

PROPOSAL TO DEVELOP MODEL IMPROVEMENTS
FOR THE EIGHT SAN JOAQUIN VALLEY MPO
TRAFFIC MODELS TO MEET THE
REQUIREMENTS OF SB 375

SUBMITTED BY:

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OVERVIEW

Fehr & Peers and its partner firms Dowling Associates, RSG, Inc., and Cambridge Systematics, together with a select team of experts in advanced transportation/land use and air quality planning (Mark Bradley, John Bowman, Michael McCoy and Nathaniel Roth, Colby Brown of Citilabs and Cari Anderson) are pleased to present this proposal to update and improve each of the eight San Joaquin Valley MPO transportation models to meet the requirements of SB 375 and related policies and guidelines and make the Valley a leader in comprehensive travel demand forecasting.

Our team has followed the development of this work for more than a year and has been engaged in detailing what needs to be done in creating the Scope of Work in the RFP during the past six months on an extremely compressed schedule. We are uniquely prepared, fully committed and extremely eager to work with the Valley to upgrade its models and modeling processes.

Members of the Fehr & Peers team have been active participants in delineating the specific modeling policies in support of SB 375 and Regional Transportation Plans. Our proposed Project Manager, Jerry Walters, served on the Air Resources Board (ARB) Regional Targets Advisory Committee (RTAC) for SB 375. Staff from Fehr & Peers Dowling Associates and Cambridge Systematics actively participated in the development of California Transportation Commission (CTC) revisions to the Regional Transportation Plan (RTP) Guidelines, and Ron West of Cambridge Systematics coordinates the California Inter-Agency Modeling Forum. In other words, we are not only aware of the changes in state modeling procedures, we have helped shape them. Fehr & Peers is also developing SB 375 compliant tools for other MPOs throughout the state and related tools and protocols for Caltrans, the California Air Pollution Control Officers Association (CAPCOA), and the American Public Transit Association (APTA).

Fehr & Peers and Dowling Associates combine deep expertise in travel demand modeling with unmatched experience developing and using the Valley's current models. This intimate familiarity with the current state of modeling in the Valley, together with an in-depth understanding of the requirements and expectations of SB 375, makes us uniquely qualified to implement the eight-county Model Improvement Plan (MIP).

Cambridge Systematics (CS) has joined the team to assist in development of a three-county model in the north Valley. CS is internationally known for innovative modeling projects and has conducted a series of technical meetings over a seven-month time frame to implement new RTP modeling guidelines to reflect SB 375 requirements. Along with Fehr & Peers they are helping to implement the 2010/2011 California Household Travel Survey. They developed the High-Speed rail version of the Statewide Travel Model, and led all phases of the San Joaquin Valley Goods Movement Study.

RSG, Inc. will lead the effort to implement the Valley's first Activity-Based models. RSG staff has performed innovative modeling for many MPOs and states and is developing national modeling guidelines under NEPA for the U.S. Environmental Protection Agency (EPA). Maren Outwater, RSG's



designated Project Manager, has a broad array of national experience with both conventional four-step trip-based modeling and advanced modeling techniques including sophisticated mode choice models and Activity-based Modeling. Maren also managed development of interregional freight models for the San Joaquin Valley and interregional passenger models for the High Speed Rail Authority. She also knows well the role of an MPO modeler, having served for many years as head of the Puget Sound Regional Council of Government's modeling division (Seattle region). RSG will work with John Bowman and Mark Bradley, architects of numerous Activity-Based models throughout the United States, including the AB model that most closely addressing the objectives of the San Joaquin Valley, the Sacramento regions SB375-compliant SACSIM model for SACOG.

Michael McCoy and Nathaniel Roth have led land use and transportation modeling for blueprint planning throughout the state, the San Joaquin Valley Blueprint, the Caltrans Interregional Blueprint, and Blueprints for many other California MPOs. They have also just completed development of the new California Statewide Transportation Model and are about to undertake development of a new eight-county valley-wide model under contract to the California Air Resources Board. Mike is a ranking expert on regional, interregional and statewide modeling, and Nate is a recognized expert on the application of GIS to land use and transportation planning. They will advise on interregional modeling issues and on land use issues, including emerging opportunities to utilize fine-grained land use data (e.g., parcel-based) in land use planning. The land use component of transportation planning is extremely important and represents an area where there are great opportunities for innovation and improvement. Fehr & Peers is currently working with Mike, Nate and other UC Davis staff on research projects aimed at producing better data and tools for integrated land use and transportation planning at the MPO level.

Colby Brown, Citilabs' Regional Director for North America, will advise on land use modeling issues. In addition to managing a number of model development and training projects, he has overseen the KernCOG Cube Land Pilot Study, which developed a proof-of-concept Cube Land model for Kern COG integrated with UPlan, and the COG's Cube Voyager travel demand model and SB375-compliant 4D's processor. .

Cari Anderson brings a strong technical and management background on developing air quality plans, analyzing control measures, and conducting transportation conformity analyses. Ms. Anderson also has extensive experience in interagency coordination, and providing staff training on air quality modeling, including air quality planning and coordination services to the San Joaquin Valley Regional Planning Agencies. She will advise on air quality conformity issues.

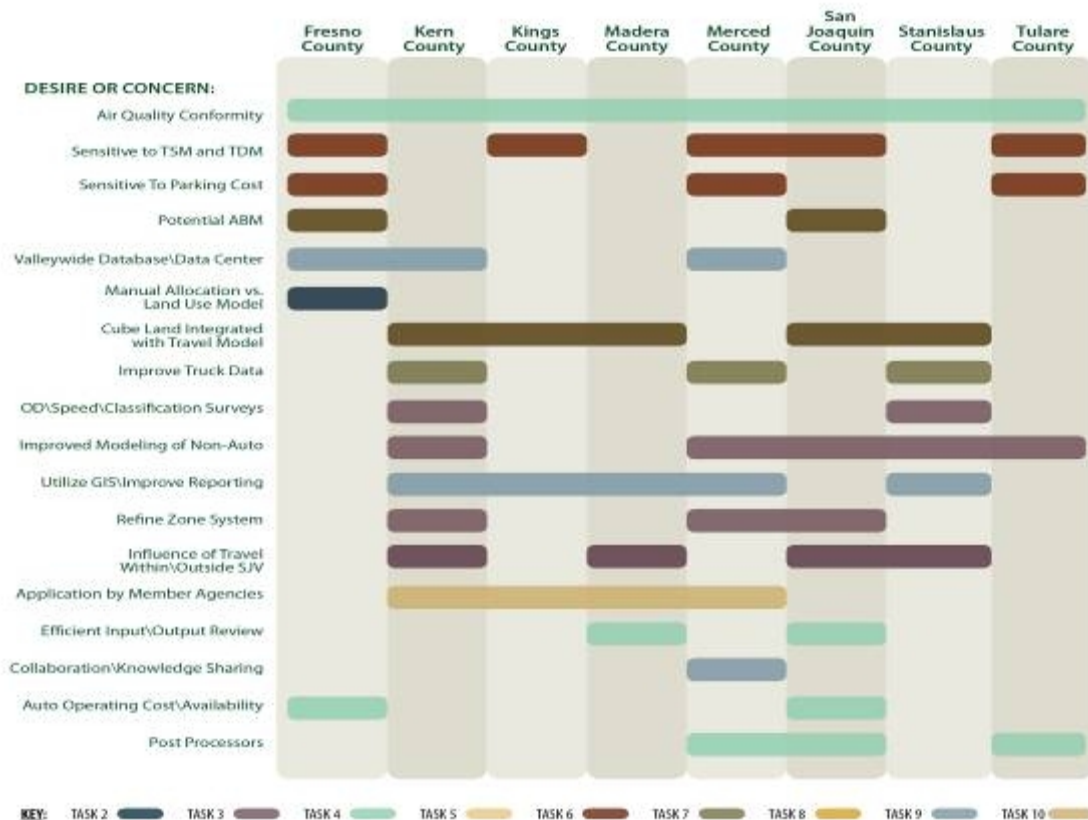
In summation, the Fehr & Peers team possesses comprehensive expertise and thorough knowledge of the improvements that are needed and desired for the models of the San Joaquin Valley (see figure next page listing modeling desires and concerns we have heard). We are thoroughly familiar with:

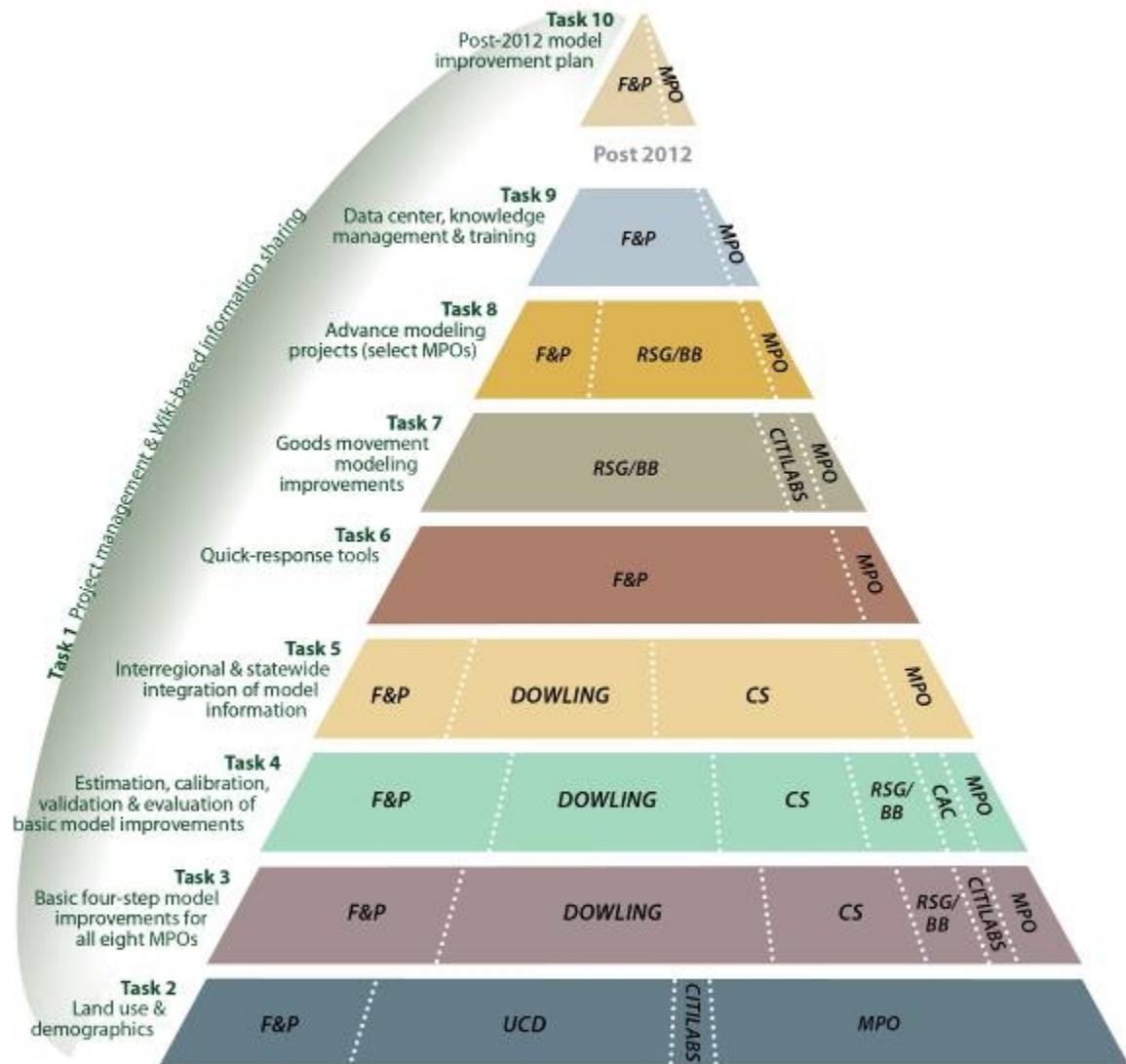
- The Valley's current constellation of models and modelers
- SB 375 and its modeling requirements and expectations



- The requirements of the 2010 Regional Transportation Plan (RTP) guidelines
- Current travel forecasting model trends and innovations such as Activity Based Modeling
- Interregional traffic flows and modeling, including freight movement
- Land use data needs, possibilities; data availability and options
- Mode choice modeling
- Measuring social equity effects of transportation and land use policies
- Integrating new cost elements, such as parking charges and potential road tolls
- Integrating transportation Best Management Practices into the modeling process

Though we represent multiple firms, the assembled team has worked together on many occasions, most notably this past year on the scoping for this project. We also share a singular commitment to improving the Valley's models, not only for the sake of SB 375 but for the Valley's own forecasting needs. We look forward to once again working closely with the Valley transportation modeling community.





DETAILED WORK PLAN

The detailed work plan comprehensively addressed tasks in the RFP as a starting point and incorporates the unique approaches and specialized tools to accomplish the goals of the San Joaquin Valley Model Improvement Plan (MIP) within the compressed schedule of 16 months. This will be possible thanks to the decades of Valley-wide modeling experience and the diverse and deep expertise of the Fehr & Peers team.

The project has been divided into ten major tasks, described in detail immediately below and shown graphically on the preceding page. The detailed task descriptions include descriptions of key deliverables, which are also listed separately following the task descriptions. A schedule detailing the task timelines and showing concurrent tasks follows the listing of key deliverables.

TASK 1 – PROJECT MANAGEMENT AND WIKI-BASED INFORMATION SHARING

Task 1.1 – Technical Coordination – Monthly Webinars

Monthly webinars will be held to present overall study progress and status of Valley-wide modeling tasks such as interregional forecasting and transferable scripts. These webinars will also provide opportunities to review and discuss progress on parallel projects and multi-jurisdictional efforts such as CUBE Land and geo-database deployment, northern counties' interregional O/D survey and activity based model development. Webinars represent a very efficient manner of conveying verbal, written and graphic communication, and will allow the team and clients to respond to new issues in a timely manner.

Task 1.2 – Administrative Coordination – Monthly Progress Reports

Monthly progress reports will be submitted to the MIP project manager accompanied by conference calls as needed. Each report will itemize tasks completed, percentage of budget spent and achievement of overall study objectives. They will also contain a summary of obstacles and issues, recommended solution or course of action, and a time-line for resolution.

Task 1.3 – On-Line Project Tracking Data – Wiki and Portal

Project coordination will be facilitated by a web-based project management center continually available to all project participants. The center will contain all relevant project status and coordination information including schedules and progress reports and other status-tracking information as well as copies of all memoranda and webinar material. It will also contain a searchable wiki for information



about the project and serve as a collaboration portal for running discussions, data sharing and collaborative document development by both the consultant team and the MPO modelers.

Deliverables

- Minutes of webinar meetings
- Monthly Progress Reports
- Updates to Project wiki (as needed)

TASK 2 – LAND USE AND DEMOGRAPHICS

Land Use

Land use classification is an essential process required for planning and for the development of travel models, land use models, and other analytic tools that support planning. The endless possible combinations of lot size, building size, building type, and land and building use must be classified into a limited number of meaningful categories that have value in describing or predicting location choice, economic activity, or travel behavior.

All planning and modeling processes in the Valley will be considered with regard to land use and building data that is either required or can provide a benefit to these processes. An overarching aim will be the creation of consistent land use categorization appropriate for both trip and activity models. Although the designation of land use categories and activity codes will be identical for all MPOs, categories with data will vary by MPO.

Task 2.1 – Review Land Use Specification Needs

The different planning and modeling needs will be reviewed to determine what existing data is used and what data might satisfy future processes. We will assess how aggregate and/or disaggregate forms of similar data might serve different purposes while maintaining consistency across planning and modeling processes across MPOs and at the statewide level.

Specifically, we will:

- List models and planning activities to be supported
- Inventory existing data categories and content from these
- Review similarities and dissimilarities of existing data and summarize in a brief technical memo



Task 2.2 – Finalize Land Use Specifications

Preliminary draft land use and building type specifications will be completed in consultation with all team members and submitted to interested representatives of all client planning and modeling processes in the Valley for review. One or more telephone conferences will be held to explain the specifications and receive feedback. A second draft will be circulated for further input from the team and the clients, and the finalized data and specifications for land use and building type classifications will be documented.

Demographics and Employment

Demographic and employment data are critical components to any land use, transportation, or integrated land use-transportation modeling effort. An appropriately detailed description of the people that live and work in each geographic zone is essential to understanding their travel behavior and in predicting the region's evolution over time. There are many sources for this data but no single source provides all needed data; this necessitates the merging of data from multiple sources and verifying its compatibility with other datasets being used. Further, most models make use of only a subset of all needed demographic data in a reclassified form. Coordinating these demands on the demographic and employment data is needed to make the best use of complementary datasets and to enable a single data store to provide standardized data to all users.

Task 2.3 – Review Needs and Draft Demographic and Employment Data Specifications

We will work with representatives of all planning and modeling processes being considered by the consultant team to review planning and modeling needs for demographic and employment data. The data sources that best satisfy planning and modeling processes as well as how aggregate and/or disaggregate forms of similar data might serve different purposes while maintaining consistency across planning and modeling processes will be determined.

Specifically we will

- List models and planning activities to be supported
- Inventory existing data categories and content from these models and activities
- Compare current and potential data and summarize in a brief technical memo

A draft specification memo will be circulated for review and one telephone conference call will be conducted to explain the specifications and receive feedback. The memo will be refined based on input from this call.



Task 2.4 – Finalize Demographic and Employment Data Specifications

A data structure for storing, maintaining, and updating demographic and employment data will be developed that conforms to the specifications outlined by the foregoing subtasks. A relational database with GIS integration will be designed as an implementable data system, enabling the tracking of current demographic data from multiple sources for multiple time periods. Means for building and maintaining and querying demographic and employment data in a relational database with links to GIS will also be defined. The data management system, as developed, will be able to extract summaries of the demographic and employment data conforming to the data standards established in Task #4 in a consistent and easily repeatable manner.

Task 2.5 – Land Use Forecasting and Modeling

We will work with each MPO to update and fully correct a parcel GIS layer for each county, including populating the parcel layer with current land use, housing and employment information. We will prepare the data in such a way as to be ready for utilization in “workshop ready” land use evaluation tools such as I-Place³s or other quick-response tools that will enable local and regional agencies to obtain a fast assessment of potential land and transportation system changes at the subregional scale.

As part of this task, we will coordinate with MPO staff to prepare land use data and processes to assist in implementation of a land use forecasting model. The current manual land use forecast allocation procedures will be updated to be sensitive to policies. This method will utilize UPLAN, I-Place³s, PECAS, or other parallel projects as appropriate and available.

Deliverables

- Draft Land Use and Demographic/Employment Specifications Memo
- Final Land Use and Demographic/Employment Specifications Memo
- Corrected GIS data files for each MPO including land use and employment data
- Relational database files and online training session on use of the databases

TASK 3 – BASIC FOUR-STEP MODEL IMPROVEMENTS FOR ALL EIGHT MPOS

The goal of the basic model improvements task is to provide each of the eight MPOs with a travel modeling system that can meet the requirements for the 2013 RTP while still providing all of the functions performed by the current travel models including air quality conformity analysis. The basic model improvements are expected to provide most but not all of the required model sensitivities. Once the basic model improvements are implemented, each model will be tested for response to inputs such



as the smart growth development D factors relative to established research, and additional processing steps will be implemented as needed.

The scope of work includes some options for the northern counties of Merced, San Joaquin and Stanislaus. A three-county network and TAZ system will be developed to support the three-county activity-based model (See Task 8.2). Any of the three counties could choose to either upgrade their current models or instead use the three-county network as the basis of a new trip-based four-step model for their 2013 RTP analysis. The maximum efficiency would occur if all three counties choose to use the three-county four-step model in place of their current models. However, one or more of the counties may have concerns about consistency with prior studies or air quality conformity so we are also providing the option to upgrade the existing models as a three-county or as a single-county version as an interim step until the new three-county activity-based model can be adopted for local use.

Several of the MPO models currently include all or portions of adjacent counties. In each case, this scope provides the option to cut each MPO model back to include only its own county. A consistent process for providing external trip inputs at the county lines is described in the section of the scope regarding interregional travel, based on an updated statewide travel model. The interregional methodology has already been successfully used for several of the MPOs which include only their own counties in their travel models.

