. We have reviewed SANDAG’s travel demand modeling files that underlie analyses of the 2050 Regional Transportation Plan (RTP) scenarios and have identified serious deficiencies that render the modeling useless for evaluating future transit ridership. SANDAG’s modeling grossly underestimates the attractiveness of transit for the vast majority of travelers in 2050. As a result, since the modeling does not accurately forecast transit ridership in 2050, SANDAG will be hesitant to allocate funding to transit facilities. This situation is a death knoll for transit in the region. Reduced transit funding leads to inferior quality transit service which, in turn, leads to low transit ridership.

CNFF has long recognized the importance of SANDAG’s travel demand modeling in RTP decision-making. Consequently, CNFF retained an independent expert in transportation modeling to review the 2050 RTP modeling files to evaluate their ability to accurately reflect future travel demand. A brief summary of this analysis, prepared by Smart Mobility, Inc. is set forth below. A full copy of the analysis and the credentials of Smart Mobility’s principal, Norm Marshall, are attached.
I. The Importance of Accurate Assumptions.

SANDAG’s March 11, 2011 Agenda Report provides an informative overview of SANDAG’s transportation modeling process. What it omits, however, are details relating to land use and travel assumptions that necessary provide the backbone for transportation modeling. Accurate assumptions are a critical part of the modeling process. Without reliable data, the results of the modeling process have little meaning and do not reflect the real world. Smart Mobility’s analysis shows that invalid assumptions were used in the 2050 RTP modeling, and consequently the modeling results are highly skewed and do not reflect reality.

A. SANDAG’s Modeling Does Not Take Into Account the Quality of Transit Service.

SANDAG’s modeling does not take into account the quality of transit service and therefore forecasts exceptionally low transit ridership in 2050. As Smart Mobility explains, the SANDAG model grossly exaggerates the importance of income in transit choice and therefore forecasts that less than 4% of “high” income travelers will ride transit in 2050 regardless of the quality of transit service. In contrast, the SANDAG model shows that about 37% of “low” income travelers will ride transit. Actual transit ridership figures from other urbanized California regions show that transit ridership increases as the quality of transit facilities increase, regardless of income level. For example, in San Francisco County, the current transit work trip shares are 29.5% for “high” income and 38.9% for “low” income. By not taking into account the fact that higher quality transit serving the San Diego region will attract middle and upper income travelers, the model cannot possibly predict future travel behavior.

In effect therefore, SANDAG’s modeled 2050 transit ridership is much more about the population assumed than it is about the quality of transit service provided. “Low” income residents are assumed to use transit at high levels regardless of the quality of service provided. “High” income residents will not use the service even if it is high quality. As the population does not change across scenarios, ridership does not change across scenarios. Therefore SANDAG’s current modeling is fatally flawed because it does not account for transit ridership variation based on the quality of service provided.

B. SANDAG’s Modeling Fails to Incorporate Land Use Feedback.

SANDAG’s 2050 model assumes that the pattern of future land is identical across scenarios. In other words, the region’s land use in 2050 is expected to be identical
regardless of whether the region chooses to invest in highways or transit. This assumption belies common sense and is simply wrong. Mixed-use walkable land use achieves large vehicle miles traveled (VMT) reductions through a combination of walk trips, short auto trips, and transit trips. Transit investments are necessary to encourage and focus such development in ideal locations. Such “development-oriented transit” is being increasingly used across the country as a powerful planning tool. In contrast, extending and widening high-speed highways propagates sprawling land use development. Any credible long-range transportation planning process must consider the vast differences in future land use that will result from transit facility investments in comparison to highway investments.

II. SANDAG Must Rely on Accurate Transportation and Land Use Assumptions and Educate the Board Accordingly.

We commend staff for educating the Board on the 2050 RTP modeling protocol. However, if the Board is to make truly informed decisions about the future of transportation for the region, it must also be fully educated about the travel patterns and behavioral data that provide the basis for modeling. These assumptions are perhaps the most critical components of the RTP modeling process. If the 2050 RTP modeling runs do not reflect reality – and Smart Mobility’s evaluation demonstrates that they do not – SANDAG must revise its model to reflect accurate assumptions. Inasmuch as travel demand modeling directly informs the environmental analysis (e.g., number of vehicular trips and the amount of regional VMT and greenhouse gas emissions), it is imperative that new modeling -- with accurate assumptions -- be conducted prior to preparation of the 2050 RTP environmental impact report.

Very truly yours,

SHUTE, MIHALY & WEINBERGER LLP

Laurel L. Impett, AICP, Urban Planner

Attachments

cc: Clint Daniels (cdan@sandag.org)
Duncan McFetridge, CNFF
Memorandum

To: Duncan McFetridge, CNFF
From: Norm Marshall
Subject: Deficiencies in SANDAG’s transit modeling
Date: March 7, 2011

I have examined SANDAG’s travel demand modeling files\(^1\) that underlie analyses of SANDAG’s 2050 scenarios. I have found that the model has such serious deficiencies that it is useless for modeling future transit ridership. These deficiencies include:

- significantly underestimating the number of transit nonwork trips,
- significantly exaggerating the importance of income in transit choice so that modeled transit ridership in 2050 is severely depressed, and
- not considering the different impacts of transit and highway investments on future land use patterns.