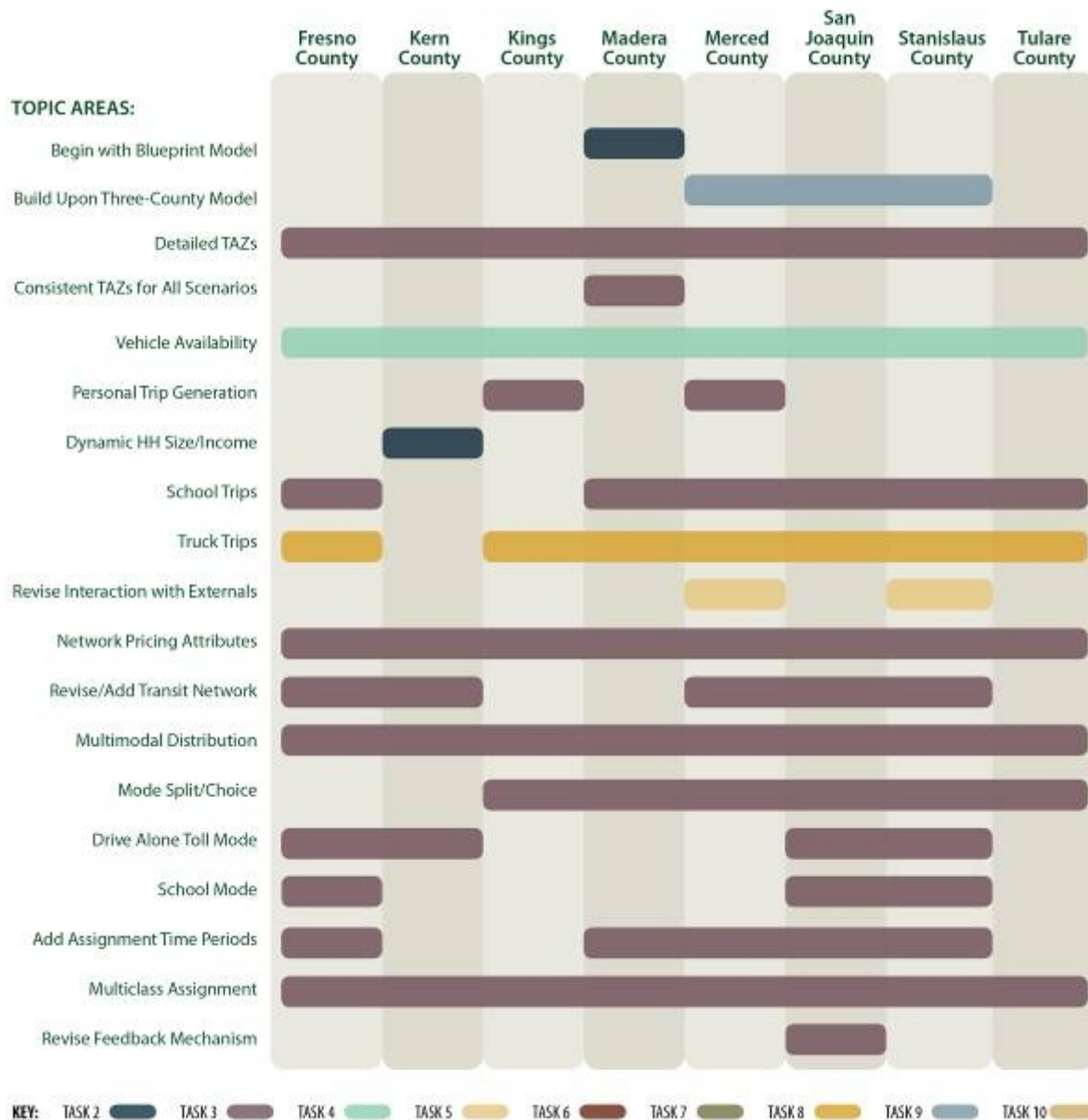
An additional goal of the basic model improvements will be to move toward standardization of model inputs and processes among the eight MPO models. Standardization will enhance the ability of the MPOs to share data and resources, and will also make it easier to develop multi-county models, if needed, for certain studies. It is acknowledged that it will not be possible for the MPOs to create new land use inputs with standardized categories within this time frame and that some models must maintain some or all of their current processes or assumptions in order to be consistent with air quality conformity requirements. However, wherever possible a framework will be set up to move toward standard model procedures.

The most recent RTP modeling files will be used. The implementation of modeling improvements to comply with the requirements of SB 375, the RTAC recommendations and the RTP modeling guidelines will require changes to each step of the modeling process. In addition, we are recommending some “good practice” updates to improve model performance and increase consistency between the eight counties.

The figure on the following page shows the model improvements for each individual MPO. See Work Plan Appendix 1 for a detailed description of improvements by MPO.

These basic model improvements will be validated and calibrated using the current model base year data. Similarly, the improved models will use the current 2020 and 2035 forecasts from the most recent RTPs. The models will be improved and ready for MPO staff to update the base and future land use and transportation systems as part of the next RTP update.





Task 3.1 – Transportation Analysis Zones

The transportation analysis zone (TAZ) system for each model will be reviewed. In consultation with the staff at each MPO, subdivisions of TAZs will be recommended in areas where more sensitivity to pedestrian- and/or transit-oriented development may be required. The appropriate GIS layers will be updated.

The TAZ system for the three-county model will be defined as part of the development of the activity-based model, but is expected to be largely consistent with the current TAZ systems for each of the three counties (Merced, San Joaquin, and Stanislaus).

Deliverable

Updated TAZ system and GIS mapping for each MPO and for the three-county model area

Task 3.2 – Land Use Inputs

It will eventually be desirable for all of the MPOs to use common categorization of land use inputs for the travel models (for example, common definitions of “medium-high residential” or “health services employment”). Due to the accelerated schedule for model improvements this scope assumes each MPO model will retain its current land use categories, validation year inventory and future land use forecasts. Equivalencies between General Plans and other land use categories will be developed. The consultant team will work with each MPO staff to determine the best way to split land uses for each analysis year into the subdivided TAZs. A framework for standardized land use categories will be set up for each MPO, and the current land use categories in each MPO will be adapted to the standard categories to the extent possible. MPO staff will be trained on how to collect and maintain the land use inputs, as discussed in Task 2.

Deliverable:

Updated land use tables with subdivided TAZs for each MPO

Task 3.3 – Transportation Networks

The transportation network tasks include a review and update of the road and transit networks (if applicable) for each of the MPO models. In addition, combined road and transit networks will be developed for the three northern counties of San Joaquin, Stanislaus and Merced.

Single County Networks

The road and transit (in Fresno and Kern counties) networks for each of the individual MPO models will be reviewed for internal consistency and accuracy of connectivity, speed and lane inputs. The



consultant team will also work with staff of each MPO to determine if additional road classifications are desirable. Capacity estimates can be improved by classifying roads as urban versus rural and by adding classifications for terrain (level, rolling, mountainous) for rural roads.

The networks will be edited to provide connections for added TAZs in each county.

Additional classification fields will be added to each model road network as necessary to account for HOV lanes, tolls and truck routes or restrictions.

In consultation with MPOs, links can also be added to represent bicycle or pedestrian routes and connections which are not available to motorized traffic such as pedestrian overpasses. These non-motorized links would not be part of the network used for traffic assignment, but would be available when evaluating connectivity for transit, bicycle and walk trips.

Deliverables

Updated road and transit networks for the base validation year and 2020 and 2035 forecast years for each of the MPO models

Three County Networks

Road Network. Following the checks on the individual MPO networks, a three-county road network will be created including San Joaquin, Stanislaus and Merced counties. The consultant team will work with the three counties to gain consensus on a common road classification coding system for all three counties. The road network will initially be created by joining the three existing networks (using only the San Joaquin County portion of the SJCCOG model network).

Transit Network. Information on fixed-route transit service within the three northern counties will be obtained from MPO staff and the transit operators. The fixed-route bus transit service will be coded onto the three-county road network. The service will include express bus routes to adjacent areas such as Alameda County. Separate coding will be added for the ACE commuter rail and Amtrak service.

Deliverables

Road and transit networks for the base validation year (2005/2006) and 2020 and 2035 forecast years for the three northern counties

Task 3.4 – Vehicle Availability

The updated models must be more responsive to household vehicle availability and the planning factors that can influence vehicle ownership such as accessibility to destinations using transit or walking. Several of the MPO models classify households by vehicle ownership, but they use a fixed percentage in each TAZ based on 2000 Census information and the percentages do not change in response to land use or transportation changes.



A modeling step will be added to each MPO model to split households into three categories: 0 vehicles available, 1 vehicle available or 2 or more vehicles available. The vehicle availability model will be based on demographic factors such as household sizes and incomes as well as accessibility factors such as destinations within a certain travel time by transit or walking as well as travel costs.

The initial estimation for the vehicle availability models will be part of the overall estimation work used to develop the two activity-based models (see Task 8.2). Depending on the outcomes of that estimation work the vehicle ownership models for the individual MPOs will be adapted directly from the model developed for the activity-based model, or a simplified form will be adapted which does not rely on the same level of data disaggregation.

For MPOs which do not currently include all of the required demographic or accessibility data (such as transit networks), the inputs to the vehicle availability model will be estimated using 2000 Census data (for information such as household incomes) and manual or GIS-based assignment of accessibility values for each TAZ (e.g., proximity to transit service).

The vehicle availability models will be tested for each MPO by comparing the outputs to household vehicle ownership data in the 2000 Census. Summary validation statistics will be presented as part of the model documentation.

Deliverables

Vehicle availability model for each MPO, additional demographic and accessibility TAZ values required for input to the vehicle availability model, validation summary.

Task 3.5 – Trip Generation

The trip generation components of each MPO model will be updated but in a way that maintains consistency with the current overall trip generation values due to the requirements of air quality conformity and the accelerated schedule for model improvements. The key required changes are:

- Ensure that all models generate person trips instead of vehicle trips
- Add sensitivity to smart growth (“Ds” e.g., Density, Diversity, Design)
- Add trip purposes for better analysis of short trips and truck trips

Four of the MPO models (Fresno, Kern, Stanislaus, and Tulare) already use survey-based person trip generation rates. The trip generation components of the Kings, Madera and Merced county models will be converted from vehicle trip generation to person trip generation using survey-based person/vehicle ratios by trip purpose (this was already done for the Blueprint version of the Madera County model). The person trip rates will also be confirmed for the San Joaquin County model.



Trip purposes for each model will be combined and/or disaggregated, with a goal of achieving as much consistency as possible for the trip purposes included in each MPO model.

- It is recommended that the two categories of non-home-based trip purposes (Work-Other and Other-Other) contained in several models be combined as they have not provided a great deal of additional model accuracy, and the separation of truck trips (described below) is more important.
- It is recommended that each model include a Home-School trip purpose (currently included in Home-Other in most models) because the mode choice and peaking characteristics of school trips are very different from other non-work trips.
- A separate Home-Shop trip purpose is recommended to better identify the outcomes of land use strategies involving retail.
- Truck trips in all of the models except Kern are basically included in the non-home-based trip category. The San Joaquin Valley Goods Movement study identified existing and future levels of truck activity in each county and it is recommended that one or more separate trip purposes for truck trips (such as long-distance and local) be added to each model, with corresponding reductions in the non-home-based trip generation.
- It may be beneficial to consider different stratifications of households in addition to or in place of single-family and multi-family. Other variables may include household size, age of head of household or age stratification of occupants, and income quartiles rather than a single median income for each TAZ. It would be desirable to update the models to apply these additional characteristics after the 2010 census and household survey data become available. However, if any of the demographic characteristics prove to be particularly useful for the 2013 RTP analysis they could be added at this time. It is envisioned that these additional demographic characteristics would initially be input as TAZ attributes (for example, percentage of population under 16 years old) rather than disaggregating the land use inputs.

The primary source for the trip purpose splits (other than the truck purposes) will be the 2000/2001 Statewide Travel Survey that was used for the derivation of trip generation rates for many of the current models. The survey analysis already combined San Joaquin Valley counties to improve the sample size for estimation, so it should be possible to develop consistent trip purpose assumptions for the counties. At a more aggregate level, the survey analysis from the 2000/2001 can be compared to the more recent 2008 National Household Transportation Survey (NHTS) to identify potential recent changes in travel



behavior. However, the NHTS has a much lower sample size than the 2000/2001 survey and cannot be used for detailed trip generation rates. Ultimately, the newer 2010 California household travel survey should be used to update assumptions in the travel models, but those data will not be available within the time frame of this model improvement program.

The revised trip generation rates will eventually be tested by comparing the resulting vehicle trips for the base year and future year (following the mode choice step) with prior estimates of vehicle trips. The rates may be adjusted to ensure that total vehicle trips fit within the established limits required for air quality conformity.

Deliverable:

Table of revised trip generation rates for each MPO, comparison of trips for base and future years

Task 3.6 – Trip Distribution

The current gravity model trip distribution process and factors for each existing MPO model will be mostly maintained for consistency. The required revisions are:

- Add friction factors for additional trip purposes
- Ensure that friction factors for non-work trips do not screen out short trips which are likely candidates for non-motorized travel, particularly in models which have only used vehicle trip generation
- Adjust impedance inputs to be based on a composite of travel times by all modes as well as travel costs, instead of just travel time by auto

For models without mode choice components, the composite travel time will be estimated using walk time based on distance and an average of walk and drive time for origin-destination pairs where walk is competitive with auto (this process has been implemented in the Fresno model).

The trip distribution process for each model will be reviewed to ensure that auto terminal times (time to walk to and from a parked car) are included in a consistent way, and that the gravity model is using enough iterations to achieve closure.

Deliverable

Updated trip distribution including additional trip purposes and consideration of multimodal times and costs



Task 3.7 – Mode Choice

The strategy for mode choice varies depending on the current status of the MPO model and the level of improvement required for the RTP guidelines.

MPOs which do not Require Mode Choice Model (Tulare, Kings, Madera, Merced)

Four of the MPOs are classified as Group B or C for the RTP Guidelines and do not require full mode choice models. However, these models still need sensitivity to land use and transportation scenarios which could reduce automobile use. A mode choice factoring process based on manual or GIS-based TAZ inputs will be implemented for these counties. A form of this process has been implemented for the Blueprint studies and in Tulare County.

The factoring process will estimate diversions to non-auto modes based on household survey data and the following criteria:

- Transit trips will be increased above current survey levels based on user-specified transit-oriented development areas and user-specified corridors with improved transit service
- Walk and bicycle trips will be estimated based on survey percentages by distance and trip purpose, so that land use scenarios which bring uses closer together will get higher bike and walk percentages

The user inputs will be a set of TAZ indicators that are input the same way as the land use inputs. The TAZ indicators can also be set using GIS procedures within Cube or ArcGIS.

MPOs which May Implement Mode Choice (San Joaquin, Stanislaus)

San Joaquin and Stanislaus counties are in Group D and are therefore expected to include sensitivity to modal options but not necessarily have a full mode choice model. The consultant team will work with the MPO staff at San Joaquin and Stanislaus counties to determine the best way to implement the mode choice process for each MPO:

- A mode choice factoring process described above for the Group B and C counties, with factors sensitive to proximity of transit service and availability of bike/walk connections, or
- A full mode choice model, based primarily on standard parameters and an existing functional multinomial mode choice model

If either county is interested in using the three-county model as their model for the 2013 RTP cycle, then the mode choice model can be implemented on a three-county level and both counties would use the same model (the mode choice model would then also be available to Merced County). Transit networks for these counties will be developed as part of the network development for the three-county model,



and many demographic inputs will be compiled in support of the three-county activity-based model. If any of the counties prefer to use a subset of the three-county area for their own modeling (just their own county, or just portions of adjacent counties), then the mode choice model would be implemented separately for each MPO.

The full mode choice model will include the following eight modes:

- Drive alone
- Drive alone – pay toll
- Shared ride 2-person
- Shared ride 3+ person
- Transit walk access (potential sub-modes for bus and rail)
- Transit drive access (potential sub-modes for bus and rail)
- Bicycle
- Walk

The mode choice model will use national average coefficients for time and cost, and mode-specific constants will be adjusted for calibration. The calibration will be based on:

- replication of mode shares by trip purpose from the 2000/2001 household travel survey
- replication of work trip mode shares from more recent survey data, if available
- validation of total fixed-route transit ridership in each county based on ridership data provided by the MPOs (not validation to individual lines)

No new parameter estimation is assumed to be necessary for this model update.

It is recommended that the transit level of service inputs use the Voyager PT module to evaluate transit paths, travel times and costs. Citilabs will be consulted to ensure that the PT parameters are set to be appropriate for the types of transit systems available in the San Joaquin Valley.

The resulting vehicle trip totals will be compared to prior versions of each model and adjusted as necessary to ensure consistency with conformity findings.

MPOs with Mode Choice Models (Fresno, Kern)

The existing mode choice models will be expanded to account for additional trip purposes such as school trips in Fresno. A choice will be added for Drive Alone-Pay Toll in preparation for potential road pricing scenarios (there is no available calibration data, so coefficients will be derived from other models). They



will also be checked to ensure that the non-motorized modes are attractive for very short trips, so that the mode choice will be responsive to denser land use patterns.

Deliverable

Updated mode choice sensitivity for each MPO (enhanced mode choice models in two counties, new mode choice model(s) in up to three counties, and mode choice factoring process in remaining counties)

Task 3.8 – Pricing

Presently, three of the four larger county models have some sensitivity to travel costs in addition to travel time: the SJCOG model contains node attributes that enable consideration of increased auto operating costs/parking charges in selected destination zones during trip distribution. Average auto per mile operating costs and parking costs at destination TAZs are used for mode choice analysis in Fresno and Kern models. In Fresno, cost sensitivity is stratified by three vehicle ownership categories, each with different median income levels. StanCOG has funding to develop better mode sensitivity; that separate project may lead to a model more sensitive to costs.

Planned Improvements include:

- Adding network cost attributes for tolls and congestion pricing to all links for models all counties.
- Adding node cost attributes for parking pricing to all links for all models (pricing will initially be set to zero, except where a baseline cost is already established).
- Updating the models' calibration procedures for trip distribution and mode choice to be based on multimodal travel time and cost (including parking costs, tolls and congestion pricing) rather than only auto travel time.

Critical to enhancing the models' price sensitivity will be monetizing values of time (VOT) based on observed behavior in the Valley and elsewhere. The most relevant literature and practice will be reviewed. For example, work trips have a higher VOT than other purposes in most cases. VOT should be lower for mode choice than for route choice (where people are already choosing to drive). In the Seattle region, PSRC recently studied route choices and concluded that VOT was about 75 percent of the wage rate (TMIP, 2008).

Deliverables

Updates link and network cost attributes for the base validation year (2005/2006) and 2020 and 2035 forecast years for each county



Task 3.9 – Trip Assignment

Trip assignment includes traffic assignments and transit assignments.

Traffic Assignment

The traffic assignment process in each model will be reviewed. If appropriate, additional iterations will be recommended along with more stringent closure criteria (the TP+/Voyager defaults allow closure well before traffic volumes have stabilized in a congested network).

Traffic assignments will be converted to a multi-class assignment which separately evaluates and reports the following five vehicle types:

- Drive Alone
- Drive Alone Toll
- Shared Ride 2
- Shared Ride 3+
- Truck

Traffic assignment scripts will also be provided to assign vehicle trips by trip purpose. Existing scripts which compile regional traffic statistics and air quality analysis inputs will be modified to account for the five vehicle classifications.

Transit Assignment

A transit assignment step will be added to the MPO models with new mode choice models. It is recommended that the Voyager PT module be used for the transit assignment step.

3.10 – Feedback Loop

The feedback loop ensures the travel times used as input to trip distribution are consistent with the travel times on the final reported congested road network, as required for air quality conformity analysis. It is recommended that the feedback loop and closure criteria used in many of the San Joaquin Valley models (Fresno, Kern, Kings, and Tulare) be implemented in the remaining models. This loop uses congested travel times from the road network from the latest iteration to recalculate trip distribution (and mode choice if included) for the next iteration. The feedback loop will be adjusted to also provide congested travel times to the vehicle availability model. The oscillations between iterations are dampened using the Method of Successive Iterations. A set of closure criteria for origin-destination travel times and trips is used to determine the number of iterations.



TASK 4 – ESTIMATION, CALIBRATION, VALIDATION, AND EVALUATION OF BASIC MODEL IMPROVEMENTS

Task 4.1 – Model Estimation

The auto availability, mode choice, and related models will start with borrowed parameters and will be estimated and calibrated using the region-specific data from the 2008-9 National Household Travel Survey (NHTS), which included a substantial add-on component for California counties. The fairly limited sample size, particularly for transit and non-motorized trips, will likely preclude the estimation of region-specific mode choice mode coefficients. For those particular parameters and any other key model parameters that cannot be accurately estimated on local data, parameters based on empirical evidence from models estimated using data from other regions such as Sacramento, the Bay Area, and Seattle will be used. Specifically, we will follow recommended model specifications for pricing and congestion effects from the SHRP 2 C04 project, for which team member Mark Bradley was a principal investigator. The SHRP 2 C04 specifications are also being adopted for Sacramento and Jacksonville, the implementation areas for the SHRP 2 C10 study. The team of Bradley, Bowman and RSG are involved in both of these implementations.

The recommended model specifications include values of time that are sensitive to income and vehicle occupancy, as well as other household, person and trip characteristics, and also include peak-spreading model sensitivity to time-of-day pricing. The model will be estimated utilizing the time, cost, and other related information from the updated distribution processes developed as part of Task 3. The model parameters that provide those capabilities will be based on evidence from areas where those types of pricing policies and transit services exist (and/or have been studied using Stated Preference methods). To maximize efficiency, reduce the input data requirements, and ensure the highest level of consistency, these models or simplified versions will be transferred to the trip based models for all eight counties.

Task 4.2 – Model Calibration

In this task, each component of the updated model will be calibrated to ensure that it produces accurate forecasts. Calibration is an iterative process where model settings are adjusted so the output of the model matches observed travel patterns.

Task 4.3 – Model Static Validation

In the static validation tests, we will run the model to ensure that the model output matches available traffic counts and roadway speeds. In addition, the model will be validated across screenlines composed of several roadways to ensure that overall traffic flows are captured. As part of the static validation procedure, elements of the trip generation, trip distribution, and traffic assignment modules may be adjusted. Our goal is to meet or exceed Caltrans and Federal Highway Administration static model validation guidelines.



Examples of static tests may include evaluation of the following:

- trip length frequency by purpose
- average travel times by purpose
- mode split by purpose
- roadway segment model-to-count ratios
- screenline ratios
- model speed versus observed speed
- route assignment
- transit system ridership

Task 4.4 – Model Dynamic Validation

The static validation tests described above ensure that the model can replicate existing traffic counts and speeds. While these tests are useful at confirming that the model can replicate existing conditions, models are generally used to forecast change, which static tests say nothing about. To determine how well the model responds to changes in land use and the transportation network, we will perform a set of dynamic validation tests. Dynamic tests may include testing the changes in the following:

- household location, density, diversity, and other household attributes (income, size, age, auto ownership)
- employment location, density, diversity, and type
- roadway network
- transit service
- parking or other pricing programs travel demand programs

Task 4.5 – Evaluation

Based on the one-on-one interviews and subsequent discussions with the San Joaquin Valley MPO modelers, conformity is a “mega issue” for each of the Valley MPOs. To address this “mega issue”, the following tasks will be performed.

Transportation modeling updates and improvements will be periodically evaluated with respect to their impact on positive conformity demonstrations, which are essential to the continued receipt of federal transportation funding, and current SB 375 baseline emissions and scenario analysis. The comparisons of the previous model to the updated model that will be performed and documented in Task 3 will be used to document and explain potential differences between the model last used for conformity analysis and the models that result from implementing this proposal.



It is assumed that the current two-year update schedule remains in effect in the future, so the 2013 FTIP conformity demonstration will be based on the current transportation models. However, the 2014 RTP with 2013 FTIP Amendment conformity demonstration are anticipated to be based on the transportation modeling updates and improvements completed via this proposal. In addition, ARB staff proposes to re-evaluate the San Joaquin Valley “placeholder” targets for SB 375 in 2012 and establish provisional targets (if appropriate) for possible consideration by ARB in 2014.

The current models include post-processors to prepare data for input into EMFAC for air quality and greenhouse gas emissions analysis, evaluation of project specific trips, and other tasks that MPO staff often performs. We will address outstanding issues with post-processing scripts, spreadsheets, and methods and ensure the functionality of the post-processors remains at least the same as before the model improvements.

Deliverables

Updated:

- Models
- Post-processors, and
- Model Development Reports summarizing the work described in Task 3 and Task 4.

TASK 5 – INTERREGIONAL AND STATEWIDE INTEGRATION OF MODEL INFORMATION

Each of the eight San Joaquin Valley counties currently uses its own estimates of travel growth at the county boundaries and the proportions of through traffic. These forecasts of growth and through trips may be very different, even for adjacent counties, making it difficult to consistently identify interregional travel and possibly consolidate travel forecasts from multiple MPOs. It is recommended to provide regionally consistent travel forecasts at the boundaries of each MPO.

The currently available tool for developing consistent regional travel forecasts is the California Statewide Model overseen by Caltrans headquarters. There is a simple version originally developed in 2003 which has been used (with limited updates) for interregional travel forecasts for several San Joaquin Valley models. There is also a High Speed Rail version completed in 2007 which has been used for High Speed Rail ridership but not for local traffic forecasts.

A new statewide model is being developed by UC Davis using an activity-based model structure integrated with a PECAS land use forecasting model. The calibration to year 2000 conditions should be complete by the end of 2010, and forecast inputs are currently being prepared. When complete, the new statewide model will supersede the existing trip-based versions of the statewide model and should



provide significantly improved forecasts of land use allocations in different regions in response to economic conditions, interregional jobs-housing balance and other issues. The two unknowns are when the travel forecasts will be available for use in the San Joaquin Valley, and how well the new statewide model will represent traffic volumes on important roads at county lines.

The basic model improvements for the 2013 RTP would build on the most applicable available version of the Statewide Model and make short-term enhancements to improve the consistency with local MPOs. Procedures would be provided to integrate the interregional forecasts into each of the eight individual MPO travel models. These procedures would also work with the new integrated activity-based Statewide Model.

Task 5.1 – Implement Interregional Trip Process

A process will be set up to develop interregional trip inputs for each MPO model based on whichever version of the Statewide Model is available. A version of this process is already used for many of the San Joaquin Valley MPOs, but is not completely standardized. With the availability of cordon origin-destination data for the northern counties, a different process based more directly on survey data may be set up for StanCOG.

Each MPO model will use the following inputs from the Statewide Model:

- Base year (2000) and future year (2035) through (XX) vehicle trips between each major county line crossing
- Base year (2000) and future year (2035) external-internal (XI) and internal-external (IX) vehicle trips by trip purpose and production/attraction orientation at each major county line crossing

These inputs are derived by using a subarea select assignment of trips by purpose for each county (or model area if larger than a single county). The subarea process is already set up and in use.

The Statewide Model results are not used directly. The actual starting values for each county cordon are the base validation year traffic counts at the cordon. The 2000 and 2035 Statewide Model values are interpolated to the appropriate base year (for example, 2006 for several of the models) and forecast year (for example, a 2020 interim year forecast). The base year values are used to split the observed traffic counts into external trip components (through trips versus IX/XI, IX/XI by trip purpose and production versus attraction). Growth factors are then calculated from the Statewide Model for the overall cordon volume and for each component. The growth factors are applied to the base year component volumes which in turn add up to the observed traffic counts.

The vehicle trips by purpose are converted to person trips using survey-based vehicle occupancy factors. The IX/XI trips by purpose are then included in the trip distribution process in each MPO model along with trip generators within the county. In effect, each cordon point is treated as if it was a large TAZ on



the edge of the county. A representative distance is used at each cordon to more accurately represent the attractiveness of the cordon relative to internal destinations.

As long as each county uses consistent traffic counts (may vary somewhat depending on the model base year), this process will generate consistent cordon forecasts for each county. By using different growth factors for each trip purpose and production/attraction orientation, the process also allows each MPO model to reflect changes in jobs/housing balance in other regions. For example, if the Statewide Model projects higher job attractions in northern Los Angeles County, the higher gateway attractions on I-5 would be reflected in the Kern County model forecasts.

For StanCOG, the Statewide Model results will be used to update through trip assumptions. However, an alternative process may be used for IX/XI trips. The origin-destination survey would be geoprocessed to obtain a specific matrix of observed trips between cordon points and TAZs within the StanCOG model area. This matrix would be used as the base year IX/XI trips. Forecast trips would be estimated by applying growth factors to the observed base year matrix. The growth factors could be set to be consistent with adjacent MPOs based on the Statewide Model, or could be based primarily on historical growth rates, or some combination.

Deliverable

Updated version of the trip-based Statewide Model for base and forecast years, subarea process for deriving interregional trips for each MPO

Task 5.2 – Interim Update of Statewide Model

In order for any version of the Statewide Model to provide reliable county line traffic forecasts, it must include the latest assumptions for land use and networks in the San Joaquin Valley. The following tasks would provide improved interregional trip estimates from an available trip-based version of the Statewide Model until the new integrated statewide model has been validated and forecasts verified.

- Update TAZ correspondence between Statewide Model and all eight MPO models
- Update land use assumptions in the Statewide Model based on current inputs from MPOs
- Update the work done on the Statewide Model future road network for the San Joaquin Valley Goods Movement Study to current RTPs and to the desired forecast year(s)
- Run each updated land use scenario through the Statewide Model
- Revise gateway procedures of individual MPO travel models as needed to accept consistent inputs from Statewide Model, including separate modeling of truck trips
- Transfer the statewide travel model results for each scenario to the appropriate gateway and through trip inputs for each of the eight county models



Deliverable

Updated version of the trip-based Statewide Model for base and forecast years, subarea process for deriving through and external trips for each MPO

Task 5.3 – Northern Valley Origin-Destination Survey

The purpose of this task is to collect data on interregional travel in the northern three counties (San Joaquin, Stanislaus and Merced). Data collected from these intercept surveys will include information on trip origin/destination, trip purpose, party size (vehicle occupancy) and other useful data needed for model validation and model development. We understand there is particular interest in evaluating the new Statewide Travel Demand Model's forecasts of interregional trips.

Survey data can be collected in a number of different ways and it is useful to describe these methods to help explain why the proposed method was selected. Detailed discussions of various survey methods can be found in Work Plan Appendix 2.

Intercept surveys of interregional travelers will be collected at key locations (rest stops and gas stations) in the three northern counties. This approach is consistent with StanCOG's desired methodology for interregional vehicle data collection. Each approach has specific constraints, whether in regards to effectiveness for specific areas of model validation or model development, cost, logistical hurdles or interagency coordination issues.

Upon official notice to proceed, key Fehr & Peers team members will meet with staff from StanCOG and other agencies for identifying the best approach for completing this task. Among the key decisions are:

- Clearly identify what elements of interregional travel will be addressed, specifically the areas model development and model validation will be addressed under this task;
- Establish data collection locations;
- Determine how many surveys are required;
- Survey instrument development;
- Specific data summaries and other analytic requirements needed for model development and model validation purposes;
- Determination to use a data collection firm to collect surveys; and
- Task schedule.

Traffic counts should be collected during the periods when rest stop interviews are being conducted to allow for proper expansion to the total numbers of vehicles by vehicle class. Combining the surveys with the counts may allow for splitting interregional vehicles by vehicle type, trip purpose, occupancy, as well as origins and destinations.



We will hire a survey data collection firm to administer the surveys and to establish proper protocols for meeting data collection targets and safety requirements of both survey administrators and respondents. Once the project team has settled on an approach for administering the surveys, the project team can ask for multiple survey firms to respond to a survey data collection request for proposal.

Deliverables:

- Technical memorandum on the detailed final work plan
- Technical report summarizing the data collection activities and results, including summary tables and charts for area policy makers
- Appropriate technical data to be included in the model systems and/or validation datasets for the three northern counties

TASK 6 – QUICK-RESPONSE TOOLS

In this task, we will develop quick response tools that capture the effects of Best Management Practices (BMPs). BMPs include a variety of measures that reduce greenhouse gas emissions including local land use (e.g., the D-factors of Density, Diversity, Design, Destination proximity, and Distance to transit) as well as demand management strategies that have traditionally been known as Transportation Demand or Transportation System Management (TDM or TSM). TDM measures attempt to reduce the demand for vehicular travel, while TSM measures attempt to make travel that does occur as efficient as possible.

Examples of TDM strategies include:

- Employer commute management programs
- Facilitating matching of travelers into carpool or vanpool ridesharing arrangements
- Providing information on transit services, facilitating pass sales
- Encouraging walking or biking through locker, change and shower facilities
- Managing parking supply through limited or preferential on-site, street or fringe facilities
- Flexible work schedules to enable coordination with alternative modes
- Telecommuting and telework options
- Modified (compressed) work weeks
- Subsidies for users of transit and other alternative modes
- Parking cash-out programs (where employees have the option of receiving the cash value of a parking space in lieu of a dedicated parking space)
- Parking fees and/or discounts/subsidies for high-occupancy vehicles



- Guaranteed ride home programs

Examples of TSM strategies include:

- Traffic flow improvements such as synchronized traffic signals, turning lanes, bus pull-out bays, right turn on red, freeway ramp metering, one-way traffic grid systems, etc.
- Priority express lanes for HOVs and transit
- HOT lanes or generalized congestion pricing
- Transit service improvements including shuttles and circulators, improved shelter and waiting areas, reduced headways, through-routing to reduce transfers, real time arrival information, etc.
- Improvements to sidewalks, trails, bike lanes, crossings, and other non-motorized facilities.

Most TDM strategies are not easily reflected in the structure of a regional travel model. Strategies like employer commute programs and rideshare matching, preferential and fringe parking, and alternative work arrangements and schedules are not directly translatable to the functions in a regional model, which primarily compute changes in modal shares through time and cost relationships. The more practical way to account for the impacts of these non time and cost strategies is through relationships derived from empirical research operationalized in a spreadsheet tool.

On the other hand, many TSM measures can be evaluated using the MPO models, particularly those where the change is complex in terms of its proportional effect on different traffic flows or transit markets. Broad-scale pricing measures such as congestion or other toll pricing, fuel taxes or VMT fees also fit this category can be directly addressed in the MPO models, and the models' sensitivities to such pricing measures will be enhanced as described in Task 3.8 above. While many TSM measures can be incorporated into the MPO models, it will be desirable to include certain local TSM measures (e.g. implementation of shuttle services and traffic calming) in a spreadsheet tool to enable quick analysis of the potential effectiveness of such measures in workshop settings, and for use by local agencies that cannot easily employ the MPO model.

SB 375 and subsequent guidance recognize that in the near-term MPO models throughout the state, not just in the Valley, cannot be expected to directly account for all transportation-related BMPs. The RTAC recommended to the Air Resources Board (ARB) analytical spreadsheet tools be created to estimate reductions from a specific BMP strategy or set of strategies in a particular setting. These tools will allow MPOs and local jurisdictions to make GHG reduction policy choices based on available research and empirical studies on the likely impacts on VMT and GHG reductions. The quick response tool will reflect BMP effectiveness in reducing VMT based on recent research compiled by Fehr & Peers for the California Air Pollution Control Officers Association (CAPCOA), SCAG and other agencies. The figure on the following page summarizes the CAPCOA research.



Best Management Practices and Optimal Effectiveness in Reduction of VMT

Source: CAPCOA CEQA Guidelines (Fehr & Peers, 2010).



As part of the Task 4 validation, the enhanced SJV models will be examined and tested as needed to quantify the degree to which they already capture some or all of the effects of various BMPs. Expected outcomes will be identified for each test (change in vehicle volumes, vehicle miles traveled, mode choice). For some BMPs, examination of the model script will suffice.

For those models (Stanislaus, Merced, Madera and Kings) which do not yet have D processors for local land use BMPs, tests will be conducted to determine if the degree of sensitivity to the following: changes in development level or density in all TAZs, small and moderate changes in land use density within select TAZs, small and moderate change in land use mix in select TAZs, changes in secondary street connectivity in select sub-areas, changes in automobile operating costs and changes in road or parking pricing. If the models already contain some of the smart growth sensitivity contained in the selected D factor elasticities we will calibrate the adjustments to be applied to each model in a manner that avoids double counting.

Task 6.1 – Estimate Local Input Variables

Review MPO data sources to develop regional averages for the following key input variables for:

- Residential density
- Non-residential employment density
- Total employment and retail employment per household
- Street density
- Accessible attractions per transportation analysis zone.

These local input variables will form the basis for the D factor adjustments made to the updated versions of each model.

Task 6.2 – Develop BMP Factor Post-Processing Spreadsheets

These quick response tools will measure the effectiveness of the D-factors described in Task 6.1 as well as the following TDM and TSM measures (this list may be modified and augmented based on ongoing research into the effectiveness of such measures):

TDM Measures

- Employer commute management programs (including ride-matching and transit promotion)
- Encouraging walking or biking through locker, change and shower facilities
- Flexible work schedules to enable coordination with alternative modes
- Telecommuting and telework options
- Modified (compressed) work weeks



- Subsidies for users of transit and other alternative modes
- Parking cash-out programs
- Parking fees and/or discounts/subsidies for high-occupancy vehicles
- Managing parking supply through limited or preferential on-site, street or fringe facilities
- Guaranteed ride home programs

TSM Measures

- Transit service improvements including shuttles and circulators, improved shelter and waiting areas, reduced headways, through-routing to reduce transfers, real time arrival information, etc.
- Improvements to sidewalks, trails, bike lanes, crossings, and other non-motorized facilities at the neighborhood scale
- Traffic calming strategies such as traffic signal synchronization, freeway ramp metering, turning lanes, bus pull-out bays and right turn on red

An integrated set of spreadsheet models will be developed to apply the BMP factor adjustments to the zone-by-zone output from applications of the model, thereby producing modified estimates of zone-specific vehicle trips and vehicle miles traveled. This process will involve calculating the zonal change in the BMP factor variables described above on a zone-by-zone basis, comparing a business-as-usual future condition with alternatives such as a Sustainable Communities Strategy. The spreadsheet will allow efficient calculation of vehicle trips and vehicle miles traveled for each development / BMP scenario, allowing quick response comparison of travel consequences of alternative regional development scenarios and policies.

Task 6.3 – Implement BMP Factor Adjustments in Travel Model

This process will involve calculating the change in the variables described above on a zone-by-zone basis. The calculations will result in adjustments to zonal trip ends by trip purpose, which will be applied within the model through matrix factoring, producing adjusted zone-to-zone trip tables that can then be assigned to the model network. This will allow the change in vehicle trips to be reflected in changes in traffic volumes on the roadway network.



Task 6.4 – Calibrate and Test BMP Factor Components

After the BMP factor data has been calculated and the BMP factor component enabled, the parameters in the BMP factors component will be calibrated based on readily available information to ensure accurate and realistic results based on the development and policy environments found in each county.

Deliverable

For each MPO, a memorandum will be prepared summarizing the development of the BMP factor component of the travel demand forecasting modeling process. The memorandum will document the assumptions and methodologies used to formulate the BMP factor adjustments, as well as how the parameters were calibrated and how the local input data were developed. In addition, the memorandum will explain how to apply the BMP factors component in the context of the regional model, as well as discuss the limitations of the BMP factors. The spreadsheet tools developed in Task 4.2 are included in this deliverable.

TASK 7 – GOODS MOVEMENT MODELING IMPROVEMENTS

Task 7.1 – Valleywide Model

The Valleywide Goods Movement Model was developed in 2007 using the best available data at that time. Since then, there have been a number of updated data sources that we will use to bring the 2000 base year in the model up to 2007. The goods movement model has two parts: long-haul truck flows developed from the Intermodal Transportation Management System (ITMS) developed by Caltrans in 1996 and updated in 2002, and short-haul or local delivery trucks developed from the Quick Response Freight Manual and other truck trip models. The data we will use to update the long-haul trip tables include:

- Freight Analysis Framework Version 3 (FAF3) for 2007
- Commodity Flow Survey (CFS) for 2007
- County Agriculture data for non-manufactured commodity flows (farm, mining, warehousing)

Each of the datasets provides some information on goods movement that is useful, but no one source is accurate and comprehensive, hence the need to include several sources to develop commodity flow trip tables for the model. University of California at Irvine has been developing a freight data repository for freight modeling in California over the last several years and we will review the data provided here for use in this project (although the FAF data is Version 2 and the CFS is not included).

The data we will use to update input data sources for short-haul, local moves (non-ITMS) are the



- Quick Response Freight Manual updated in 2007
- Kern COG truck model

We also propose to develop freight rail mode shares that can be included in the models as a placeholder for a freight mode choice model. There are several data sources that contain information on freight rail (FAF3, CFS, Rail Waybill Sample, etc.) that can be used to identify an initial freight rail trip table. These fixed mode choice factors to convert freight to trucks and rail can be used in the future as a policy lever to test the performance impacts on the highway system if short-haul freight rail were to capture a larger share of the market.

Once we have updated the various data sources in the goods movement model and expanded this to include freight rail, we will validate the model for 2007 using updated truck counts and we will check the reasonableness of truck speeds.

Deliverable

2007 Valleywide Goods Movement Model

Task 7.2 – County Models

Once the Valleywide Goods Movement Model is updated, we will adapt this model for use in building county truck trip models. This will involve adapting the Valleywide Goods Movement Model, as follows:

- Adapt the short-haul, local truck trip rates to build a truck trip generation model for each county
- Apply trip distribution functions from the local trip distribution models
- Apply the time period factors from Valley model
- Export external/gateway truck trip tables from the updated Valleywide Goods Movement Model
- Integrate the truck trip tables into a multiclass assignment
- Validate each county model against county vehicle classification counts for trucks

The validation will likely uncover some differences between the model truck volumes and the counts. We will adjust truck trips rates for short-haul initially to see if these adjustments can produce a validated model. If there are other potential validation issues, we will adjust the trip distribution or time period factors as well. If these adjustments indicate a need, we may iterate back to the Valleywide Goods Movement Model and adjust trip distribution or TOD factors here as well. This will maintain some consistency between the models and improve the overall performance of the model.