The SANDAG model substantially underestimates the number of transit nonwork trips. It inflates the number of transit work trips to compensate for this problem, but does so by exaggerating the number of transit work trips made by “low” income households (by almost a factor of three). Even worse, these problems are then projected to 2050 when the SANDAG model assumes that 73% of all trips will be made by “high” income residents (due to optimistic economic assumptions). Despite large investments in transit in the RTP “Hybrid” scenario, the SANDAG model forecasts only a 3.7% transit work trip share for the “high” income group vs. 36.6% for the low income group. In other regions with good transit service, the income gap is much smaller. For example, in San Francisco County, the current transit work trip shares are 29.5% for “high” income and 38.9% for “low” income.

Therefore the SANDAG model grossly underestimates the attractiveness of transit to the vast majority of future travelers. “Low” income residents are assumed to use transit at high levels regardless of the quality of service provided. “High” income residents are assumed to not use the service even if it is high quality. As the population doesn’t change across scenarios, ridership does not change across scenarios. This makes the model useless for evaluating future transit alternatives.

In addition, the SANDAG scenarios assume that the pattern of future land is identical across scenarios, i.e. that a “Highway Emphasis” scenario will produce the same future land use pattern as a “Transit Emphasis” scenario will. This is wrong. Mixed use walkable land use achieves large VMT reductions through a combination of walk trips, short auto trips, and transit trips. Transit investments are necessary to encourage and focus such development in ideal locations. Such “Development-Oriented Transit” is being increasingly used across the United States as a powerful planning tool. In contrast, extending and widening high-speed highways propagates sprawl. Any credible long-range transportation planning process must consider the great differences in future land use that will result from transit investments vs. highway investments.

\(^1\) Modeling files related to the current 2050 scenario analyses developed as part of the 2050 RTP process and provided by SANDAG in December 2010.
SANDAG’s 2050 RTP Scenarios Vary Widely in Funding for Transit Service

The Minutes of SANDAG’s Board of Directors meeting state:

On December 17, 2010, SANDAG’s Board of Directors accepted the recommendation of the Transportation Committee to accept the Hybrid Scenario as the preferred Revenue Constrained Transportation Network Scenario for use in developing the Draft 2050 Regional Transportation Plan (RTP) to be circulated in 2011. The Hybrid Scenario is designed to maximize transit system enhancements, integrate biking and walking elements, promote transportation demand management and transportation system management, and meet greenhouse gas emissions reduction targets. (www.sandag.org, meetingid_2554_12347.pdf).

The Hybrid Scenario along with four other 2050 “build” scenarios plus a no-build scenario were summarized in an agenda document for the December 10, 2010 Transportation Committee. The December 10, 2010 Transportation Committee agenda package (meetingid_2573_1210.pdf) included detailed information about the 2050 RTP alternatives including project lists and estimated capital costs. As shown in the figure below, transit capital costs vary widely across the alternatives, with the capital investment in the adopted Hybrid Scenario being almost $5 billion greater than for the Fusion Scenario.

Note: High Speed Rail and other unconstrained projects are identical across all scenarios.
SANDAG’s 2050 RTP Scenarios Vary Very Little in Estimated Ridership or Vehicle Miles Traveled (VMT)

In contrast to the wide variation in transit investment assumed, the SANDAG regional travel demand model estimates little difference in 2050 transit ridership.

There is even less sensitivity between RTP scenarios in Vehicle Miles Traveled (VMT)

---

### Modeled 2050 Transit Ridership

**SANDAG 2050 Scenarios**

<table>
<thead>
<tr>
<th>Modeled 2050 Transit Ridership</th>
<th>SANDAG 2050 Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thousands/weekday</td>
<td>Transit nonwork trips</td>
</tr>
<tr>
<td></td>
<td>Transit work trips</td>
</tr>
</tbody>
</table>

### Vehicle Miles Traveled (VMT) per Person per Weekday

**SANDAG 2050 Scenarios**

<table>
<thead>
<tr>
<th>Vehicle Miles Traveled (VMT) per Person per Weekday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit</td>
</tr>
<tr>
<td>25</td>
</tr>
</tbody>
</table>
This Insensitivity of Transit Ridership to Transit Service is Inconsistent with Both Common Sense and Other Scenario Analyses in Both the SANDAG Region and Other Regions

In 1998, SANDAG found transit ridership could be increased greatly and VMT decreased greatly with “Transit-Centered” and “City-Centered” scenarios.²

SANDAG’s failure to build on the 1998 scenario process has been cited as a planning failure:

“...several of the MPO sponsors did not connect the outcome of their scenario planning project to their regular regional transportation planning process (e.g., San Diego Association of Governments 1998)... a failure to connect one governmental function (visioning/scenario planning) with another (transportation planning and funding).”³

In contrast, in its award-winning Blueprint, the Sacramento Area Council of Governments (SACOG), the metropolitan planning organization for the Sacramento region has adopted a plan that is calculated to reduce future VMT by 26% relative to the 2050 Base Case Scenario.⁴

The insensitivity of transit ridership in the most recent (2050) SANDAG RTP scenario analyses does not reflect the real world, but rather is evidence of serious deficiencies in the SANDAG model. Some of these deficiencies are documented in the following sections.