Deliverable

2007 Truck Trip Models for each County



Task 7.3 – Integration with Statewide Freight Model

The new statewide freight model is tentatively estimated to be completed by University of California at Irvine between January 2011 and December 2012 (two years). Thus, any integration that will need to occur with the San Joaquin Valley county models should be included in the model improvements plan for 2012 and beyond.

Deliverable

Integration plan for 2012 and beyond

TASK 8 – ADVANCED MODELING PROJECTS (SELECTED MPOs)

In addition to the basic improvements to all eight MPOs and the further improvements to the four larger San Joaquin Valley MPOs, advanced modeling projects will be developed to meet the near-term needs for select MPOs with the intent of transferability to other San Joaquin Valley MPOs beyond 2012. These advanced modeling projects will include the following projected to be implemented by early 2012:

- Calibration and validation of a land use forecast and allocation model utilizing a geodatabase which considers development costs, transportation accessibility, real estate and development potential for Kern County.
- Implementation of an activity-based model for Fresno COG at a parcel level.
- Implementation of one activity-based model for the northern three MPOs (San Joaquin, Stanislaus, and Merced) at a TAZ level.

Task 8.1 – Cube Land and Geodatabase Integrated Land Use/Transportation Model

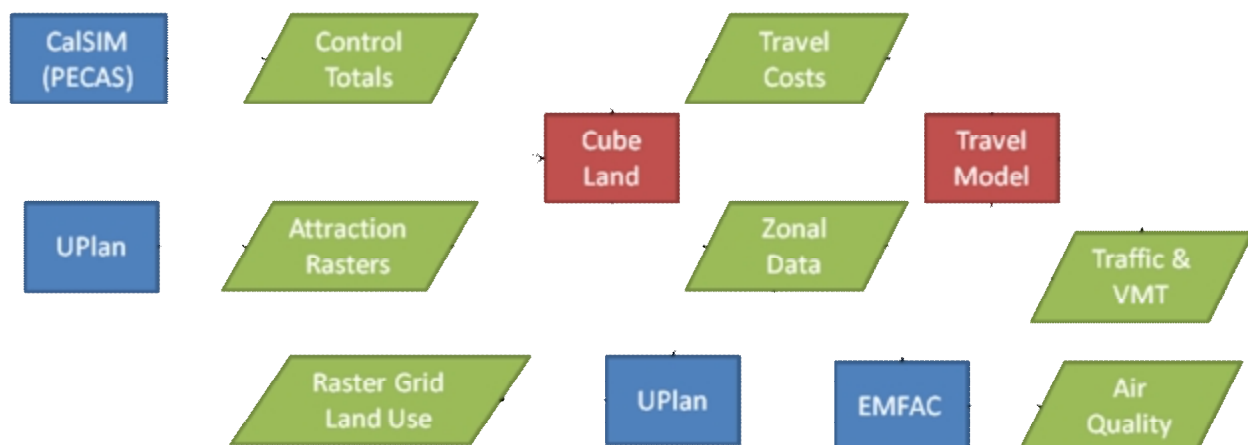
The San Joaquin Valley now has experience with three land use modeling tools, serving potentially distinct, yet related functions at different levels of geographic scale.

- The California Statewide Integrated Model (CalSIM), currently under development at UC-Davis, uses PECAS and Cube Voyager software. When completed, it will be well-suited to studying interactions between the economies and transportation systems of the metropolitan areas within the San Joaquin Valley as well as between the San Joaquin Valley and nearby areas.



- Cube Land, which has been successfully tested in the Kern COG area, is an economic land-use allocation model that can easily be integrated with any Cube Voyager model. This software's key strengths are its flexibility, ease of use, and consistency with existing travel demand models.
- UPlan, a GIS-based land use model developed by the UC-Davis, is a sketch-level scenario visioning tool that can disaggregate estimates of household and employment for an area to a fine raster grid, providing maps of land use change at a very detailed level. UPlan was used for the San Joaquin Valley Regional Blueprint project as well as some ongoing work.

While there are some areas of overlap between these tools—all are spatial land-use allocation models that interact in some way with transportation forecasting models—in general they are quite complementary, if each is applied at the scale and context of greatest suitability. The diagram below illustrates a proposed multi-scale integrated modeling system that would accomplish this objective.



As noted previously, CalSIM, when completed, will be able to forecast interregional flows of people, goods and services, and allocate economic activity for the state as a whole to the various metropolitan regions within the San Joaquin Valley. From the perspective of the MPOs, this tool can be used to answer questions about externally-based travel and in determining the influence development patterns outside of the San Joaquin Valley on development within the Valley and related regional travel.

Cube Land can take into account these interregional interactions by using CalSIM outputs as regional control totals for any given metropolitan region within the San Joaquin Valley. The Cube Land model then allocates jobs and population to transportation analysis zones (TAZs) within the metro area, which are input to the travel demand model to forecast traffic using currently accepted methods and practices. The outputs can be fed back into Cube Land as “accessibility measures” which influence location preferences and growth patterns based upon congestion. This cycle is iterated until the output forecasted land uses and traffic patterns are consistent with one another. These final outputs of the travel model can then be input to an emissions model such as EMFAC to estimate air quality and CO2.



In KernCOG, Cube Land has been integrated with UPlan to use information about the factors that influence development attractiveness at a very detailed level of geography. UPlan outputs “attraction rasters” that incorporate local knowledge accumulated through the Regional Blueprint process, including public workshops held throughout the state. Cube Land uses this information at the zonal level to calculate the probability that development of a certain type will occur in a given zone. To this extent, Cube Land allocates development to zones in a manner that is relatively consistent with public involvement and scenario visioning processes already established within the San Joaquin Valley.

Through the KernCOG Pilot Study, the team identified another potential application of UPlan within the multi-scale integrated model system described above. Should an agency wish to disaggregate land use forecasts produced by Cube Land to a more detailed level of geography, for further analysis or public presentation, the zonal data produced by Cube Land could be used as subarea control total inputs to UPlan, which would then generate a fine raster grid representation of the scenario land use forecast. Although this level of integration has not yet been demonstrated, both Citilabs and UC Davis staff believe that such an application would be technically feasible within the project scope.

To enable to the multi-scale integrated model system proposed above, the following work would need to be completed by the project team members:

- Completion of the CalSIM statewide PECAS-Cube Voyager model. This work is ongoing and supported by other funding sources; hence it is not a part of the current project scope. However, that effort shares personnel from UC Davis with this team, who can advise the project on CalSIM progress and necessary data, interfaces to ensure smooth integration.
- Refinement of the Kern COG Cube Land framework and generalization to other areas. An initial pilot study model was completed by Citilabs and KernCOG staff in 2010 with Fehr & Peers serving in an advisory role. The model documentation effort completed for this pilot study identified several areas for potential future improvement and refinement. With more data, such as a validated regional digital parcel layer, a household interview survey, and/or more detailed business location information, it may be possible to estimate improved model parameters for a more robust real estate supply model and a demand model calibrated in greater detail. That work will be led by Fehr and Peers with advisory help and other assistance from Citilabs, UC-Davis, and RSG.
- Updated transportation model to utilize Cube Land data within a geodatabase framework. To maximize the use of GIS data and have a fully integrated land use/transportation model, the transportation model process will be updated to take advantage of ArcGIS capabilities within Voyager. At the same time, the additional information provided by Cube Land that is not



currently utilized within the transportation model will be incorporated into the processes discussed in Tasks 2 through 8. This work would be led by Fehr & Peers, with advisory guidance from Citilabs staff.

- Adaptation of UPlan for disaggregation of Cube Land results. It is technically possible to disaggregate Cube Land results using UPlan within the current software implementation as an ArcGIS extension. However, the process could be made much more efficient by re-programming certain key sections of the UPlan code. In addition, some kind of interface between the two models may need to be developed to make this process easier to apply. This work would be led by the UC-Davis members of the project study team, with advisory guidance from Citilabs staff.

Deliverables

- Land Use Model calibration application
- Integrated land use and transportation planning model
- Geodatabase of relevant land use and transportation data
- Documentation



Task 8.2 – Activity-Based (AB) Models Using Parcels Data (FresnoCOG) and Zonal Data (SJCOG, StanCOG, MCAG)

We propose to implement two activity-based (AB) models as requested, one for Fresno County and one for the three northern counties. For purposes of this document, they are called the Fresno model and the three-county model. The two models will have the following key features:

- Both models will be comprehensive tools for supporting advanced planning and policy analysis as needed for SB 375 and other purposes, including sensitivities to pricing policies and land use.
- The Fresno model will use parcel data to represent land use and location choices, and the three-county model will use TAZ data for that purpose. The two models will be compatible with each other.
- Each model will be developed, calibrated, validated and tested for its own sub-region (Fresno, or three-county), using local data wherever possible.
- The activity-based component of the model will build on and be compatible with the AB models applied by other MPOs in California and within the U.S. so that the Valley MPOs can enjoy synergistic benefits with other users. Similar methodologies have also been used successfully in San Francisco, Denver and Portland.

Details of specific modeling system design, functionality, and specifications for potential applications are contained in Work Plan Appendix 3.

Prepare for Development

At the outset of this project, some detailed design will need to be carried out to assure that each AB model is completely consistent with the specific requirements of the Fresno and three-county regions (e.g., modes and land use categories), and to identify the adjustments that must be made to existing Fresno and three-county model components that will serve as the basis of the non-AB model components in the model system. In the case of the three-county model, special attention will be given to identify and resolve existing variations in these components across the three counties. John Bowman and Mark Bradley will co-lead this design effort.

This task will involve preparing all parcel or zonal data required to support model development, calibration and validation. It will also involve preparing highway and transit network skims for various time periods. At a minimum, this will include auto time and distance skims for four periods (AM peak, midday, PM peak and evening) and walk-to-transit skims for AM peak and midday periods, and drive-to-transit skims for the AM peak periods. Skims for more times of day can be accommodated by the AB model if desired, as this involves a trade-off between the accuracy of travel times in the models and the



run time required to perform assignments for more periods. RSG will provide support for this data processing effort.

The three-county model will utilize the network and zone system developed as part of Task 3. Our initial recommendation is to retain the same internal zone definitions and network links that will also be used in the updated four-step models for those counties, although some changes will clearly be needed to the specification of external zones. For Fresno County we also recommend using the same zone structure and network links as will be used for the updated four-step model. Although the Fresno AB model will use parcels as the main spatial unit for land use data and destination choice, the auto and transit level of service will still be at the TAZ-to-TAZ level, as parcel-to-parcel assignment is not feasible with current static assignment methods. Dowling will lead this effort, with support from RSG.

Develop and Calibrate AB Model Components

Building on work conducted as part of Task 4, we will estimate and calibrate the coefficients and constants in all models to the local NHTS data. We will pool data from the Valley counties to the extent possible in order to increase sample size and statistical power, but we will also test for any significant county-specific differences.

Specifically, the models to be estimated and calibrated on the data include:

- Mode choice and time of day models at the tour level and trip level
- Destination choice models for all tour destinations and stops
- Tour and stop generation models for several different tour purposes
- Household auto ownership models
- Models of workers' usual workplace location (including work at home)
- Models of students' choice of school location

All estimated and asserted model parameters will be reported to the relevant MPO's for review and comment before deciding on the final model specifications.

Auto availability models developed for the activity-based models will be adapted to work with trip-based models. Any differences in these models will be a measure of which variables are possible within each model. The auto availability models will be a function of socio-demographic, land use and level-of-service data.

Modify/Develop Non-AB Model Components

An activity-based model predicts all non-commercial travel made by residents of the region. Auxiliary trip-based models are used to predict the following types of trips:



- Resident trips with one trip end outside the region (IX, XI)
- Through vehicle trips (XX)
- Commercial trips and freight traffic
- Trips attracted by special generators such as airports or military bases

We propose that the auxiliary models used in the AB model systems will be the same as those used in the updated trip-based four-step models, including both the model specification and the model application scripts within the CUBE software framework. If the AB models use traffic assignments for more time periods in the day than the trip-based models, then we will derive additional time of day factors to split the auxiliary trips into the appropriate time periods for assignment. For the three-county AB model, some adaptation of the auxiliary models may be necessary to use them with the merged zone system and networks, but we will keep them as consistent as possible with the models used by each county.

Implement Integrated Model System software and scripts

The AB model will be run from inside the familiar CUBE user interface, allowing all of the complementary steps of running the auxiliary models and the highway and network assignments and system equilibration to keep their familiar mode of operation. We have experience in Sacramento and Jacksonville of running the AB model within the CUBE environment, and have written scripts to merge the results of the AB model and the auxiliary models and globally equilibrate those models with the traffic assignment models in the most fast and efficient method possible. The newest upgrades to the AB model software will be implemented and evaluation of distributing the simulation across processors will be investigated.

This task includes the following sub-tasks:

1. Test and optimize the fully integrated CUBE-based model for each of the two implementations on our own hardware.
2. Install and test the model system on relevant MPO hardware systems.
3. Prepare and distribute a Model Documentation specific to each implementation.
4. Hold training sessions to familiarize MPO staff with using the system, including preparing inputs, running the model system, and querying and summarizing output.

Calibrate and Validate Model System

For this task we will estimate and calibrate the AB demand models on the household survey data that is available. Once the AB models are implemented with the supply and auxiliary models into the full forecasting system, they can be validated and calibrated further where needed. For the validation, we typically use the following sources of validation data:



- Census/CTPP and ACS data on auto ownership distributions, home-to-work OD flows, and usual mode to work
- Traffic counts available from screenlines and loop sensors, by location and time of day
- Transit passenger counts available from on-board surveys, by route
- Household survey data distributions weighted and expanded to the regional population and adjusted for typical sources of survey non-response bias.

For the latter item, our team members have extensive experience on comparison of GPS-based versus diary-based travel surveys, and are aware of the typical adjustments that need to be made to travel diary-based data to arrive at representative aggregate model calibration target distributions.

The model will be calibrated and validated to similar standards as the trip-based models for each model component, as discussed in Task 4.

Deliverables

- Integrated parcel-level AB model system for Fresno County, suitable for:
 - o RTP forecasting
 - o Air Quality Conformity analysis
 - o Evaluation of SB 375 GHG reduction targets
- Integrated TAZ-level AB model system for the northern three-county region, suitable for:
 - o RTP forecasting
 - o Air Quality Conformity analysis
 - o Evaluation of SB 375 GHG reduction targets
- Region-specific and overall model system Model Documentation



TASK 9 – DATA CENTER, KNOWLEDGE MANAGEMENT, AND TRAINING

During the interviews and in subsequent discussions with the San Joaquin Valley MPO staff, the issue of data collection, management, and distribution became an important issue not directly addressed by SB 375 or Prop 84. In addition to data, MPO modeling staff expressed concerns over version control and executive directors mentioned the need for a knowledge sharing/training mechanism to enhance collaboration and to leverage resources throughout the San Joaquin Valley. To address these concerns, we propose to implement a data center and training program, both utilizing a knowledge management system or wiki.

Task 9.1 – Create Data Center and Knowledge-Sharing Web-site (Wiki)

The data center will store the survey, GIS, and model files for each of the eight valley MPOs. Processes to summarize, extract, and report information from one or more of the MPOs survey and GIS data will be developed and the model files will be stored with version control functionality.

The user interface to the data and training materials will be in the form of a knowledge management system, also referred to as a wiki. This wiki will contain information and documentation of each of the eight valley MPOs data sources, survey results, GIS files, land use and travel demand models, and have dedicated areas for collaboration between the eight valley MPOs and outside agencies or groups. The wiki will be updated over the course of the project so the status and results of the tasks can be evaluated with increased frequency. The coordination and centralization of information will help ensure successful delivery of the model improvements within the limited schedule and also provide a mechanism for increased collaboration and sharing between the eight valley MPOs. A web-based demonstration of the wiki and data center will be scheduled for early in the project to maximize its usefulness.

Task 9.2 – Training in Basic Modeling and Quick-Response Tools

A curriculum will developed and technical briefs developed for training modelers at all MPOs in the updated trips-based models. Training will then be provided at two day-long workshops, one in the northern Valley, and one in southern Valley. The same day-long workshop will also cover training in the understanding and use of the BMP tools and processes will be conducted in order that the local agencies will have staff that is proficient in the use and application of the upgraded models and BMP factor processes.

Training in Activity-Based Modeling

A curriculum and technical briefs will be developed for training modelers at San Joaquin, Stanislaus, Merced and Fresno counties in the use and development of the activity-based models developed for these MPOs. Training will be provided in a two-day workshop in the northern Valley. Other modelers in the Valley with an interest in activity-based modeling will be welcome to attend.



Cube Land and Geo-database Training

A curriculum and technical briefs developed for training modelers interested in integrating Cube Land and geo-databases into their MPO models Training will be provided in a day-long workshop, with a focus on the KernCOG applications. Other modelers in the Valley with an interest in Cube land and geo-databases will be welcome to attend.

Land Use Data Development and Forecasting for Valley-wide Implementation

A one and one-half day course will developed to educate MPO staff and train others interested in improving model land use inputs. The course is intended to provide a framework for training those with interests in land use or transportation planning, travel demand modeling, urban geography, or local economic conditions to verify existing land use data for use in transportation models. Because land use data is frequently a weak component in transportation models, and neither public nor private data sources are wholly satisfactory, transportation modelers need to take those existing sources and either conform or improve their accuracy for use in modeling efforts, using a variety of techniques including field surveys and site visits. The training will be open to all interested parties but aimed at interns and college students who can help MPOS improve their land use data in a cost-efficient manner. This course will be offer initially by the consultant team. It will be designed to be easily replicated at MPOs and colleges and universities throughout the Valley in 2012 and beyond.

Project Wiki Transfer (Knowledge-Management System and Data Center)

At the conclusion of the project, the data center and wiki will be transferred to the MPOs for their continued use, update, and maintenance. The data center and wiki will contain the survey data and processes, GIS data, and model data in addition to the documentation and discussions that occurred over the course of the project. Instructions on the maintenance and update of the data center and wiki will also be provided.

Deliverables

- Wiki based data center and knowledge management system
- Data compiled and used during model updates
- Final model files
- 1 1-day training session on basic improvements and quick-response tools
- 1 day training course on Activity-based modeling
- 1 1½-day training session land use inputs for models



TASK 10 – POST-2012 MODEL IMPROVEMENT PLAN

To ensure continued maintenance and improvement to the modeling process, the work concludes with the scoping of a follow-up Model Improvement Plan. At this point in time, the following tasks are envisioned. Collectively these tasks for “next MIP” are intended to: utilize the pending release of new Census and travel survey data; transfer and implement the advanced models to other MPOs within the Valley; and respond to the evolution of policies related to SB 375 and travel demand forecasting in general.

Task 10.1 – Land Use Modeling and Basic Modeling Improvements

We will draft a detailed work scope for updating the models with the latest survey data, transferring the land use models, and on-going model improvements. This work scope will include the following tasks:

- Updating and fully correct the parcel (or other fine-scale) GIS layer for each county.
- Populating the parcel/fine-scale layer with current land use, housing and employment information, including Census 2010 data.
- Implementing a land use forecast and allocation model such as Cube Land or PECAS which considers development costs and transportation accessibility.
- Recalibrating models for use in the 2018 RTP cycle using the 2010/2011 California Household Travel Survey (final survey results expected after February, 2012).

Task 10.2 – Activity-Based Modeling

We will draft a detailed work scope for transferring the activity based models to other MPOs. This work scope will include the following tasks:

- Implementing activity-based modeling in place of the current trip-based modeling for trip generation, trip distribution and mode choice. It is recommended that the SJV counties use proven methodologies and software from the northern county and Fresno implementation of activity-based modeling, after they have been thoroughly tested and refined.
- Developing recommended procedures for application of the activity-based model for local studies. Activity-based models employ random allocations of activities and trips and typically do not produce results in a deterministic way. Procedures will be created to adapt and use the activity-based model for local studies of development or transportation improvements to achieve logical and consistent results.



- In conjunction with activity-based modeling developing capability in each model to estimate the travel behavior of traveler types and household types based on their sensitivity to cost based on income and other demographic characteristics.
- Setting up automated two-way linkages between the land use modeling and the travel models to provide for iterative evaluation of land use and transportation interactions.

Deliverable

Memo documenting Post-2012 Model Improvement Plan

SUMMARY OF DELIVERABLES

The following table summarizes the deliverables by task including deliverable date. Delivery date is approximate mid-point of the eight models' delivery date, and will vary by MPO.