Deficiency #1: SANDAG Model Overestimates Share of Transit Trips that Are Work Trips

SANDAG conducted an extensive onboard transit survey in 2009 (published in 2010). The share of work trips for each transit submode is shown in the figure below. Using the annual ridership numbers for each submode, the overall share of regional transit trips that are work trips is 30.7%.

As shown in the figures below, the SANDAG travel demand model estimates a much higher 47.1% of total transit trips as work trips for the base year 2008 (extracted from model files provided by SANDAG). As is discussed below, this problem extends into the 2050 scenario analyses.
Deficiency #2: SANDAG Model Overestimates the Transit Share for “Low”-Income Travelers and Underestimates the Transit Share for “High”-Income Travelers.

SANDAG divides the population into three income groups based on household income expressed in 1999 dollars: “low” less than $30,000 per year, “middle” $30,000 - $60,000 per year, and “high” more than $60,000 per year. The model base year is 2008. In 2008 dollars, the cutoffs are equivalent to $38,770 and $77,540. “High” income suggests a small exclusive group, but in the SANDAG model, more than half of all trips (i.e., trips by all modes (auto, transit, bicycle and pedestrian) are made by “high” income residents in the 2008 base year. In 2050, “high” income residents are projected to be making 73% of all trips. In contrast, in 2050, the “low” income group is projected to be making only 9% of all trips.

The large share of trips made by “high” income residents in the model is primarily due to assumptions about current and future income. There also is some evidence that the SANDAG model may be overestimating the extent to which “high” income residents make more trips than other residents.
The SANDAG model assumes that the decision to use transit is highly dependent on income and will continue to be in 2050. In regions where transit service is limited and few people use it, most transit riders have low incomes, and are sometimes described by planners as “transit-dependent. In regions with extensive, high-quality transit service, there is a high level of transit usage across all income groups. The figure below compares 2005-2009 U.S. Census American Community Survey (ACS) data for work trip share by worker earnings across three California counties.

In San Diego County, existing transit shares are low, especially for higher income workers. In Alameda County, the transit share for high income workers is almost as high as for low income workers. In San Francisco County, the transit work trip share is greater than 30% in every income group.
In the SANDAG model, income is defined as household income. In the ACS data, income is defined by annual worker earnings. In order to compare the transit shares between the SANDAG model and the ACS data, the ACS data have been grouped so that there is the same proportion of work trips as in the SANDAG model. For example, in the ACS data for San Diego County, 19% of the workers surveyed earn less than $15,000/year. Similarly, the SANDAG model has 19% of work trips made by workers in “low” income households. As shown in the figure below, the SANDAG model grossly overestimates the current transit work trip shares for “low” and “middle” income residents. This is the underlying cause behind the model’s overestimating the share of transit trips that are work trips (discussed above.)
SANDAG modelers have made total modeled transit trips approximately equal total observed transit trips. However, in this case, they are trying to make two wrongs equal a right. As discussed above, the model underestimates the number of transit nonwork trips. It inflates the number of transit work trips to compensate for this problem, but does so by exaggerating the number of transit work trips made by “low” income households (by almost a factor of three). Even worse, these problems are then projected to 2050 when the SANDAG model assumes that 73% of all trips will be made by “high” income residents (due to optimistic economic assumptions). Despite large investments in transit in the Hybrid scenario, the SANDAG model forecasts only a 3.7% transit work trip share for the “high” income group vs. 36.6% for the low income group. In other regions with good transit service, the income gap is much smaller. For example, in San Francisco County, the current transit work trip shares are 29.5% for “high” income and 38.9% for “low” income.
The SANDAG model grossly underestimates the number of future work transit trips by “high” income workers in 2050 RTP scenarios with high-quality transit services (including the Hybrid scenario). It also grossly underestimates the number of future nonwork transit trips by all income groups, with the share in 2050 for “high” income residents being ludicrously small at 0.2%.

The exaggerated share of current transit ridership that is assigned to “low” income work trips has been projected into the future. Since there are projected to be few “low” income trips made, there is an upper bound to future modeled transit ridership. In effect, modeled future transit ridership is much more about the population assumed than it is about the future transit service provided. “Low” income residents are assumed to use transit at high levels regardless of the quality of service provided. “High” income residents will not use the service even if it is high quality. As the population doesn’t change across scenarios, ridership does not change across scenarios. Therefore the SANDAG modeling does not account for transit ridership variation based on the quality of service provided.

Given all of these problems, the current SANDAG model is useless for modeling future transit ridership.
Deficiency #3: SANDAG Fails to Incorporate Land Use Feedback

The SANDAG scenarios assume that the pattern of future land is identical across scenarios, i.e. that a “Highway Emphasis” scenario will produce the same future land use pattern as a “Transit Emphasis” scenario will. This is wrong, and is an additional major factor in the vehicle miles traveled (VMT) insensitivity discussed above.

Mixed use walkable land use achieves large VMT reductions through a combination of walk trips, short auto trips, and transit trips. Transit investments necessary to encourage and focus such development in ideal locations. Such “Development-Oriented Transit” is being increasingly used across the United States as a powerful planning tool. In contrast, extending and widening high-speed highways propagates sprawl. The figure below shows how VMT per person per year is affected by the land use form (from Vision California).

Any serious long-range scenario process must consider the great differences in future land use that will result from transit investments vs. highway investments.
Resume

NORMAN L. MARSHALL, PRINCIPAL
nmarshall@smartmobility.com

EDUCATION:
Master of Science in Engineering Sciences, Dartmouth College, Hanover, NH, 1982
Bachelor of Science in Mathematics, Worcester Polytechnic Institute, Worcester, MA, 1977

PROFESSIONAL EXPERIENCE:
Norm Marshall helped found Smart Mobility, Inc. in 2001. Prior to this, he was at Resource Systems Group, Inc. for 14 years where he developed a national practice in travel demand modeling. He specializes in analyzing the relationships between the built environment and travel behavior, and doing planning that coordinates multi-modal transportation with land use and community needs.

Regional Land Use/Transportation Scenario Planning
Climate Plan (California statewide) – Assisted large coalition of groups in reviewing and participating in the target setting process required by Senate Bill 375 and administered by the California Air Resources Board to reduce future greenhouse gas emissions through land use measures and other regional initiatives. This work including reviewing the transportation models of the four largest Metropolitan Planning Organizations (MPOs) and less detailed analyses of the planning efforts of the smaller MPOs.

Chicago Metropolis Plan and Chicago Metropolis Freight Plan (6-county region)— developed alternative transportation scenarios, made enhancements in the regional travel demand model, and used the enhanced model to evaluate alternative scenarios including development of alternative regional transit concepts. Developed multi-class assignment model and used it to analyze freight alternatives including congestion pricing and other peak shifting strategies. Chicago Metropolis 2020 was awarded the Daniel Burnham Award for regional planning in 2004 by the American Planning Association, based in part on this work.

Envision Central Texas Vision (5-county region)—implemented many enhancements in regional model including multiple time periods, feedback from congestion to trip distribution and mode choice, new life style trip production rates, auto availability model sensitive to urban design variables, non-motorized trip model sensitive to urban design variables, and mode choice model sensitive to urban design variables and with higher values of time (more accurate for “choice” riders). Analyzed set land use/transportation scenarios including developing transit concepts to match the different land use scenarios.

Mid-Ohio Regional Planning Commission Regional Growth Strategy (7-county Columbus region)—developed alternative future land use scenarios and calculated performance measures for use in a large public regional visioning project.

Baltimore Vision 2030—working with the Baltimore Metropolitan Council and the Baltimore Regional Partnership, increased regional travel demand model’s sensitivity to land use and transportation infrastructure. Enhanced model was used to test alternative land use and transportation scenarios including different levels of public transit.

Chittenden County (2060 Land use and Transportation Vision Burlington Vermont region) – leading extensive public visioning project as part of MPO’s long-range transportation plan update.

Burlington (Vermont ) Transportation Plan – Leading team developing Transportation Plan focused on supporting increased population and employment without increases in traffic by focusing investments and policies on transit, walking, biking and Transportation Demand Management.
**Transit Planning**

Regional Transportation Authority (Chicago) and Chicago Metropolis 2020 – evaluating alternative 2020 and 2030 system-wide transit scenarios including deterioration and enhance/expand under alternative land use and energy pricing assumptions in support of initiatives for increased public funding.

Capital Metropolitan Transportation Authority (Austin, TX) Transit Vision – analyzed the regional effects of implementing the transit vision in concert with an aggressive transit-oriented development plan developed by Calthorpe Associates. Transit vision includes commuter rail and BRT.

Bus Rapid Transit for Northern Virginia HOT Lanes (Breakthrough Technologies, Inc and Environmental Defense) – analyzed alternative Bus Rapid Transit (BRT) strategies for proposed privately-developing High Occupancy Toll lanes on I-95 and I-495 (Capital Beltway) including different service alternatives (point-to-point services, trunk lines intersecting connecting routes at in-line stations, and hybrid).

Central Ohio Transportation Authority (Columbus) – analyzed the regional effects of implementing a rail vision plan on transit-oriented development potential and possible regional benefits that would result.

Essex (VT) Commuter Rail Environmental Assessment (Vermont Agency of Transportation and Chittenden County Metropolitan Planning Organization) – estimated transit ridership for commuter rail and enhanced bus scenarios, as well as traffic volumes.

Georgia Intercity Rail Plan (Georgia DOT) – developed statewide travel demand model for the Georgia Department of Transportation including auto, air, bus and rail modes. Work included estimating travel demand and mode split models, and building the Departments ARC/INFO database for a model running with a GIS user interface.

**Roadway Corridor Planning**

Hudson River Crossing Study (Capital District Transportation Committee and NYSDOT) – Analyzing long term capacity needs for Hudson River bridges which a special focus on the I-90 Patroon Island Bridge where a microsimulation VISSIM model was developed and applied.