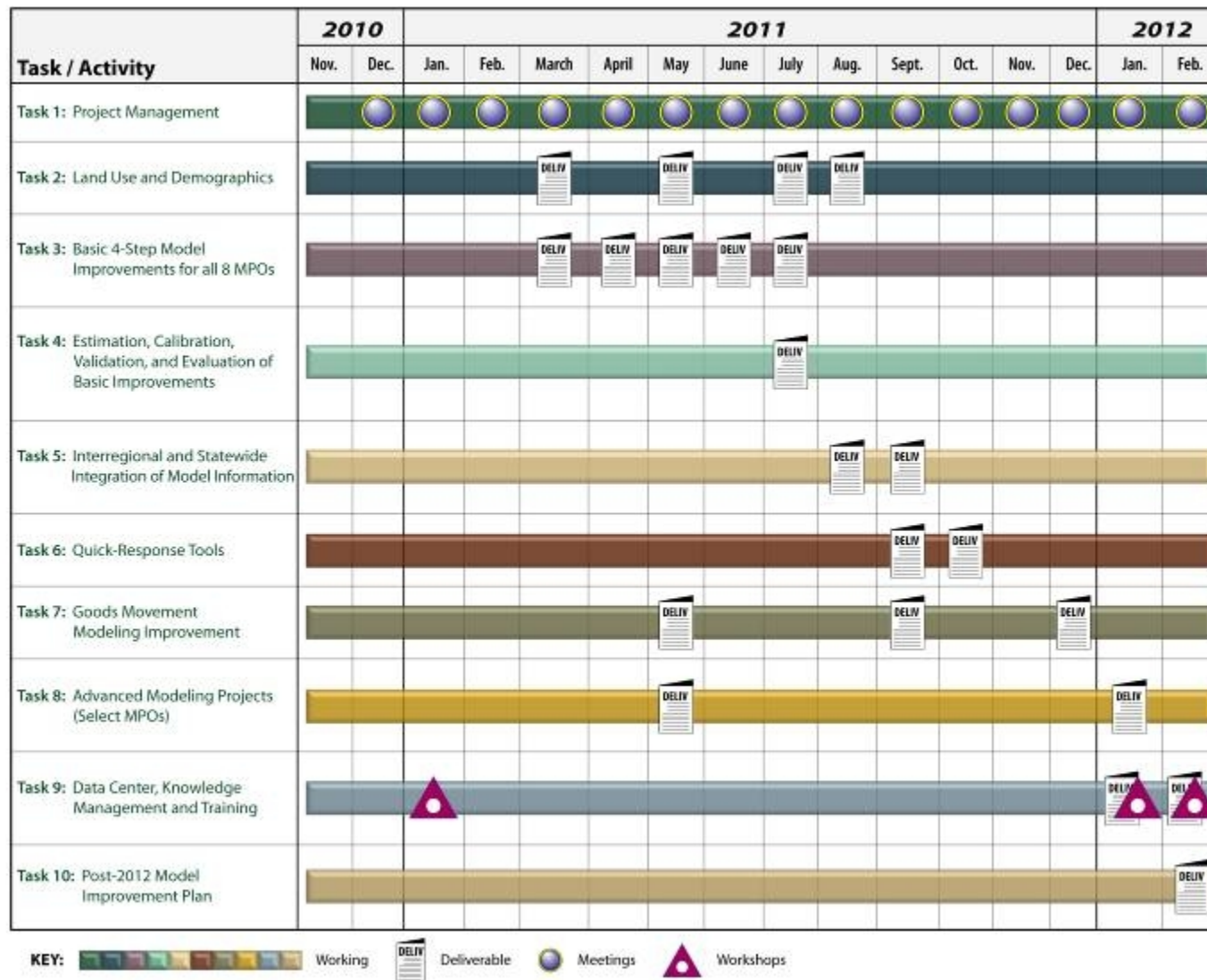


Project Deliverables		
	Deliverable	Delivery Date ¹
Task 1	Minutes of webinar meetings	Monthly from Dec. 2010
	Monthly Progress Reports	Monthly from Dec. 2010
	Updates to Project wiki (as needed)	As needed
Task 2	Draft Land Use and Demographic/Employment Specifications Memo	March 2011
	Final Land Use and Demographic/Employment Specifications Memo	May 2011
	Corrected GIS/land use/employment data files	July 2011
	Relational database files and online training	August 2011
Task 3	Updated TAZ system and GIS mapping	March 2011
	Updated land use tables with subdivided TAZs for each MPO	April 2011
	Updated base and future road and transit networks for each MPO	April 2011
	Updated base and future road and transit networks for 3-county model	April 2011
	Vehicle availability	May 2011
	Revised trip generation rates for each MPO	May 2011
	Updated trip distribution process	June 2011
	Updated mode split/choice	June 2011
Task 4	Documentation comparing previous model to updated model	July 2011
	Updated models, post-processors, and Model Development Reports ¹	July 2011
Task 5	Updated subarea process for deriving interregional trips	August 2011
	Updated subarea process for deriving through and external trips	August 2011
	Technical memorandum on the detailed final work plan	September 2011
Task 6	Spreadsheets and/or other processing tools	September 2011
	Memo documenting development and application of tools	October 2011
Task 7	2007 Valleywide Goods Movement Model	May 2011
	2007 Truck Trip Models for each County	September 2011
	Integration plan for 2012 and beyond	December 2011
Task 8	Land Use Model calibration application	May 2011
	Integrated land use and transportation planning model	January 2012
	Geo-database of relevant land use and transportation data	January 2012
	Land Use Model Documentation	January 2012
	Integrated parcel-level AB model system for Fresno County	January 2012
	Integrated TAZ-level AB model system for the northern three-county region	January 2012
	Region-specific and overall model system Model Documentation	January 2012
Task 9	Wiki based data center and knowledge management system	February 2012
	Data compiled and used during model updates	February 2012
	Final model files	February 2012
	1 1-day training session on basic improvements and quick-response tools	January 2012
	1 day training course on Activity-based modeling	January 2012
	1 1½-day training session land use inputs for models	January 2012
Task 10	Memo documenting Post-2012 Model Improvement Plan	January 2012

Note 1 – Delivery date is approximate mid-point of the 8 models delivery date, and will vary by MPO.



SCHEDULE



WORK PLAN APPENDIX 1 – BASIC MODEL IMPROVMENTS BY COUNTY



WORK PLAN APPENDIX 1 – BASIC MODEL IMPROVMENTS BY COUNTY

The following sections summarize the key basic model improvements to be provided for each county, consistent with the improvements listed by model step above.

Fresno

The Fresno County travel model, in particular the version updated for the Public Transportation Infrastructure Study, includes many of the elements required for SB 375 analysis. The key improvements will include:

- Detailing of TAZs in areas identified for potential higher density, mixed-use or transit-oriented development
- Vehicle ownership model to replace fixed vehicle ownership splits
- Add trip purposes for school and trucks (combine Work-Other and Other-Other)
- Add fields to road network for pricing
- Trip distribution based on multimodal time and cost
- Add Drive Alone Toll to mode choice, and separate mode choice for school trips
- Add assignment time periods if required for consistency with activity-based model
- Update multi-class traffic assignment for trucks

Kern

The Kern County model already includes the trip purposes recommended for all models, as well as a full mode choice model and four time periods for assignment. The key improvements will include:

- Detailing of TAZs in areas identified for potential higher density, mixed-use or transit-oriented development
- Add vehicle ownership model and include vehicle ownership in subsequent model steps
- Consider replacing lookup system for household size and income quartiles with more direct inputs derived from land use modeling
- Add fields to road network for pricing
- Trip distribution based on multimodal time and cost
- Add Drive Alone Toll to mode choice, and separate mode choice for school trips
- Update multi-class traffic assignment for tolls



Kings

The Kings County model is based on vehicle trips but already includes school trips as a separate purpose. The key improvements will include:

- Detailing of TAZs in areas identified for potential higher density or mixed-use development
- Vehicle ownership model to replace fixed vehicle ownership splits
- Convert trip generation from vehicles to persons
- Add truck trip purposes
- Add fields to road network for pricing
- Trip distribution based on multimodal time and cost
- Implement mode choice factor system based on survey data, trip lengths and TAZ inputs for urban form characteristics
- Implement multi-class traffic assignment

Madera

The Madera County model used for air quality conformity currently includes three other counties and is based on vehicle trip generation. For the Blueprint studies, a single-county version was developed based on person trip generation. Either version of the model is set up for daily trips only. The key improvements will include:

- Build from single-county Blueprint version of model with person trip generation
- Ensure model includes all TAZ splits for all previous studies including Rio Mesa and establish consistent TAZ system for all study years including the validation base year
- Detailing of TAZs in areas identified for potential higher density or mixed-use development
- Add vehicle ownership model and include vehicle ownership in subsequent model steps
- Add trip purposes for school and trucks
- Add fields to road network for pricing
- Trip distribution based on multimodal time and cost
- Implement mode choice factor system based on survey data, trip lengths and TAZ inputs for urban form characteristics
- Add time-of-day factors for up to four time periods and/or peak hours
- Implement multi-class traffic assignment for each time period



Merced

The Merced County model currently includes Merced County and a portion of Stanislaus County. Merced County will be included as one of the counties in the three-county activity-based model, and a three-county road and transit network and TAZ system will be established as part of that work. For the 2013 RTP, Merced County's current model will be upgraded to include improvements required for SB 375 compliance. This upgrade will include the following tasks:

- Detailing of TAZs in areas identified for potential higher density or mixed-use development
- Add vehicle ownership model and include vehicle ownership in subsequent model steps
- Add trip purposes for school and trucks
- Eliminate IX and XI trip purposes and incorporate in other purposes for interregional consistency
- Add fields to road network for pricing
- Trip distribution based on multimodal time and cost
- Implement mode choice factor system based on survey data, trip lengths and TAZ inputs for urban form characteristics
- Add assignment time periods if required for consistency with activity-based model
- Implement multi-class traffic assignment for each time period

San Joaquin

The San Joaquin County model currently includes San Joaquin County, the Bay Area and the Sacramento area. San Joaquin County will be included as one of the counties in the three-county activity-based model, and a three-county road and transit network and TAZ system will be established as part of that work. For the 2013 RTP, San Joaquin County's current model will be upgraded to include improvements required for SB 375 compliance. This upgrade will include the following tasks:

- Detailing of TAZs in areas identified for potential higher density or mixed-use development
- Add vehicle ownership model and include vehicle ownership in subsequent model steps
- Add trip purposes for school and trucks (combine Work-Other and Other-Other)
- Add fields to road network for pricing
- Adapt prior coded transit networks or code new transit network
- Trip distribution based on multimodal time and cost
- Implement mode choice model based on Fresno process and standard coefficients, calibrated to surveyed mode shares and total transit ridership



- Add assignment time periods if required for consistency with activity-based model
- Implement multi-class traffic assignment for each time period
- Implement standardized feedback loop from other counties

Stanislaus

The Stanislaus County model currently includes Stanislaus County and portions of San Joaquin and Merced counties. Stanislaus County will be included as one of the counties in the three-county activity-based model, and a three-county road and transit network and TAZ system will be established as part of that work. For the 2013 RTP, Stanislaus County's current model will be upgraded to include improvements required for SB 375 compliance. This upgrade will include the following tasks:

- Detailing of TAZs in areas identified for potential higher density or mixed-use development
- Add vehicle ownership model and include vehicle ownership in subsequent model steps
- Add truck trip purposes (combine Work-Other and Other-Other)
- Add fields to road network for pricing
- Code new transit network
- Implement external trip tables for base year based directly on surveyed origin-destination data at cordon points, geocoded to specific TAZs within the model study area, with growth factors for future forecasts
- Trip distribution based on multimodal time and cost
- Implement mode choice model based on Fresno process and standard coefficients, calibrated to surveyed mode shares and total transit ridership
- Add assignment time periods if required for consistency with activity-based model
- Implement multi-class traffic assignment for each time period

The recommendation to implement mode choice models in San Joaquin and Stanislaus counties by adapting the current Fresno mode choice modeling process conforms to standard model development practices. Making use of the basic Fresno structure and nationally acceptable standard coefficients is an efficient way to develop a mode choice model. The Fresno model has had the longest history of development and use in the San Joaquin Valley. It is worth noting that the original Fresno mode choice model was based on a Sacramento mode choice model that was used by SACOG for modeling in the Sacramento area for many years. The San Joaquin and Stanislaus



mode choice models will be calibrated and validated using local information regarding the travel times, service frequencies and costs and utility of transit modes in San Joaquin and Stanislaus counties combined with household survey data extracted specifically for those counties. The mode choice models will be validated to local conditions based on observed transit ridership on each service provider. It will also be possible to add modes, such as ACE commuter rail, that are not represented in the Fresno mode choice model.

Tulare

The key improvements for the Tulare County model will include:

- Detailing of TAZs in areas identified for potential higher density or mixed-use development
- Vehicle ownership model to replace fixed vehicle ownership splits
- Convert trip generation from vehicles to persons
- Add school and truck trip purposes (combine Work-Other and Other-Other)
- Add fields to road network for pricing
- Trip distribution based on multimodal time and cost
- Implement mode choice factor system based on survey data, trip lengths and TAZ inputs for urban form characteristics
- Implement multi-class traffic assignment



WORK PLAN APPENDIX 2 – INTERREGIONAL ORIGIN-DESTINATION SURVEYS



WORK PLAN APPENDIX 2 – INTERREGIONAL ORIGIN-DESTINATION SURVEYS

Telephone surveys. Households in the areas of interest would be called to obtain information on qualifying travel. Qualifying travel in this case would be for trips that have crossed a county line. Examples of telephone-based interregional surveys are the 2005 California High-Speed Rail Model, and the 2006 SANDAG Interregional Travel Behavior Study.

In these surveys, respondents would be asked a qualifying question – that is if a household member had recently made an interregional trip. These surveys can capture trip rate and origin-destination data, making them useful for development of interregional trip generation and distribution models. However, they are a relatively expensive method of data collection, particularly if large numbers of surveys are required to cover multiple gateways. The target populations must be carefully considered before administering the surveys, and qualifying households tend to be hard to identify. Telephone surveys cannot be directly used for traffic assignment validation. Telephone surveys are used to collect only personal household-related travel data, and not for commercial travel.

License plate video capture. High speed cameras are positioned above the roadway at a set location (for example at an overpass) and electronically capture the license plates of all vehicles passing that location. Here, two methods for data collection can be used. One method is to position cameras at multiple locations and to record the numbers of vehicles passing by two or more locations – typically positioned at regional external gateways. This can be a fairly quick and non-intrusive method of counting external station to external station (i.e., through trips), and external-to-internal vehicles. However, important information on trip purpose and party size would not be collected, and no information on origins and destinations would be gleaned beyond the location of the external gateways.

A second and more commonly applied approach is to collect license plate numbers and then match those to a DMV database of addresses of license plate owners. Typically, short survey questionnaires are then mailed out, with questions on origin-destination, trip purpose, party size, trip duration, etc. Respondents can either mail back the survey or respond via internet. Response rates are usually fairly low, usually with up to fifteen percent of vehicle owners responding. These types of surveys are comparatively expensive to administer and require extensive coordination with DMV to ensure the address records are obtained on a timely basis. Response rates deteriorate rapidly when there is a long lag from when the license plates are videotaped and when then the surveys are mailed out. These surveys can provide data for trip distribution and assignment validation.

License plate capture surveys can capture commercial vehicle as well as personal vehicles. However, survey mailouts to commercial vehicle owners may be more complicated as the commercial vehicle owners and vehicle drivers are often unrelated.



Example of Video License Plate Capture



Source: Texas Transportation Institute.

Interviews at rest stops/gas stations. Interviewers administer surveys at rest stops and/or at refueling stops at or near external gateways. When a rest area that is conducive to operating a survey station is located near a survey area boundary, an intercept or a postcard mailback survey could be used. One advantage for the rest stop interviews is the ability to collect both personal and commercial vehicle surveys. Key concerns revolve around how representative the travelers at these rest stops relative to overall roadway traffic. In addition, there are important considerations on whether large numbers of travelers can be effectively surveyed at gas stations and other rest areas where multiple commercial establishments are present.

Intercept interview surveys. All vehicles are required to stop and surveys are administered to respondents from their vehicles. This approach has obvious logistical and safety issues that must be addressed, and is generally only applied to low volume roadways. Since there is far greater interest in



high volume roadway data, it is doubtful that vehicle intercept surveys will be seriously considered for this project.

Example of Vehicle Intercept Survey



Source: Texas Transportation Institute.

Intercept surveys can also be directly administered on interregional trains and buses. However, the numbers of interregional transit users may be so low as to not be deemed important. In addition, transit operators may already have station/stop on and off data available, minimizing the need for such in-person surveys.

Vehicle tracing techniques. The potential exists for tracking vehicles based on GPS data from GPS transponders or smart phones. However, there are serious privacy issues that would have to overcome, and it may not be feasible for this study to contemplate such an endeavor given available resources and time constraints.

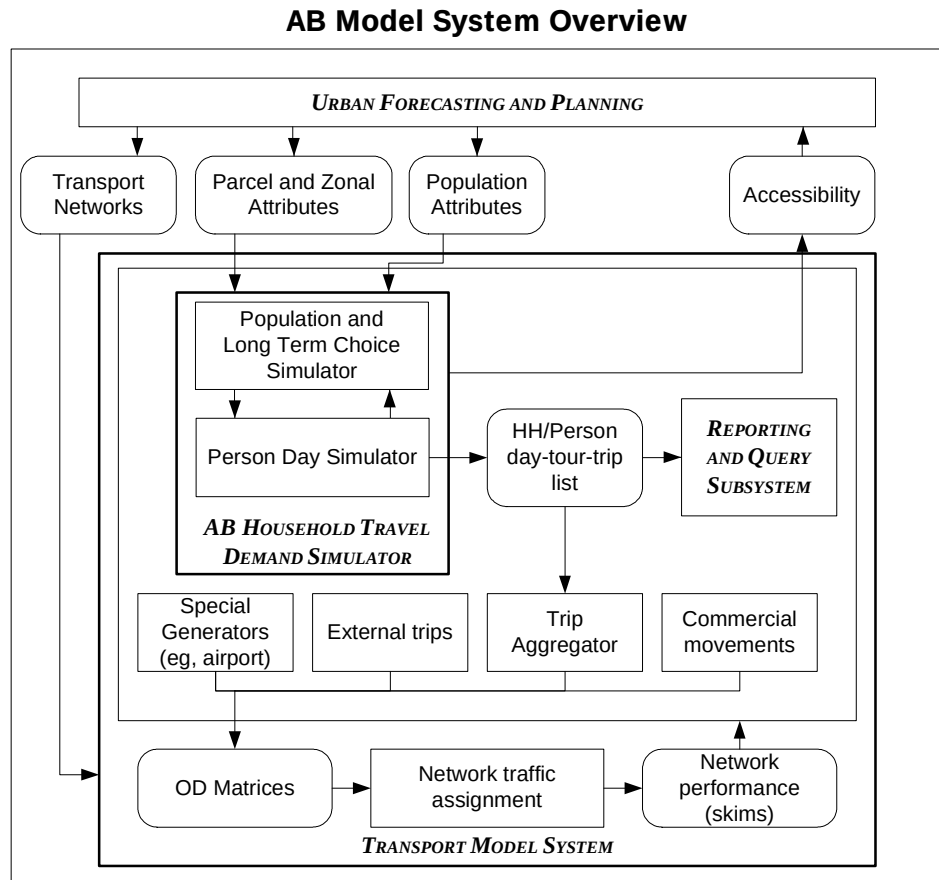


WORK PLAN APPENDIX 3 – ACTIVITY BASED MODEL SYSTEMS



WORK PLAN APPENDIX 3 – ACTIVITY BASED MODEL SYSTEMS

The figure below provides a high level overview of the entire AB model system.



The transport model system will take inputs from the urban forecasting and planning process. These include highway and transit networks, zonal attributes (3-County) or parcel attributes (Fresno), and socioeconomic information about the population. DaySim, the AB household travel demand simulator, will generate a synthetic population representing the future population of the region and predict activities and trips for every member of each synthetic household. For purposes of traffic assignment, the DaySim trips will be aggregated into zone-to-zone flows. Other components of the model system will predict zone-to-zone trip movements related to special generators, such as airports, trips carried out by persons who live outside the region, and commercial movements. These non-DaySim demand model components will be based on their counterparts in the existing model systems. The trips will be combined into O-D matrices and assigned using CUBE assignment procedures. The entire system will run iteratively seeking convergence, with skims from CUBE serving as inputs to DaySim in each iteration.

In the Fresno model, DaySim will use a large database of parcel attributes instead of only zonal attributes. This is very desirable because it provides substantially better information about transit



accessibility, travel times for non-motorized and short trips, and destination attractiveness in heterogeneous zones. The models can use information about each individual parcel, as well as information about the nature of a buffer zone surrounding the parcel. The buffer attributes, such as the number and type of intersections, represent neighborhood effects more realistically than zonal attributes because they are centered on the parcel.