State Routes 5 & 92 Scoping Phase (NYSDOT) —evaluated TSM, TDM, transit and highway widening alternatives for the New York State Department of Transportation using local and national data, and a linkage between a regional network model and a detailed subarea CORSIM model.

Twin Cities Minnesota Area and Corridor Studies (MinnDOT) — improved regional demand model to better match observed traffic volumes, particularly in suburban growth areas. Applied enhanced model in a series of subarea and corridor studies.

**Developing Regional Transportation Model**

Pease Area Transportation and Air Quality Planning (New Hampshire DOT) — developed an integrated land use allocation, transportation, and air quality model for a three-county New Hampshire and Maine seacoast region that covers two New Hampshire MPOs, the Seacoast MPO and the Salem-Plaistow MPO.

Syracuse Intermodal Model (Syracuse Metropolitan Transportation Council) — developed custom trip generation, trip distribution, and mode split models for the Syracuse Metropolitan Transportation Council. All of the new models were developed on a person-trip basis, with the trip distribution model and mode split models based on one estimated logit model formulation.

Portland Area Comprehensive Travel Study (Portland Area Comprehensive Transportation Study) — Travel Demand Model Upgrade — enhanced the Portland Maine regional model (TRIPS software). Estimated person-based trip generation and distribution, and a mode split model including drive alone, shared ride, bus, and walk/bike modes.
Research

Obesity and the Built Environment (National Institutes of Health and Robert Wood Johnston Foundation) – Working with the Dartmouth Medical School to study the influence of local land use on middle school students in Vermont and New Hampshire, with a focus on physical activity and obesity.

The Future of Transportation Modeling (New Jersey DOT)—Member of Advisory Board on project for State of New Jersey researching trends and directions and making recommendations for future practice.

Trip Generation Characteristics of Multi-Use Development (Florida DOT)—estimated internal vehicle trips, internal pedestrian trips, and trip-making characteristics of residents at large multi-use developments in Fort Lauderdale, Florida.

Improved Transportation Models for the Future—assisted Sandia National Laboratories in developing a prototype model of the future linking ARC/INFO to the EMME/2 Albuquerque model and adding a land use allocation model and auto ownership model including alternative vehicle types.

Critiques

C-470 (Denver region) – Reviewed express toll lane proposal for Douglas County, Colorado and prepared reports on operations, safety, finances, and alternatives.

Intercounty Connector (Maryland) – Reviewed proposed toll road and modeled alternatives with different combinations of roadway capacity, transit capacity (both on and off Intercounty Connector) and pricing.

Foothills South Toll Road (Orange County, CA) – Reviewed modeling of proposed toll road.

I-93 Widening (New Hampshire) – Reviewed Environment Impact Statement and modeling, with a particular focus on induced travel and secondary impacts, and also a detailed look at transit potential in the corridor.

Stillwater Bridge – Participated in 4-person expert panel assembled by Minnesota DOT to review modeling of proposed replacement bridge in Stillwater, with special attention to land use, induced travel, pricing, and transit use.

Ohio River Bridges Projects—Reviewed Environmental Impact Statement for proposed new freeway bridge east of Louisville Kentucky for River Fields, a local land trust and historic preservation not-for-profit organization.

PUBLICATIONS AND PRESENTATIONS (partial list)

Understanding the Transportation Models and Asking the Right Questions. Lead presenter on national Webinar put on by the Surface Policy Planning Partnership (STTP) and the Center for Neighborhood Technologies (CNT) with partial funding by the Federal Transit Administration, 2007.


Chicago Metropolitan 2020: the Business Community Develops an Integrated Land Use/Transportation Plan with Lucinda Gibson, P.E., Frank Beal and John Fregonese, presented at the Institute of Transportation Engineers Technical Conference on Transportation’s Role in Successful Communities, Fort Lauderdale FL, March 2003.

Evidence of Induced Travel with Bill Cowart, presented in association with the Ninth Session of the Commission on Sustainable Development, United Nations, New York City, April 2001.


Subarea Modeling with a Regional Model and CORSIM” with K. Kaliski, presented at Seventh National Transportation Research Board Conference on the Application of Transportation Planning Methods, Boston MA, May 1999.


Multimodal Statewide Travel Demand Modeling Within a GIS with S. Lawe, Transportation Research Board Annual Meeting, Washington DC: January 1996.

Linking a GIS and a Statewide Transportation Planning Model, with L. Barbour and Judith LaFavor, Urban and Regional Information Systems Association (URISA) Annual Conference, San Antonio, TX, July 1995.


Linking a GIS and a Statewide Transportation Planning Model, with L. Barbour and Judith LaFavor, Urban and Regional Information Systems Association (URISA) Annual Conference, San Antonio, TX, July 1995.


MEMBERSHIPS/AFFILIATIONS
Member, Institute of Transportation Engineers
Individual Affiliate, Transportation Research Board
Member, American Planning Association
Member, Congress for the New Urbanism
This Relates to Agenda Item #2, Board of Directors, March 11, 2011

3/25/2011
Countywide Survey Sept. 2010
Countywide Survey Sept. 2010

**Figure 9**

Voters Support for More Compact and Transit-Friendly Development

Would you support or oppose locating more homes and jobs closer together and near transit in your community, providing people with more choices to shorten commute times and reduce pollution?

- **Total Support**
  - Strongly: 46%
  - Somewhat: 27%
  - Total: 73%

- **Total Oppose**
  - Strongly: 12%
  - Somewhat: 10%
  - Total: 22%

- **Don't Know**
  - 5%
April 12, 2011

Laurel L. Impett
Shute, Mihaly & Weinberger LLP
396 Hayes Street
San Francisco, CA 94102

Dear Ms. Impett:


The following is SANDAG’s response to Shute, Mihaly & Weinberger LLP’s letter to the SANDAG Board of Directors on behalf of the Cleveland National Forest Foundation dated March 9, 2011. The response letter summarizes and makes reference to its attachment which is the memorandum from Norm Marshall to Duncan McFetridge dated March 7, 2011, thus SANDAG’s responses are to the points presented in that memorandum. The points being addressed are excerpts from the memorandum and are shown in bold font; page numbers refer to the pagination of the original memorandum.

The insensitivity of transit ridership in the most recent (2050) SANDAG RTP scenario analyses does not reflect the real world, but rather is evidence of serious deficiencies in the SANDAG model. Some of these deficiencies are documented in the following sections. (pg. 4)

Mr. Marshall has not provided a solid foundation for his claims, because he uses selective bits of information rather than a comprehensive review of the data. Mr. Marshall has chosen isolated examples from data that support his position; however, his choice of data reveals an incomplete understanding of the latest economic recession and appears to ignore the unique travel characteristics of the San Diego region. The SANDAG transportation model follows the guidelines and principles set forth in the California Transportation Commission Regional Transportation Plan (RTP) Guidelines and is consistent with state-of-the-practice transportation modeling in the United States. The following discussion highlights some of the deficiencies in Mr. Marshall’s analysis.

In 1998, SANDAG found transit ridership could be increased greatly and VMT decreased greatly with “Transit-Centered” and “City-Centered” scenarios. Reference: SANDAG, Region 2020: 2020 Cities/County Forecast Land Use Alternatives, 1998 – reported in
SANDAG’s failure to build on the 1998 scenario process has been cited as a planning failure: “… several of the MPO sponsors did not connect the outcome of their scenario planning project to their regular regional transportation planning process (e.g., San Diego Association of Governments 1998)... a failure to connect one governmental function (visioning/scenario planning) with another (transportation planning and funding).” Reference: Bartholomew, Keith. Land use-transportation scenario planning: promise and reality. Transportation, 2006. (pg. 4)

Mr. Marshall’s analysis relies on the Series 9 forecast from 1998. The draft Series 12 Regional Growth Forecast (accepted by the SANDAG Board of Directors for planning purposes in February 2010) is more focused on smart growth development and matching housing near jobs than the Series 9 forecast. For example, the Series 9 Forecast estimated the projected 400,000 new housing units by 2020 would require 600,000 acres of development. The draft Series 12 Forecast also projects approximately 400,000 new housing units by 2050, but the local land use plans and policies can accommodate the new development on 300,000 acres. The land area needed for new development in the most recent forecast will be cut in half from previous estimates.

The greatest strength of the draft Series 12 Forecast is its reliance on existing plans and policies, and it enjoys unanimous support from the local jurisdictions. The Series 9 Forecast, on the other hand, relied on significant density assumptions not supported by the local jurisdictions at the time and with no local commitment to implement the density changes over time.

In conjunction with aggressive land use planning by the local jurisdictions, the transportation networks included in the current analysis of the draft 2050 RTP indicate transit ridership will double by 2050. In addition, the 2020 RTP (April 2000) projected daily vehicle miles traveled (VMT) for 2020 at approximately 99.7 million miles; current projections for 2020 in the draft 2050 RTP indicate VMT would be approximately 86.3 million miles, a 13 percent reduction in projected VMT for 2020 from the 2020 RTP projection.

Finally, Mr. Marshall leaves out one key finding from Mr. Bartholomew’s article discussing the SANDAG planning process. Mr. Bartholomew states, “Most [metropolitan planning organizations] lack zoning and planning authority, a key component to implementing many of the regional strategies tested in scenario planning projects.”

While SANDAG does not have land use authority, SANDAG is investing actively in smart growth planning and implementation through the Smart Growth Incentive Program (SGIP). The SGIP is funded by the local half-cent sales tax program known as TransNet, which was approved by San Diego County voters in 2004.

The goal of the TransNet SGIP is to fund public infrastructure projects and planning activities that will facilitate compact, mixed-use development focused around public transit, and that will increase housing and transportation choices. The projects funded under this program serve as models for how modest investments in infrastructure and planning can make smart growth an asset to communities around the region.