The main output of the DaySim AB travel demand simulator is a detailed itinerary for every person in every household. This output can be aggregated in a great variety of ways, extracting information that is not available from trip-based models, especially the impact of a policy on various population subsets.

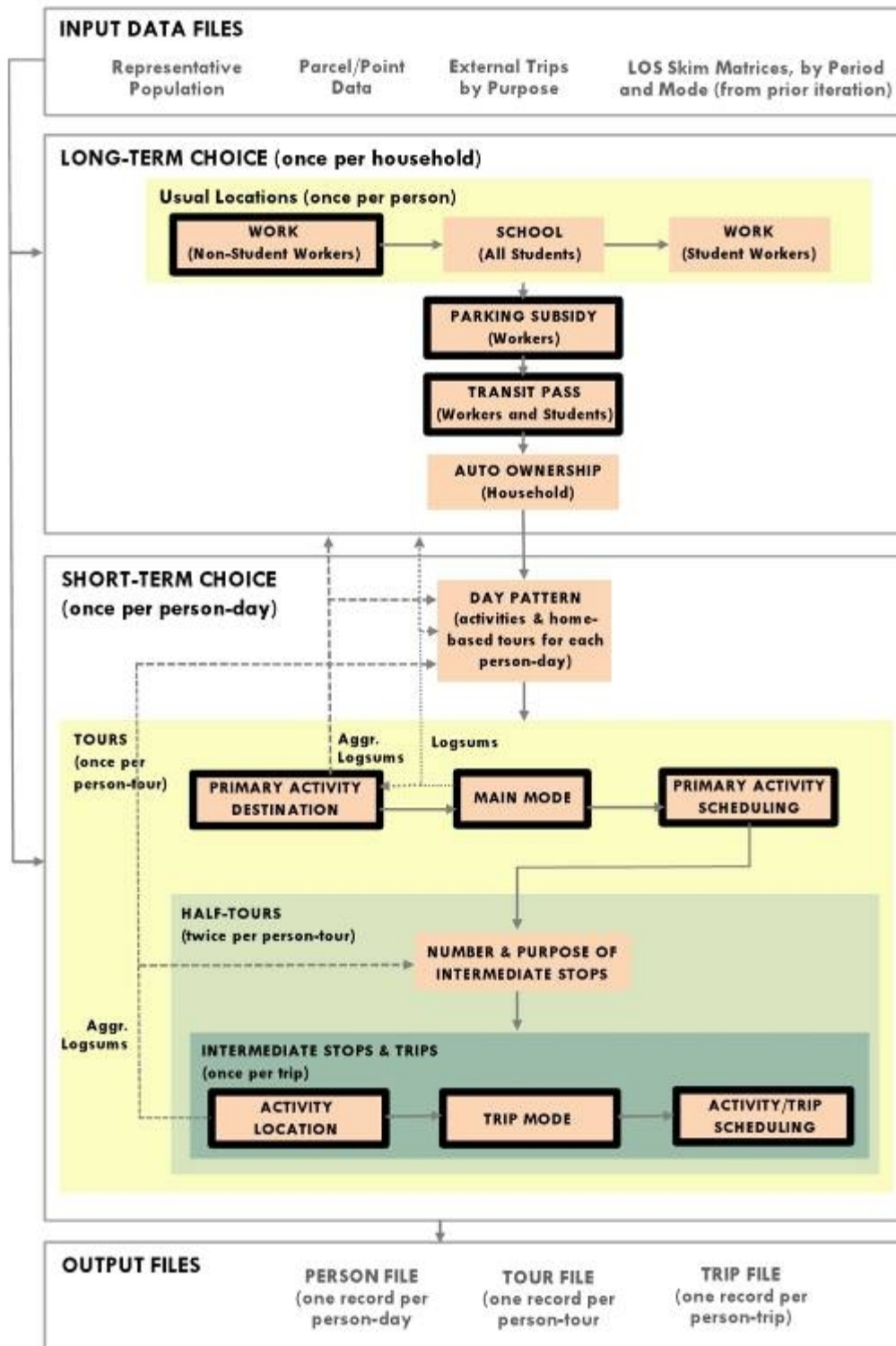
DaySim AB Model Features

The DaySim AB model component that we propose matches the design shown in Figure 1, which is similar to the existing DaySim AB model used in SACOG's SACSIM model system.

The following list identifies several of the important features of DaySim:

- Accessibility effects. DaySim employs a number of disaggregate and aggregate accessibility measures (logsums) in a consistent manner through the model system. These measures are based on the estimated mode, destination and scheduling models (representing tour and trip generation). They are carefully implemented to consistently incorporate sensitivity, at all levels of the model, to travel conditions that vary by mode, destination and/or time-of-day. For example, a pricing policy that impacts only the peak period will affect not only time-of-day choice, but also mode choice, destination choice, tour/trip generation, and even auto ownership.
- Pricing and congestion effects. The following features enhance DaySim's ability to represent the effects of pricing and congestion.





- Modeling toll/non-toll choice at the mode choice level: This feature involves bringing in separate highway cost and time skims for the best tolled and non-tolled paths, and including a sub-model in mode choice to predict diversion to facilities such as HOT lanes.
- Drawing value of time from a distribution: While VOT is related to income, it is also related to many unobservable factors that can be trip-specific. DaySim will use empirical VOT distributions to stochastically draw a separate value of time for each simulated tour, which will influence the destination choice, mode choice (including toll/non-toll), and time of day choices for that tour.
- Including peak spreading effects: DaySim models time of day at the level of half-hour periods, which enables it to integrate peak spreading effects into the models, using as temporally detailed of information about travel times and costs as is available from traffic assignment. (The assignment models may be enhanced to provide skim data for more than four time periods in the day.)
- Sensitivities to parking costs may be enhanced through the implementation of a simple parking subsidy model that identifies workers for whom parking costs are subsidized.

Software Capabilities.

An enhanced version of the DaySim software is currently being implemented for Seattle (PSRC), Jacksonville and Sacramento (SACOG), and will serve as the software code base for Fresno and the 3-County models. It has several attractive features:

- It is open source, giving the MPO's full access to the code and license to make changes and distribute the code if desired.
- Objected oriented C# for high performance and ease of maintenance
- A flexible configuration of modes, submodes, time periods, zones and correspondence with LOS skim matrices
- Reading and writing of LOS matrices in native CUBE binary formats
- Reading and writing of other input and output files in SQL, DBF or ASCII formats, configurable by user.
- Improved ability to reduce run times by distributing processes to multiple machines
- Automated model re-specification and re-estimation facilities integrated with ALOGIT, using an integrated scripting language similar to Python.
- Consistent model specification and application routines used for all choice models (makes code more modular and easier to read and update).



Management Approach

The San Joaquin Valley Model Improvement Plan (VMIP) will be a highly accelerated, multi-faceted project involving a large number of interrelated efforts across all eight counties to be conducted by a multi-disciplinary consultant team. The February 2012 sunset on availability of Proposition 84 funds, and the contracted time schedule for preparing each MPO's next RTP will require highly effective management of the project schedule and effective interactions among the Valley modelers and consultant staff.

We also recognize that Valley models will be under very close scrutiny when deployed for the next RTP cycle. The current Valley SB 375 targets are described by ARB as "provisional" and subject to re-consideration depending on information produced through improved modeling. In addition, other entities in Sacramento and the region may continue to subject Valley RTPs to focused legal scrutiny.

Furthermore, the results of the VMIP process will need to demonstrate to the Strategic Growth Council and the rest of the State of California that Proposition 84 funds have been spent in a productive manner that will lead to further evolutionary advances of modeling practices within the state beyond 2012.

For these reasons we have assembled a team of experts and analysts with the highest levels of technical expertise available in US who also have deep familiarity with the existing Valley models and regional and statewide issues. We also have a management team, management approach, and management track record that will assure all of the above challenges are met.

Management Team

Because of the complex and inter-organizational nature of the study, we are naming one of Fehr & Peers most senior Principals as overall Project Manager, and experienced task managers for administration, team coordination, and oversight of the team's technical approach.

- Overall Project Manager – Jerry Walters: Jerry is a founding Principal of Fehr & Peers, the firm's Chief Technical Officer and a member of Fehr & Peers' Executive Committee. He has the experience and authority to assure full firm commitment and any needed resources are allocated to the project. He also has over 30 years experience in travel forecasting and related policy issues. He has managed complex studies such as the US EPA Study of Mixed Use Trip Generation and Caltrans Statewide Modeling Tools.
- Administrative Project Manager – Laura Johnson: Laura has over 20 years experience managing federal and multi-agency contracts. She has extensive experience in contract administration and compliance. Laura is the Administrative Office Manager of the Fehr & Peers Walnut Creek



office and is responsible for allocating and supervising administrative resources. She plays a key role as administrative project manager on the California Statewide Modeling Tools project and other complex projects.

- Deputy Project Manager – Richard Lee, Ph.D.: Richard has over 25 years experience in regional transportation planning and modeling, much of it focused on the San Joaquin Valley. He will serve as the day-to-day team manager ensuring implementation of VMIP study design. He has in-depth familiarity with Valley and its planning agencies, as well as expertise on SB 375 and RTP requirements and procedures. He is a specialist in off-line and in-line quick-response tools for augmenting the analytic capacity of travel demand forecasting models.
- Technical Approach Manager – Mike Wallace: Mike is an Associate with Fehr & Peers and has 8 years of in-depth modeling experience which includes substantial work with all of the MPO models in the San Joaquin Valley. Building upon his coordination role on Valley MIP study design and leveraging his experience with similar multi-county multi-consultant model development projects with MPOs such as SLOCOG and AMBAG, Mike will serve as Technical Approach Manager on the overall study to ensure consistency between the consultant team and coordinate distribution of tasks and deliverables. Mike will coordinate closely with others on the management team to aid in communication between the consultant team and the MPO staff, and to keep the project moving forward smoothly.

In addition, each of the individual consultant groups will be managed by highly experienced leaders within their respective organizations. Not only do these individuals offer the highest levels of technical expertise, but they have the seniority within their organizations to insure that the needed resources are available to this study.

Task Leader for Mid-Valley County Models and Interregional Travel – Mike Aronson, Dowling Associates. Mike is a Principal with Dowling Associates and has over 25 years experience with statewide, regional and countywide modeling within the San Joaquin Valley. He has extensive experience in model development and training. He will oversee improvements to the countywide models for Fresno, Madera, Tulare and Kings counties as well as modeling of interregional travel among all Valley counties and between the Valley and external regions.

Task Leader for North Valley Model Integration and O/D Surveys, and StanCOG Model – Ron West, Cambridge Systematics. Ron is a Principal with Cambridge Systematics and has over 25 years experience in transit forecasting, travel demand model development, corridor studies and



regional analyses. He currently manages a number of statewide initiatives for the Caltrans Office of Transportation Systems Information, including the California household travel survey, and the revision of RTP guidelines in response to SB 375 requirements, and the statewide travel model users group. Ron will manage the development of three-county transportation networks for the north Valley sub-region, interregional travel surveys related to the north Valley sub-region, and county-specific model upgrades for the StanCOG model.

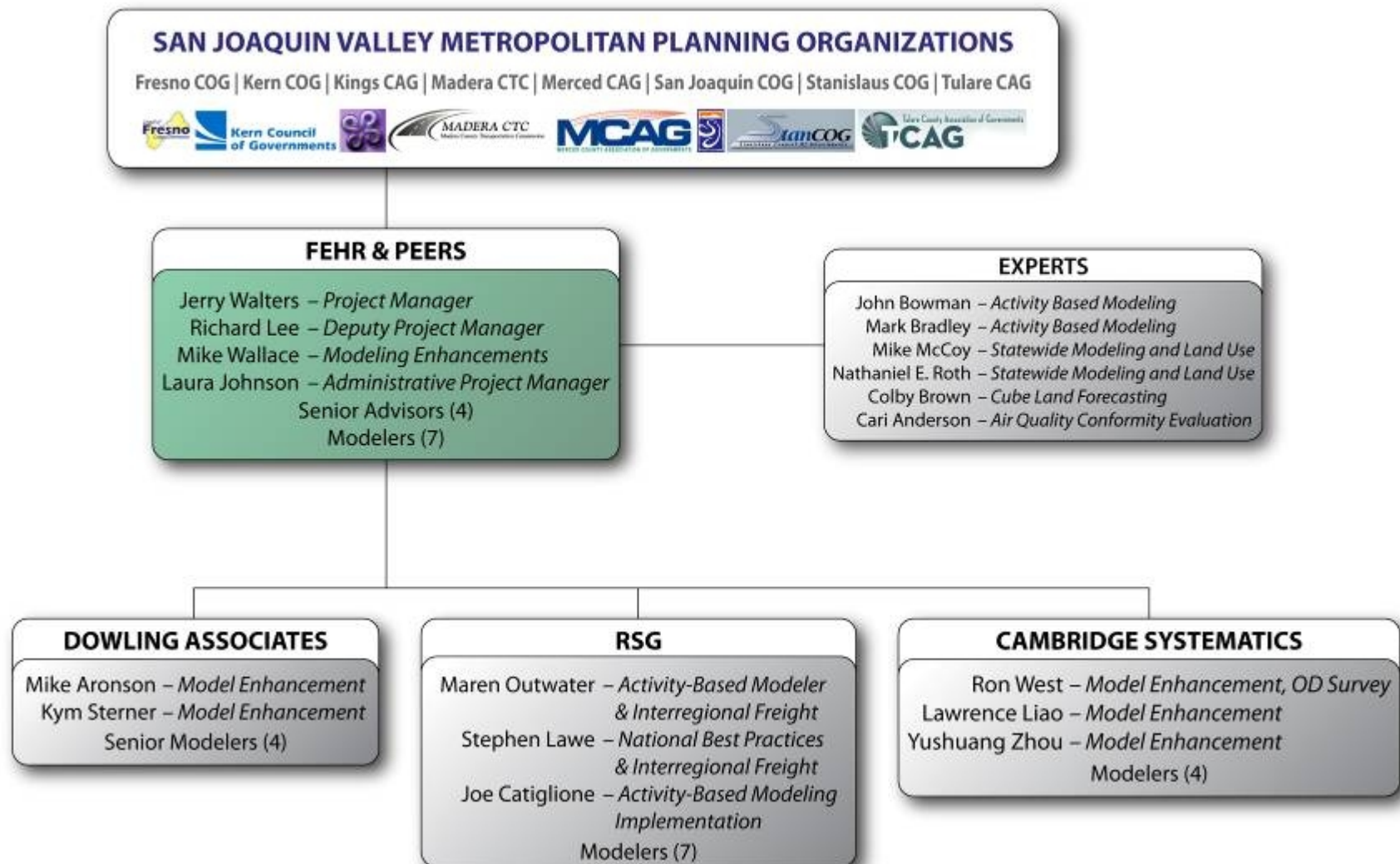
Task Leader for San Joaquin, Merced and Kern and Land Use Models – Mike Wallace, Fehr & Peers. In addition to Technical Approach Manager for the overall study, Mike will manage improvements to the individual county models for Kern COG, Merced CAG and San Joaquin COG as well as the CUBE Land model application and geo-database in Kern County.

Task Leader for Activity Based Models: Maren Outwater, RSG. Maren is a Director of RSG and will lead the team of RSG staff and other national experts in activity-based models. Maren has over 25 years experience managing significant and complex projects for regional and State agencies, and for the US EPA and FHWA, and has served as Director of Data Systems and analysis for a major west coast MPO. She has also been involved in highly successful activity-based modeling implementations in Sacramento, Seattle and the eastern US. Maren will manage the development of activity based models for Fresno COG and for the three-county north Valley sub-region, supported by Mark Bradley and John Bowman.

The Organization Chart on the following page illustrates our proposed management organization, the roles of the individuals listed above and other key members of our team.



ORGANIZATION CHART



OUR MANAGEMENT APPROACH

Our overall management approach will emphasize coordinated, direct interaction with each Valley MPO modeler and their MPO's associated planning staff. Each model improvement will have a dedicated consultant task manager and group of consultant staff who will work directly with the model to perform the improvements in direct consultation with MPO staff. In cases where the MPO modeler prefers to play a hands-on role, the consultant will engage the MPO staff at that level. In cases where the MPO modeler prefers only to be kept informed and then familiarized and trained in the changes at the end of the effort, we will work in that manner.

Each of the individual projects will be coordinated through a consultant management team who will engage in regular progress meetings with the Valley modelers group.

Technical Coordination – Monthly Webinars

In addition to our continuous interaction with individual Valley modelers on their respective model improvements, we will conduct monthly webinars on the overall project progress and the status of Valley-wide tasks such as interregional forecasting and transferable scripts. These webinars will also provide opportunities to review and discuss progress on pilot projects and multi-jurisdictional efforts such as CUBE Land and geo-database deployment, and northern counties interregional O/D survey and activity-based model development. They will also include timely reviews of the political and planning context within which the models will be used, including conformity issues, Proposition 84 grant funding decisions, and schedules for individual Valley RTPs, issues confronted by other MPOs around the state in producing their SB 375 target compliance estimates, and status of parallel efforts such as the Caltrans statewide model, travel survey, and MPO tools projects.

Administrative Coordination – Monthly Progress Reports

We will submit monthly progress reports to the VMIP project manager and will arrange and participate in conference calls as needed. Each report will itemize tasks completed, percentage of budget spent and achievement of overall study objectives. They will also contain a summary of any obstacles and issues encountered and recommended means and time-line for resolution.

On-Line Project Tracking Data – Wiki and Portal

We will maintain a web-based project management center continuously available to all project participants. The center will contain all relevant project status and coordination information including schedules, progress reports and other status tracking information, as well as copies of all memoranda and webinar material. It will also contain a searchable wiki for information about the project and serve as a collaboration portal for running discussions, data sharing and collaborative document development.



Our Track Record

The Fehr & Peers staff responsible for management and oversight of the VMIP project have broad and effective experience managing projects of this type, involving complex and multi-dimensional technical issues, with diverse groups of stakeholders and large consultant teams. We have consistently performed fully within project schedules and budgets and with highest levels of client satisfaction. The following table provides examples of successful similarly complex projects.

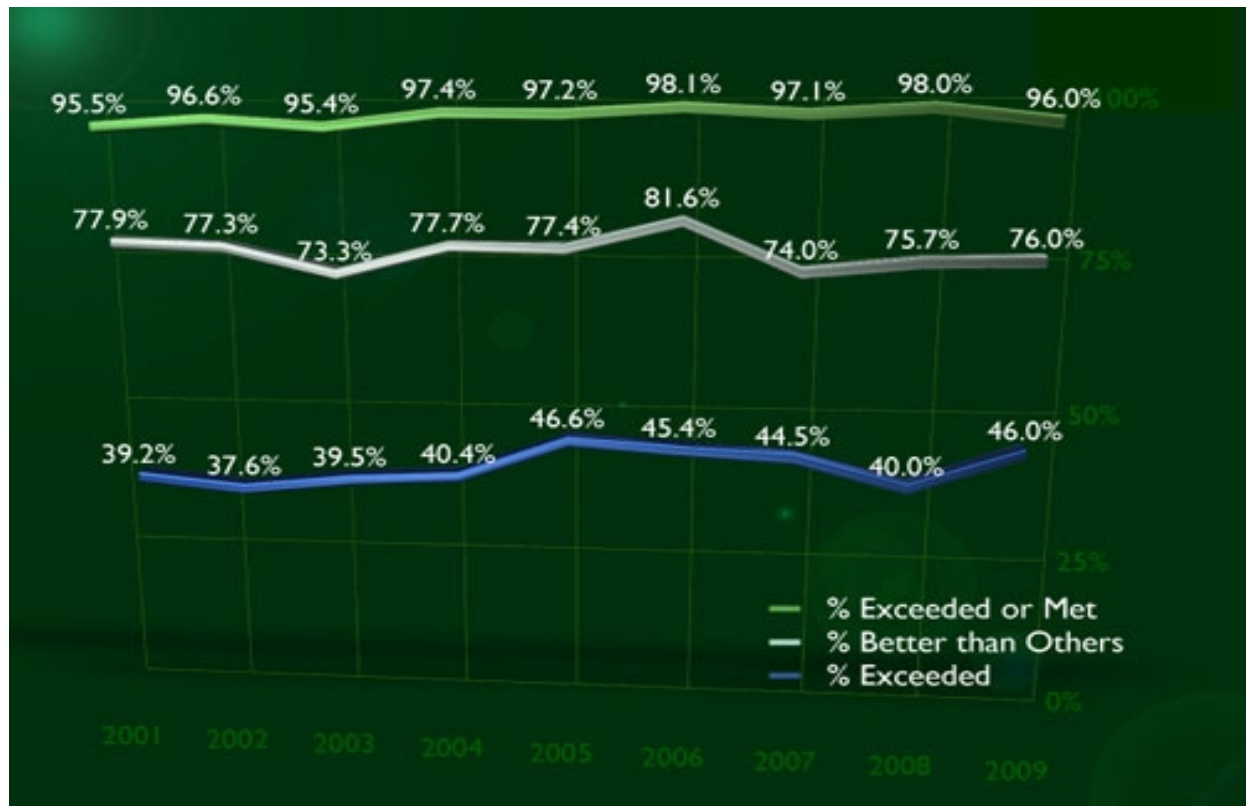
Experience Managing Multi-Jurisdiction, Multi-Disciplinary Studies

Study	Number of Clients/ Jurisdictions	Number of Sub-Consultants	Time/ Budget Performance
San Joaquin Valley Model Improvement Study Design	8 Fresno COG, Kern COG, StanCOG, SJCOC, MCAG, TCAG, MCTC, KCAG	5	Accelerated schedule, on-budget
National Study of Mixed-Use Trip Generation	2 US EPA, ITE (plus 6 major US metro regions)	4	On schedule, on-budget
California Statewide MPO Transportation/Land Use Tools	8 representative California urban and rural MPOs	2	On-time and budget (through 40% of schedule)
Quantifying Greenhouse Gas Mitigation Measures	35 (10 active) California Air Quality Management Districts	0	On-time, on budget
San Diego Smart Growth Trip Generation Methods	20 SANDAG plus member jurisdictions	3	On-time, on budget
Fresno Public Transit Infrastructure Study I	17 FresnoCOG plus member jurisdictions	8	On-time, on budget
I-5 Corridor Strategic Transportation Plan	10 SJCOC, StanCOG, MCAG and representative cities	4	On-time, on budget

Fehr & Peers is dedicated to client service and achieves exemplary levels of client satisfaction on all of its projects, large and small. We continuously survey all of our clients on the quality of our performance. Our client satisfaction levels have remained consistently high, as illustrated below. Over 96% of our clients rate us as meeting or exceeding their expectations, with 46% saying we exceeded expectations, and over 75% rating us better than our competitors.