SANDAG conducted an extensive onboard transit survey in 2009 (published in 2010)...Using the annual ridership numbers for each submode, the overall share of regional transit trips that are work trips is 30.7%....The SANDAG travel demand model estimates a much higher 47.1% of total transit trips as work trips for the base year 2008...this problem extends into the 2050 scenario analyses. (pg. 5)

Mr. Marshall relies on only one data point for comparison and overestimates the impacts of the current economic recession on future transportation trends. Looking back over the last 20 years, commute trips have historically made up 45 percent of transit trips in the San Diego region.\(^2\) The SANDAG model relies on numerous data sources and analyzes long-term trends for its modeling assumptions, tempering isolated historical events like the recent economic recession. Unemployment due to the recent economic recession would logically result in fewer transit commuters, because there are fewer commuters in general. The number of unemployed workers grew more than 50 percent between 2008 and 2009.\(^3\)

**SANDAG Model Overestimates the Transit Share for “Low”-Income Travelers and Underestimates the Transit Share for “High”-Income travelers.** (pg. 6) [and supporting arguments (pgs. 6-8)]

According to SANDAG estimates, the median household income in 2008 is $51,920 (in 1999 $). The median income is near the top of the medium income category, so nearly half of the households in the San Diego region fall within the high income category. According to the 2006 San Diego Household Travel Behavior Survey, high income households generate nearly 20 percent more person trips than medium income households and nearly 50 percent more person trips than low income households. Since high income households make up nearly half of San Diego households and high income households generate more trips, it is completely reasonable to assume that high income households would make more than half of the trips in 2008.

The mode choice module of the SANDAG transportation model relies on trips by income classification to identify the appropriate travel mode for each trip. Income directly affects household auto ownership, and transit usage is inversely correlated to auto availability in the household.\(^4,5\)

**SANDAG modelers have made total modeled transit trips approximately equal total observed transit trips. However, in this case, they are trying to make two wrongs equal a right. As discussed above, the model underestimates the number of transit nonwork trips. It inflates the number of transit work trips to compensate for this problem, but does so by exaggerating the number of transit work trips made by “low” income households (by almost a factor of three).** (pg. 9)

---

\(^2\) Results of the Onboard Transit Passenger Survey for the San Diego Region. San Diego Association of Governments. March 2004. Figure 9, Page 16.

\(^3\) Annual Average Unemployment Rate. San Diego Workforce Partnership.


As discussed earlier, the SANDAG transportation model correctly accounts for commute and non-work transit trips.

Mr. Marshall relies again on only one data source, in this case the American Community Survey (ACS), on which to base his transportation assumptions. In many places around the United States, relying on the ACS would be completely reasonable; however, in the San Diego region, residents of Mexico, who are not included in the ACS, have a significant impact on the San Diego transit system. In 2008, the Trolley station at the San Ysidro Port of Entry had more than 12,000 average weekday boardings, the most transit boardings anywhere in the region.

Mr. Marshall also does not account for the ACS margin of error in his memorandum. The margin of error for transit riders by income class from the ACS referred to in the memorandum is +/- 10 percent. Therefore, the low income commuter mode share for transit may be anywhere between 0 and 16 percent according to the U.S. Census Bureau. When travelers from Mexico are added to the ACS data, it is completely reasonable that low income commuter mode share for transit is 16 percent.

Mr. Marshall also states the SANDAG model exaggerates the number of transit work trips made by low income households. According to the 2009 On-Board Survey, more than 60 percent of transit trips are made by people from low income households, while low income households comprise only 25 percent of the total households in the region. These trip-making patterns are consistent with the results of the 2003 On Board Transit Survey as well.

…the SANDAG modeling does not account for transit ridership variation based on the quality of service provided. (pg. 10)

The SANDAG model includes five mode choices for transit: local bus, express bus, bus rapid transit, light rail (trolley), and commuter (heavy) rail. The desirability of each of these modes is based on a utility function reflecting a traveler’s perception of the quality of service, travel times, wait times, proximity to service, and other factors. During the Mid-Coast Alternatives Evaluation process for the Federal Transit Administration (FTA) New Starts program, SANDAG compared light rail alternatives to bus rapid transit and expanded express bus service in the Mid-Coast corridor. The SANDAG model and alternatives analysis were reviewed extensively by the FTA to ensure adequate sensitivity to transit mode alternatives. In November 2010, the FTA certified the technical methods of the SANDAG Mid-Coast alternatives analysis.

In conjunction with focused land use planning by the local jurisdictions, the draft 2050 RTP transportation network (which includes significant enhancements in transit quality of service) indicate transit ridership would double by 2050. The types of quality of service improvements included in the draft 2050 RTP include increasing transit frequency, adding new express bus and rail services, and new Trolley and streetcar expansion.

The SANDAG scenarios assume that the pattern of future land [use] is identical across scenarios, i.e. that a “Highway Emphasis” scenario will produce the same future land use pattern as a “Transit Emphasis” scenario will. This is wrong, and is an additional major factor in the vehicle miles traveled (VMT) insensitivity discussed above. (pg. 11)

In February 2010, the SANDAG Board of Directors accepted the 2050 Regional Growth Forecast for planning purposes. SANDAG staff held the accepted land use constant to evaluate each
transportation alternative on the basis of its transportation impacts. After the Board of Directors in December 2010 selected the preferred transportation network alternative for the draft 2050 RTP, SANDAG staff ran a comprehensive and iterative land use and transportation model that accounts for the relationship between transportation and land use in the draft 2050 RTP.