Summary of Fehr & Peers Client Survey Results 2001-2009.



In the critical areas of quality, value, and service, the following percentages of clients state that we met or exceeded their expectations:

- Quality – 97%
- Value – 95%
- Service – 96%

In summary, the Fehr & Peers team offers not only the full range and depth of expertise needed for VMIP but also the management team, management approach and track record to produce a highly successful project.



Budget and Billing Format

The cost proposal was prepared using the Actual Cost plus Fixed Fee method and does not exceed the maximum of \$2,500,000 budgeted for consultant services. See Attachment C for task budget, cost breakdown, and detailed rate information.

Conflict of Interest

Fehr & Peers provides consulting services for various California State, County and City agencies. Fehr & Peers is a California corporation, does not serve in a decision-making capacity, and has no reportable financial, business or other interests with the San Joaquin Valley MPOs, which would affect the outcome of this contract.

Insurance Requirements

Fehr & Peers meets the specified project insurance requirements.

Disadvantaged Business Enterprise (DBE) Certification

See Attachment B for DBE Participation.

Summary of Qualifications

See following pages for Qualifications and Resumes.



Qualifications & Experience

FEHR & PEERS

Building on more than a decade of experience and a commitment to innovation matched by a commitment of internal R&D resources, Fehr & Peers staff are experts in travel demand modeling and the application of transportation models, alternative modes planning, and the evaluation of interactions between land use and transportation. With respect to implementing the 4Ds in conjunction with travel demand modeling our experience is unparalleled. The following is a selection of projects that exemplify our expertise and local knowledge that give us a vital edge in developing a scope of work for needed short-term improvements in the Valley's modeling tools.

Fehr & Peers specializes in providing transportation planning and traffic engineering services to public and private sector clients. We emphasize the development of creative, cost-effective, and results-oriented solutions to planning and design problems associated with all modes of transportation.

SPECIALIZED SERVICES

Rather than trying to offer a multi-disciplined approach, we choose to focus on being the best traffic engineering and transportation planning consulting firm. We offer specialized expertise in the following areas:

- Travel Demand Forecasting
- Land Use & Smart Growth Planning
- Transportation Systems Planning
- Traffic Operations & Simulation
- Intelligent Transportation Systems
- Traffic Calming
- Bicycle & Pedestrian Planning and Design
- Transit Planning & Simulation

Clients hire Fehr & Peers because we provide the right combination of leading-edge technical skills, high-quality work, and superior client service. We thrive on challenging assignments in controversial environments where complex problems can only be solved by using state-of-the-practice analytical techniques, developing innovative, yet practical solutions, and achieving consensus amid the diverging views of stakeholders. We often find ourselves called into projects where others have failed. We consider each potential assignment carefully, and we only accept those projects we are able to complete successfully.



San Joaquin Valley Model Improvement Plan Scope of Work

Fehr & Peers, with subconsultants Dowling Associates, RSG, Inc., and Mark Bradley, John Bowman, Michael McCoy and Nathaniel Roth, developed a scope of work to update and improve each of the eight San Joaquin Valley MPO transportation models to meet the requirements of SB 375 and related policies and guidelines. Fehr & Peers provided overall project management, and led the analysis of requirements for SB 375 Compliance, and 4D and GHG analysis model enhancements. Subconsultant roles included Dowling Associates (key input on existing Valley MPO Models, Mode Choice, and Air Quality Conformity); RSG, Inc. (National Best Practices, Interregional and Freight Models, Activity-Based Models; Michael McCoy – Expert Advisor on Interregional Economics and Statewide Travel Modeling. Nathaniel Roth, Expert in Valley-wide Land Use Data and Modeling; and John Bowman and Mark Bradley, Expert Advisors on Activity-Based Models.

Due to new state-level mandates, the timeframe for this work was compressed. The Fehr & Peers team successfully developed the Valley Model Improvement Scope of Work in only five months – four months ahead of the original schedule.

Improved Tools for Local and Regional Integrated Land Use/Transportation “Scenarios” Planning in California (Ongoing Project)

As part of a team that includes SACOG and UC Davis, and with funding from Caltrans, Fehr & Peers is in the process of developing Ds elasticities for eight representative regions of California. Ds elasticities are statistically-estimated coefficients which specify the range of changes or differences in key travel behaviors, based on changes or differences in the land use or land use/transportation characteristics of the place of residence or activity locations of the traveler. We will validate the Ds elasticities through rigorous statistical testing and reasonableness checks.

The Ds elasticities will be estimated using the data collected for this project, checked for reasonableness, and potentially calibrated using the literature review, with input and review by the Expert Panel. Where statistical evidence suggests differences, the elasticities will be varied by region, taking account of the land use and transportation characteristics of each of the regions. The geographic scale and content of land use data available in each region will also be considered in the development of the Ds elasticities. The geographic scale for the I-PLACE3S module, and for all data provided by SACOG, will be parcel or parcel/point; for the UPLAN module and all data provided by UCD, the scale will be grid-cell, or grid-cell/point; and for the Ds travel model post-processor, the scale will be traffic analysis zone, ideally with parcel or grid-cell data available for development of the post-processor.

This project will develop and provide more accurate and robust planning tools than are currently available and will represent a substantial increase in the transportation planning capacity in mid-sized regions such as the Central Valley, as well its cities and counties. These improved tools will enable



development of land use and transportation systems that have fewer impacts and greater benefits for regions, localities, and the entire state.

Vision California

“Vision California” is an unprecedented statewide effort to explore the critical role of land use and transportation investments such as High Speed Rail in meeting the environmental and fiscal challenges facing the Golden State over the coming decades. The study, funded by the California High Speed Rail Authority and the state’s Strategic Growth Council, will examine alternative land use and transportation scenarios through which California can accommodate expected growth and create a more sustainable future.

Fehr & Peers is providing the transportation expertise on the Vision California team, a team that is lead by Calthorpe Associates, and that also includes experts in land use, natural resources, energy and public health. The work is a natural extension of Fehr & Peers’ work for the US Environmental Protection Agency on 4D and MXD modeling tools and our role helping define the process for addressing California’s AB32 and SB375 climate laws as participants in California State Air Resources Board Regional Targets Advisory Committee.

Fresno D-Processor and Scenario Analysis

On two occasions, Fehr & Peers assisted the Council of Fresno County Governments (Fresno COG): the initial effort was performed under subcontract to the University of California Davis in support of the Valley Blueprint Study; the second effort was coordinated directly with Fresno COG in support of SB 375 greenhouse gas reduction target-setting. On each occasion, Fehr & Peers worked closely with the staff of Fresno COG to improve the capacity of the Fresno COG’s travel model to respond to observed travel elasticities reflecting the effect of changes in density and land use diversity, as well as urban design to improve walkability (the 3Ds). A fourth D variable, regional destinations, was deemed to be adequately accounted for by the COG’s travel demand model.

Spreadsheet files for applying the first 3Ds were initially created and applied. Ultimately an in-line processor for adjusting vehicle trip generation within the full Fresno COG 4-step model was developed. The enhanced model was recently applied to four future land use/transportation scenarios developed as prototypes of the Sustainable Community Strategy required under SB 375. Fehr & Peers also assisted COG staff in the development of the land use scenarios, and with the interpretation and presentation of the results.

The inline D-processor development for Fresno COG (as well as similar efforts for San Joaquin, Kern and Tulare MPOs, described below) represents substantial basis for further enhancement of model sensitivity to local land use factors in these models. It also provides the groundwork for developing D-processors for the other four MPOs in the San Joaquin Valley.



Kern COG D-Processor for SB 375 Target-Setting

Fehr and Peers enhanced the Kern COG TDF model to estimate the per capita vehicle (VT) and vehicle miles traveled (VMT) reductions that would occur with the implementation of smart growth policies and practices in Kern County and its cities.

In developing 4D model adjustments, there are two primary ways to implement the process. The first is through an off-model spreadsheet post-processor which would identify the reductions outside of the travel demand model. The second is to develop trip tables within the Kern COG model that would include 4D model enhancements and incorporate the adjustments directly into the model structure. Our current intent is to assist the COG model that would include 4D model enhancements and incorporate the adjustments directly into the model structure. This will streamline the use of the 4Ds in interactive scenario planning such as that which Kern COG may choose to conduct in order to inform California Air Resources Board (CARB) in its efforts to define draft regional SB 375 targets in early 2010. It will allow Kern COG to more effectively distinguish the changes in VMT that relate to interregional travel and through trips, as well as travel by special trip generators that may be exempt from SB 375 targets such as jobs in strategic resource activities such as sustainable energy, agriculture, lumber, oil and mining resources, military, prisons, and rural recreation.

Tulare CAG SB375 Climate Change "4D" Travel Demand Model Enhancements

Fehr and Peers is assisting the Tulare CAG TDF model to estimate the per capita vehicle (VT) and vehicle miles traveled (VMT) reductions that would occur with the implementation of smart growth policies and practices in Tulare County and its cities.

The CAG model as enhanced to enable scenario planning that Tulare CAG may choose to conduct in order to inform California Air Resources Board (CARB) in its efforts to define draft regional SB 375 targets in early 2010. The enhanced TCAG model will not only be sensitive to local land use D-factors – it will also enable Tulare CAG to more effectively distinguish the changes in VMT related to interregional travel and through trips, as well as travel by special trip generators that may be exempt from SB 375 targets, such as jobs in strategic resource activities such as sustainable energy, agriculture, lumber, oil and mining resources, military, prisons, and rural recreation.

San Joaquin Council of Governments Travel Demand "4D+" Model Enhancements

Fehr & Peers developed in-line modeling procedures to adjust the San Joaquin Council of Governments (SJCOG) Travel Demand Forecasting model (implemented in Cube/TP+). These procedures, fully internal to the four-step model, estimate the per capita vehicle trip (VT) and vehicle miles traveled (VMT) reductions that would occur with the implementation of smart growth policies and practices in San Joaquin County and its cities. In addition, Fehr & Peers developed a script for congestion management program deficiency analysis, as well as to reflect HOV lanes in the model network. This work was done in anticipation of modeling requirements for the 2011 San Joaquin Regional Transportation Plan (RTP)



and analysis that will be needed for compliance with SB 375. A separate element of this project incorporated a new base year land use, and revalidation of base year model results against traffic counts and VMT estimates. The entire project was completed in four months.

Sacramento Regional Blueprint Project



Fehr & Peers worked with the Sacramento Area Council of Governments (SACOG) and the Sacramento Transportation and Air Quality Collaborative, representing 60 businesses, government, environmental, and community groups, to develop four long-range future land use and transportation scenarios. We assisted in conducting a 4D analysis that included application of locally-calibrated 4D factors in combination with the conventional SACOG travel demand models. The SACOG models were refined to enhance sensitivity to neighborhood density, land use diversity, pedestrian-friendly design and destination accessibility. Statistical analysis helped to define a set of enhancements to the modeling process to capture 4D effects on vehicle trips and vehicle miles of travel.

Santa Barbara Travel Demand Forecast Model and General Plan Update



Fehr & Peers developed a sub-area travel demand forecasting tool incorporating smart growth land use and transportation attributes for use in updating the City of Santa Barbara General Plan. The travel demand model includes advanced features that allow it to better capture the effects of Smart Growth land use and policy decisions and mixed-use developments. These features include:

- Integrated 4D refinements to enhance the sensitivity of the model to account for how travel behavior is affected by the built environment. Such refinements are critically important for evaluating the change in vehicle trips and vehicle miles of travel associated with infill and smart growth developments.
- Trip assignment that isolates drive-alone and shared-ride (2 and 3+) trips by purpose. This multimodal assignment will be used to evaluate HOV/HOT lane facilities in the future.
- Established a district-based TDF model structure to capture different travel characteristics in different areas of the City.



SEGA Specific Plan



Fehr & Peers assisted Calthorpe Associates with the development of the South East Growth Area (SEGA) specific plan in the City of Fresno. Specifically, we utilized our 4D adjustments and direct ridership forecasting models to modify the Fresno COG model in evaluating the SEGA specific plan which is expected to house the next 100,000 people in the City of Fresno. The project included extensive sub-area validation of the Fresno COG model, integration of our 4D model, and evaluation of the specific plan.

"I would like to thank you and F&P for the excellent training and wonderful hospitality! Though I am pretty new to the GIS methodology scene, watching you go through it along with the detailed protocol gave me hope that I have at least a toehold on the subject. And Kevin confirmed that your training filled in a couple of missing pieces and he is now fully confident of

Proposition 1C Statewide TOD Evaluation Tool

For the State of California, Fehr & Peers developed a Transit-Oriented Development (TOD) project evaluation tool, as required by Proposition 1C, passed by the voters in 2006. The tool scores proposed housing projects on the basis of the 5Ds (density, diversity, design, destinations and distance to transit). Key deliverables included: 1) basic model, 2) calibrated model, 3) user manual, 4) one-day training session with Caltrans and the Department of Housing and Community Development (HCD), and 5) proposal evaluation assistance. Dr. Susan Shaheen of UC Berkeley's PATH program served as client project manager.

Fehr & Peers was hired by the University of California to build and analyze 53 transit oriented development (TOD) sites. Part of our scope was to build an efficient process to capture the population density within a 4-mile radius of each TOD site, and train the client technical staff to use the tool. Following is a testimonial provided by the client:

Smart Growth Twin Cities

Fehr & Peers worked with the Metropolitan Council, the MPO for the Twin Cities region of Minnesota, to enhance their large-scale regional travel demand models for enhanced sensitivity needed to reflect the parcel-level planning efforts of the Smart Growth Twin Cities study. Enhancing the models involved:



- Analysis of the recent regional Travel Behavior Inventory to ascertain specific current relationships between neighborhood land use density, mix, and urban design, and the number of vehicle trips and vehicle miles generated by neighborhood households.
- A synthesis of data from over 40 studies on relationships between built environment and travel demand for urban areas throughout the United States.
- Investigation of the regional model's native sensitivity to changes in local land use density, diversity, design, and regional accessibility, and the model's average vehicle-trips-per-capita and vehicle-miles-per-capita results based on income and transit availability.
- Development of a set of regionally-calibrated 4D elasticities to enable the model to capture sensitivities to neighborhood density, diversity, design and destinations as exhibited in the regional Travel Behavior Inventory and national data synthesis

SLOCOG Regional Vision

The council of governments for San Luis Obispo County (SLOCOG) held a series of public workshops to develop a long-range vision for how the county should accommodate growth without compromising either the natural beauty of their coast and wine-growing regions or the small-town atmosphere that attracted new residents. A key issue was the growing traffic problems on the county's sparse roadway network. Fehr & Peers developed a streamlined version of SLOCOG's travel demand model, including calibrated 4D factors that enabled workshop participants to try out different land use configurations and get forecasts of the corresponding traffic volumes within 15 minutes. This was the first time the general public had access to the same tools as professional transportation planners, and attempted to face similar issues of managing growth within a set of realistic constraints. Participants quickly learned the importance of Smart Growth principles in reducing travel demand, and the importance of a jobs/housing balance in reducing the need for longer-distance travel.

SJCOG Regional Transit Systems Plan

Fehr & Peers led a multi-disciplinary consulting team to create a long-range strategic plan aimed at organizing and prioritizing transit infrastructure projects and services in San Joaquin County, with an emphasis on interurban and interregional transit. The plan is establishing procedures for coordinated provision of transit infrastructure and operations among the County's eight jurisdictions and seven transit providers. SJCOG intends to use the Regional Transit Systems Plan for future updates to the Measure K Strategic Plan transit element, the Regional Transportation Plan, the Congestion Management Plan, and the Measure K Smart Growth Incentive Program. The plan was developed based on current plans and key staff interviews, along with modeling of potential future transit demand.



San Joaquin Valley Growth Response

On a team led by VRPA, Fehr & Peers played a key role advising and informing local jurisdictions, regional agencies, and the California Department of Transportation on effective “Smart Growth” planning processes and tools for use in this rapidly growing eight-county region of central California. This area experienced intense suburbanization pressures from San Francisco, Los Angeles, and other sources, leading to rapid consumption of agricultural land, saturation of roads and other infrastructure, and severe air quality impacts. The Growth Response effort was focused on assisting local and regional planning agencies in identifying, testing and adopting tools to predict the economic, transportation, and environmental consequences of various land use development scenarios and related planning decisions. Candidate land use allocation models included MEPLAN and UrbanSIM; visioning and impact assessment tools, such as Smart Growth INDEX and PLACE3S, were also under consideration. The Caltrans-sponsored Growth Response exercise includes year-long case study applications of the tools and planning processes in the region’s cities as well as in small rural communities.



Statewide Managed Lanes Study - Utah Department of Transportation

Fehr & Peers was retained by the Utah Department of Transportation (UDOT) to conduct its first-ever statewide study of the potential for managed lanes. We assisted UDOT in assessing the feasibility of various measures to promote a long-term balance between the demand and supply of road space in Utah. This study for UDOT accomplished several objectives:

- Provided the department a list of facilities where managed lanes might be appropriate.
- Raised awareness of managed lanes to policymakers.
- Educated UDOT management on the concept of managed lanes.

In the study, managed lanes were defined as reversible lanes, high-occupancy vehicle lanes (HOV), high-occupancy toll lanes (HOT), and toll roads. Fehr & Peers developed a screening process that reviewed the applicability of each strategy on potential corridors. Screening criteria included current and future traffic volumes, system connectivity, directional split, and facility type. Final selection of the corridors included applying the Salt Lake City regional travel demand model to forecast demand on tolled and other facilities. Since managed lanes are a new concept in Utah, the project included a thorough review of case studies from around the country, including technical, institutional, and policy issues. In addition, toll and revenue forecasts were developed for several corridors to illustrate how tolling might impact the budget for traffic impacts on future highways.



DOWLING ASSOCIATES PROJECTS

Dowling Associates is a traffic engineering and transportation planning consulting firm based in Oakland, California with offices in the Central Valley and Sacramento. Founded in 1986, we currently employ over 35 full-time professional and support staff. Our clients include the Federal Highway Administration, the National Academy of Sciences, Caltrans, the University of California, plus numerous cities, counties, and metropolitan planning organizations.

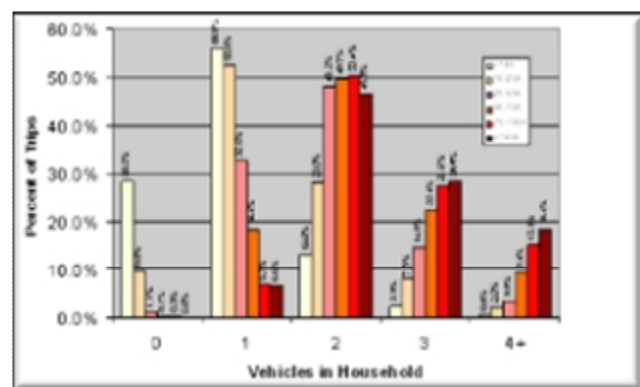
Our specialties include traffic engineering traffic operations analysis, microsimulation modeling, traffic impact analysis, travel demand modeling, research, bicycle and pedestrian planning, and transportation circulation element planning. We pride ourselves on leading with the most advanced techniques and technology in transportation engineering and planning.