**Given all of these problems, the current SANDAG model is useless for modeling future transit ridership. (pg. 10)**

As described above, Mr. Marshall's critique of the SANDAG modeling framework fails to use a comprehensive review of data to support his claims. His choice of data reveals an incomplete understanding of the latest economic recession and appears to ignore the unique travel characteristics of the San Diego region.

Please direct technical questions to Kurt Kroninger, Technical Services Director, at 619-699-6996 or kkr@sandag.org.

Sincerely,

JEROME STOCKS
Chair, Board of Directors

JS/KK
May 23, 2011

Ms. Elyse W. Lowe
Move San Diego
P.O. Box 87588
San Diego, CA 92138

Dear Ms. Lowe:

SUBJECT: Letter dated March 10, 2011, re: March 11, Item No. 2 on the Board Agenda

Thank you for your letter regarding the March 11, 2011, SANDAG Board Policy meeting that discussed transportation modeling to support the 2050 Regional Transportation Plan. This letter responds to some key points raised in your letter.

The SANDAG transportation modeling tools have been extensively peer reviewed and are considered to be among the premier in the United States. They are based on solid empirical evidence and decades of research and development by transportation professionals and SANDAG staff. The SANDAG transportation model meets all federal requirements for analyzing the scenarios and policies considered in the development of the Draft 2050 Regional Transportation Plan (2050 RTP).

The responses below address some of your points regarding the SANDAG planning and modeling process. The points being addressed are excerpts from your letter and are shown in **bold font**; page numbers refer to the pagination of the original letter.

[Generally accepted SANDAG] biases include ... only low income people will use transit in any significant numbers (particularly buses). (pg.2)

SANDAG has developed a plan for transit that is inclusive of the entire region. The Draft 2050 RTP includes nearly $90 billion (year of expenditure) for transit investment, 46% of the total as compared to 31% for transit in the 2030 RTP. This includes investments in bus rapid transit (BRT) along the Interstate 15 (I-15) corridor (partially paid for by revenues from the managed lanes), increased local bus frequency in the urban core, and significant investment in more than 125 miles of new light-rail. Under this investment
plan, SANDAG expects transit mode share will double in every income group over the life of this plan.

[Generally accepted SANDAG] biases include ... freeway expansion will not increase regional vehicle miles traveled (VMT). (pg. 2)

SANDAG acknowledges that there is a relationship between expansion of the regional transportation system and vehicle miles traveled (VMT). Providing people transportation choices, however, also assists in reducing greenhouse gas emissions. Each of the alternatives explored in the Draft 2050 RTP would reduce greenhouse gas emissions compared to the no-build alternative by providing residents and visitors with competitive transit, biking, and walking alternatives to driving to work, school, and recreation.

[Generally accepted SANDAG] biases include ... buses are less attractive than railcars. (pg. 2)

In developing the Draft 2050 RTP, the focus is on providing the most efficient mode of transportation to meet the needs of the San Diego region. In some cases along the I-15 and in the South Bay, the transit improvements include BRT services. In other areas throughout the urban core, Mid-Coast corridor, and SPRINTER corridor, the most efficient transportation was determined to be light-rail. During the development of the Draft 2050 RTP, numerous route and mode alternatives were explored to find the combination that provides the most benefits. As an example, SANDAG engaged in a multi-year process with Federal Transit Administration and local stakeholders to identify the best mode, and route for the Mid-Coast corridor light-rail extension to University Towne Centre.

HOT lanes – Inaccurate modeling by grossly overestimating current and future toll lane usage and revenues. (pg. 1)

The SANDAG transportation model is a regional aggregate model, and it is not used to forecast specific toll revenues for any particular corridor. Toll revenue estimates are based on experience to date from the I-15 FasTrak® program, given expected increases in usage of the I-15 Managed Lanes over time. In summary, the SANDAG transportation model and planning process are well-suited for the type of analysis conducted to support the Draft 2050 RTP.

Your letter closes with several requests. Namely, you request transparency and a model that is useable and understandable, and that all current and future model files are made open to the public without a Board policy decision required for each public information request. SANDAG held a Board Policy meeting in March 2011, during which SANDAG staff explained the SANDAG model to the Board of Directors and the public in an attempt to make it useable and understandable. SANDAG has continued the process of updating and enhancing the model and its documentation for the RTP and public review process. Intermediate level documentation is available in the Regional...
Models section of the SANDAG Web site at www.sandag.org/models. Model validation and sensitivity reports will be posted later this spring. Final detailed technical model documentation will be posted prior to adoption of the 2050 RTP this fall.

As you know, SANDAG considers elements of its current model to be source code and therefore not a public record. SANDAG provides responses to public records requests without approval from the Board of Directors, and has responded to the six requests for public records that have come from Move San Diego over the past two years. SANDAG has offered to provide Move San Diego with a license for its source code under the same terms it has provided to others, but Move San Diego has not agreed to those terms.

Thank you again for taking the time to provide your feedback and suggestions. If you have any questions or additional comments, please feel free to contact Kurt Kroninger, Technical Services Director, at (619) 699-6996 or kkr@sandag.org.

Sincerely,

JEROME STOCKS  
Chair, Board of Directors

JS/KKR/kca