Principals are actively involved in the Transportation Research Board and the Institute of Transportation Engineers. Seven of the staff are certified civil engineers, six are certified traffic engineers and four are AICP certified planners. Our principals also teach university courses and participate in significant government research projects.

Dowling Associates, Inc. uses state of the art computer software including traffic simulation software such as Paramics, VISSIM, CORSIM and Synchro; travel modeling software such as TransCAD, VISUM, Cube/Voyager/TP+/Viper, EMME/2, TRANPLAN, MINUTP and QRS; and traffic analysis software such as HCS, FREQ and TRANSYT-7F. Dowling Associates, Inc. is the author of FSP-Trak and TRAFFIX™, and provides certified training for Paramics and TP+/Viper.

San Joaquin Valley Blueprint Study, Central Valley, CA

The eight counties in the Central Valley of California are preparing a Blueprint study of alternative growth scenarios. Each of the eight counties is using the UPlan model to prepare alternative land use forecasts for the year 2050 based on various policies for allowable densities and preservation of agricultural land. Dowling Associates provided technical assistance to all counties for the transportation evaluation of the alternatives, including conversion of UPlan outputs into socioeconomic inputs to transportation models, forecasts of travel between counties, and estimates of mode choice changes related to land use mix and density.



San Joaquin Valley-Wide Air Quality Planning and Coordination Services

As a subconsultant, Dowling Associates has provided on-call assistance to counties in the Central Valley on transportation modeling and air quality issues. Dowling Associates prepared a working paper on induced travel demand, researched historical traffic growth rates at county boundaries, and provided technical assistance on data interfaces between TP+ modeling software and air quality analysis programs. Subsequent tasks include forecasting vehicle miles traveled, congested speeds, centerline miles, and lane miles by facility types and ADTs.

San Joaquin Valley Conformity Strategy Study

Dowling Associates led a multidisciplinary team of experts to assist the eight county councils of governments (COGs) in the San Joaquin Valley Air basin in the development of a long-term strategy for improving their transportation and air quality modeling capabilities. This effort was designed to specifically meet the requirements laid out by the U.S. Environmental Protection Agency in their Transportation Conformity requirements. ISTEA and state planning requirements were also included in the evaluation of possible model improvement strategies.

San Joaquin Valley Goods Movement Study Phases 1 and 2

Dowling Associates supported the first two phases of the San Joaquin Valley Goods Movement Study. In the first phase, Dowling targeted carriers and shippers/receivers, and focused on origins and destinations, number of trips generated, commodities hauled by mode, industry type, and routes used. For the second phase, Dowling modified the Statewide Travel Model to include road improvements from each of the eight counties, and adjusted non-home trips to compensate for the trips estimated by the goods movement model.

Caltrans Statewide Model

The California Department of Transportation (Caltrans) developed a new multimodal statewide travel model that was a product of a unique collaborative effort between Caltrans staff and Dowling Associates. The model was developed through a series of classes taught by Dowling Associates on TP+/VIPER software and on travel demand modeling. Caltrans and consultant staff worked together to complete each component of the model through a set of class assignments. Dowling has frequently applied the Statewide model to provide forecasts of interregional travel to the RTPAs for use in their local forecasts.



California Motor Vehicle Stock, Travel and Fuel Forecast (MVSTAFF) Model Improvements

The MVSTAFF model was developed in the 1970s to forecast fuel consumption, VMT, and motor vehicle stock by County. Dowling Associates was selected to prepare the first-ever update to this model, which will include demographic information (e.g., responsiveness to aging population), new types of vehicles (e.g., hybrid, electric, biofuel), and increased flexibility of use in a spreadsheet environment. For example, it will be able to test “what if?” scenarios easily for planning purposes. The model is envisioned as providing a baseline to assess their compliance with AB32/SB375 compliance. Completion of the model is expected in 2010.

Fresno Model Updates, Fresno County, CA

Dowling Associates has been responsible for several phases of updates and improvements for the regional travel demand model maintained by the Council of Fresno County Governments since 2000. The current project focuses on updates to the base year land use inventory and travel behavior assumptions. The updated land use inventory used 2000 Census data for residential uses and several available employment databases plus additional field checking for employment uses. The employment sites (over 30,000) were individually geocoded for allocation to specific model zones. The 2001 California Household Travel Survey was used to update trip generation and distribution assumptions. The mode choice model and traffic assignment have been improved and validated to represent 2003 observed conditions. Prior updates implemented sophisticated feedback loops to account for traffic congestion in destination and travel mode choices, and developed detailed multi-modal measures of effectiveness for Environmental Justice assessment.



Kings County Association of Governments Regional Model Update

Dowling Associates updated and revalidated the Kings County regional model and is currently providing on-call modeling services as requested. Model update tasks included estimation of the socioeconomic inputs, development of a master highway network, comparison of forecast volumes to traffic counts (subject to Root Mean Square Error targets) and HPMS VMT estimates, model documentation and training. On-call services to-date have included writing TP+ scripts to obtain model outputs for air quality conformity analysis and applying the model for traffic impact studies.



StanCOG On-Call Model Support (Stanislaus County, CA)

Dowling Associates was responsible for incorporating updated census-based land use projections into the StanCOG regional model and revalidating it to 2000 conditions using TP+ and Viper software. Sample tasks were the creation of a "master network" that includes base year network and programmed and planned infrastructure improvement assumptions, updated trip generation rates, and the development of vehicle miles traveled (VMT), lane mile and centerline mile VMT estimates for submittal to ARB as part of air quality conformity.

Tulare County Association of Governments Regional Land Use and Travel Model Update

Dowling Associates provided technical assistance and guidance to TCAG staff on the process to update their travel demand model input land use assumptions by traffic analysis zone (TAZ), as well as other preparatory steps needed for their current revalidation efforts. Tasks included recommending TAZ splits, obtaining socioeconomic data sources, updating base and future household, employee, and special generator assumptions, as well as reviewing network attributes. We are currently completing the second of two 3-year contracts to provide on-call travel demand modeling services to TCAG.



Other notable Dowling Associates modeling- and SB 375-related projects include

- Kern Transportation Model Update
- San Joaquin County General Plan Update
- San Joaquin County Traffic Impact Mitigation Fee Program Update
- San Joaquin County On-Call Services
- Riverside Motorsports Park, Merced County, CA
- Santa Nella Transportation Improvement Plan, Merced County, CA
- NCHRP 25-21 Air Quality Effects
- SCAG Arterial Monitoring and Freeway/Arterial Speed-Flow Curve Development Project



RESOURCE SYSTEMS GROUP, INC. (RSG)

Resource Systems Group, Inc. (RSG) is a full-service transportation planning, modeling, and survey research firm with offices in Vermont, Chicago, and Salt Lake City. The firm was founded by three Dartmouth College professors with the goal of implementing the most promising demand modeling innovations being generated by academic researchers. RSG has grown steadily for 23 years and has completed projects in over 30 U.S. states and 30 countries. RSG is very comfortable with the spectrum of aggregate and disaggregate models for land-use, travel demand, transportation system performance, and environmental modeling. Just as important, RSG understands both the nuanced technical details of models and the planning applications and policy considerations that require thoughtful analyses. RSG's experience is broad-based geographically and deep technically, touching all aspects inherent in excellent planning and project development analyses. Implementing demand modeling innovations naturally led to a focus on the front-end data requirements of the modeling process and resulted in the development of a large-scale survey capability. Over the last decade RSG has grown into a full-service transportation and land-use forecasting firm with an in-depth understanding of travel behavior in order to develop insightful models and produce defensible forecasts of transportation and environmental impacts.

FHWA Development of Guidelines on Travel Demand and Land Use Forecasting in NEPA

RSG developed for Federal Highway Administration (FHWA) process and procedural guidance on travel and land use forecasting in the context of the NEPA process. RSG met the goals of the project by conducting outreach to agencies, practitioners, and other stakeholders involved in NEPA projects, and reviewing documentation from recent NEPA projects. RSG then worked with an FHWA task force to develop the guidelines. The guidance provides FHWA, and its partners and stakeholders in the NEPA process with information on the state-of-the-practice; a review of relevant case law; guidance for better describing/representing procedures, data and analysis results in NEPA documents; guidance for improving the state-of-the-practice in forecasting for NEPA; and case study examples. The guidance deals with emerging issues and trends such as linking planning and NEPA, land use scenario planning, advanced travel and land use forecasting methods, tolling and pricing, and congestion management.

FHWA Greenhouse Gas Calculator

RSG is leading a project for Federal Highway Administration (FHWA) to facilitate the ability of DOTs and MPOs to integrate climate change considerations into the planning process by providing accessible, state-of-the-art tools and techniques. This involves developing a web-based guide to specific transportation-related strategies for reducing GHG emissions, various education materials on the state of the practice and a web-based tool for DOTs and MPOs to use in estimating GHG emission impacts from surface transportation strategies.

California Energy Commission Vehicle Choice Models



RSG conducted the 2008-09 California Vehicle Survey (CVS), and provided input data for the California (light-duty) Conventional and Alternative Fuel Response Simulator (CALCARS) model at the California Energy Commission (CEC). The 2008-09 CVS collected data on both stated and revealed preferences of vehicle owners in California, to forecast their vehicle choice and the use of both conventional and alternative fuel vehicles.

SACSIM Pricing, Cost, and Transit Enhancements

RSG is supporting the development to add capabilities to the Sacramento Activity-based Travel Simulation Model (SACSIM) to analyze pricing, tolling and transit proposals. These capabilities are being added to address current limitations in the modeling system, SB 375 requirements and the next round of forecasting and analysis needs for the next metropolitan transportation plan. RSG will provide quality control for the model enhancements and calibration, validation, and sensitivity testing of the overall model system. RSG is working with Mark Bradley, John Bowman and DKS Associates (prime) on the project.

Development of a Fully Integrated Disaggregate Model System In Sacramento

In a cutting-edge project in Sacramento with the Sacramento Area Council of Governments (SACOG) and the Federal Highway Administration (FHWA), RSG led the development of a fully integrated disaggregate model system including the DaySim activity based model and TRANSIMS. Components of SACOG's Cube model are also integrated into the modeling chain. This is one of the first fully integrated disaggregate models in the United States.

San Francisco County New Starts Support

RSG is under contract with the County Transportation Authority in San Francisco to provide support in the application of their activity-based model for FTA New Starts modeling efforts. Recent work includes updates to the Central Subway forecasts, as well as BRT forecasts for the Geary and Van Ness corridors.

SCAG Regional Congestion Pricing Study

RSG is involved in all aspects of the development of advanced choice models and behavioral elasticities characterizing traveler response to various regional congestion pricing strategies. RSG has designed and is about to field a stated preference survey to collect responses to various pricing policies (corridor pricing, area wide pricing, VMT pricing, etc) in terms of trip suppression, time-of-day choice, destination choice, mode choice, vehicle occupancy choice, and route choice. RSG will be developing choice models to understand each of these choices and their prevalence in response to specific pricing policies.



Atlanta Regional Model Enhancement

RSG, working for a private venture, extended the Atlanta Regional Commission (ARC) four-step model geography and capabilities to support tracking of demographic cohorts throughout the network. This model system can be used complex analyses of environmental justice. The model geography was extended from 13 counties to 25 counties to better represent outer suburbs. An enhanced routing methodology was developed to track the route from each O-D pair throughout a multi-path user equilibrium run. Custom software and statistical methods were developed estimate a synthetic population and associate the route choice with individuals.

Florida Statewide Transportation Model for Florida's Turnpike Authority

RSG assisted in the construction of a auto based transportation model with several cutting edge features. The network for the model is automatically generated from clean GIS layers and can be developed at three different levels of detail for any or all of the State of Florida. The TAZ layers are then automatically generated using the road network and loadings are automatically assigned for each TAZ using road classifications and other generalized heuristics. This allows the Turnpike to analyze anything from general statewide policies to localized issues using the same network and demand. Several advanced toll features have also been introduced including ramp-to-ramp pricing and assignment and a toll mode choice model.

Statewide Land Use Allocation Model for Florida's Turnpike Authority and Florida DOT

Using parcel data with historical information for the entire State of Florida, RSG estimated a land use allocation model that has been linked to both the Florida's Turnpike Authority and Florida Department of Transportation statewide transportation models. The land use model operates uses demographic control totals and any geography – most commonly provided at the county level. It allocates to any specified TAZ boundary provided using GIS methods. The model is parameterized to be sensitive to several important economic drivers such as presence of key employers (Disney, etc.) and location relative to the coast. It is also sensitive to political considerations (urban growth control boundaries and other zoning constraints).

Utah Statewide Transportation Model

RSG assisted developing the network and socioeconomic data for the Utah Statewide Transportation Model. The statewide model uses the networks from each MPO and then integrates a network that covers the rest of the state. RSG developed GIS tools for performing this integration. RSG also developed the TAZ structure and the base and future socioeconomic data. In the case of Utah, this also involved a substantive description of the national park system in the state. Finally, RSG assisted in developing a model structure for system implementation.



Georgia Statewide Intercity Rail Model

RSG developed a statewide model for Georgia in order to develop an intercity rail plan. The model included air, auto, bus, and rail modes. It was built off the ARC/INFO database running at the state and integrated the many different mode-specific layers together in real-time during the model run. The model was built with custom software and produced a wide array of visualization features for results analysis.

Rochester New York Transportation Model

RSG has been an on-call consultant to the Genesee Transportation Council MPO (GTC) for several years now. Initially we converted their three-step model from TModel2 into TRANSCAD. Then we re-estimated the model to include a mode choice component. We have since added time-of-day capabilities so that the model forecasts every hour of the day and compresses these into a daily number to support air quality conformity. The peaking capabilities of this model are important in the area where large employers such as Xerox are located. We have conducted multiple training sessions and the model has been used to support several infrastructure and transit projects as well as general MPO planning efforts.

TRANSIMS Implementation in Chittenden County

RSG, working for the Federal Highway Administration (FHWA), completed a “track 1” implementation of TRANSIMS in Chittenden County, Vermont. Track 1 is the full development of the supply-side capabilities including the router and microsimulator. This project was a proof-of-concept to illustrate how medium-sized MPOs can reasonably afford to develop and support a regional microsimulator. In addition, we showed that this tool can be successfully used for operations and general planning projects.

Vermont Chittenden County MPO Model Support

RSG has been the on-call consultant to the Chittenden County MPO (CCMPO) since 1988. We have built and maintained their award-winning model over that period. The model has evolved over the years and continues to stay among the more advanced models being used by medium sized MPOs. While it is best described as a four-step model it has several advanced features including an integrated land use allocation model, time-of-day forecasting, peak shifting, synthetic population generation, distance-sensitive transit forecasting, parking re-allotment and an integrated air quality forecasting. The model now runs in TransCad with most additional features written in GISDK.



Salt Lake City & Provo, Utah MPO Modeling Retainer

RSG has been providing modeling services to the Wasatch Front Regional Council and Mountainland Association of Governments for four years. This includes model maintenance, recalibration, and model improvements. The WFRC/ MAG model uses the Cube software. Previous work included calibration of

the mode choice model using recent on-board survey data, and calibration of the advanced UrbanSim

land-use model.



CAMBRIDGE SYSTEMATICS

Cambridge Systematics is dedicated to ensuring that transportation investments deliver the best possible results. By providing innovative policy and planning solutions, objective analysis, and technology applications, CS helps clients meet future transportation needs while improving the performance of existing infrastructure and operations. Above all, we are committed to our clients' success in making transportation better for future generations.

Cambridge Systematics specializes in:

- Policy, strategic planning, and management; freight planning services; environment and transportation; forecasting; operations and simulation; transportation safety; tolling and road pricing; asset management; software and information technology consulting; and geographic information systems (GIS) and data management
- Customized tools and products for operations management, including regulatory systems for commercial vehicles; infrastructure management, including bridge, pavement, planning, and budgeting systems; and planning and program development, including freight analysis and other tools to help our clients evaluate, prioritize, and optimize investment in transportation projects and programs

SHRP Project C10 – Partnership to Develop an Integrated, Advanced Travel Demand Model and a Fine-Grained, Time-Sensitive Network

For the Strategic Highway Research Program (SHRP), CS is developing the first true integrated travel model that combines an activity-based demand model with a traffic microsimulation model using a fine-grained, time-sensitive network. CS is integrating the state-of-the-art activity-based model (SACSIM) maintained by the Sacramento Area Council of Governments (SACOG) with the best available traffic microsimulation model, DynusT; and testing it in the Sacramento metropolitan area in cooperation with SACOG. The project also includes enhancements to SACSIM and DynusT to analyze the effects of reliability on the transportation system, and integration of the new integrated model with the U.S. Environmental Protection Agency's (EPA) MOVES program for air quality analysis. The new dynamic model, integrated with an advanced activity-based travel demand model with a fine-grained, time-dependent network, will be ready to be adapted for use by planning agencies, and to be used in further research efforts.



Caltrans Technical Meetings Facilitation

For Caltrans Office of TSI, CS oversees a series of statewide technical initiatives. Among the initiatives covered include the following:

- New Modeling Guidelines for RTPs – CS guided a series of technical meetings over a seven-month time frame to implement new RTP modeling guidelines to reflect SB 375 requirements. Participants included a wide range of stakeholders from regional agencies, Caltrans districts and headquarters, other state agencies, and special interest groups. These new guidelines array requirements and recommendations according to the size of each MPO, and recognize that agencies cannot fully implement full SB 375 requirements until they have had time to implement model improvements.
- California Statewide Household Travel Survey – CS is guiding a series of technical meetings designed to implement the 2010/2011 CHTS. The current primary goal is to issue an RFP for the survey. The group has spent considerable time examining whether MPO survey efforts can be fully combined with the Caltrans effort, or whether survey instrument coordination will suffice. Special consideration is being given to the data needs of each of California's 18 MPOs. The survey will have an emphasis on collecting interregional surveys; of prime importance due to SB 375 requirements.
- CIA Modeling Forum – The CIA Modeling Forum is the statewide group for public agency modelers and model users. CS has guided this group over the last three years, and has restructured the meetings to be more useful and meaningful. One key change has been to create a theme for each meeting, ensuring that presentations complement each other and are tailored for a portion of the modeling community. Past meetings have focused on statewide modeling tools, SB 375, traffic microsimulation, and data collection.

San Joaquin Valley Goods Movement Study – Phases I, II, and III

The Valley has become a major location for regional distribution centers of consumer products. Population and industrial growth also create demand for freight transportation, and create land use conflicts between truck intensive uses and residential/commercial uses. Trucks are also a major source of pollution in the Valley. Concern over these issues created the impetus for the region's transportation and air quality planners to join to undertake a Valley-wide goods movement study.

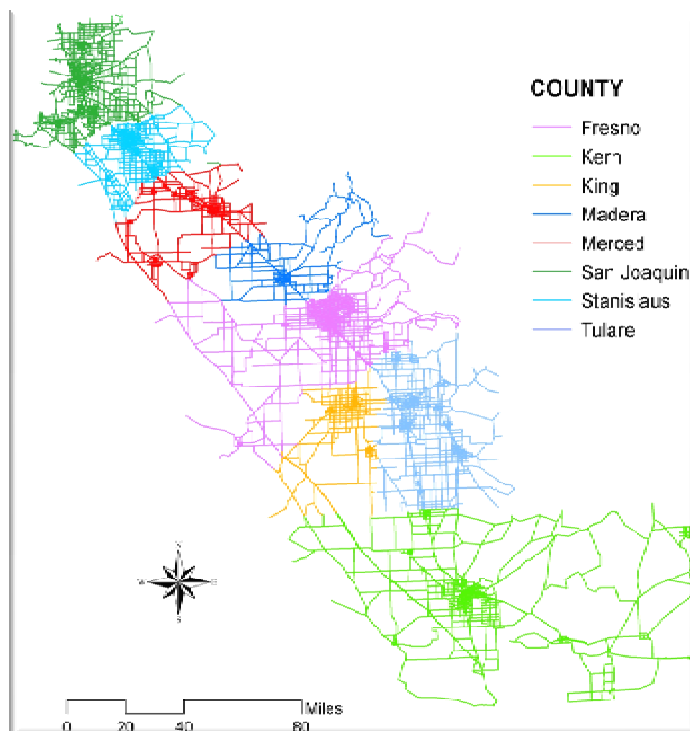


Phase I objectives included quantifying the level of goods movement in the region by commodity, identifying the flow of goods by geographic region and time of year, locating and quantifying the movement of combo trucks on nondesignated routes, and quantifying traffic impacts of goods movement within the Valley. A framework for a valley-wide truck model also was proposed for later implementation.

Phase II included a valley-wide truck model and analytical tools used to forecast truck traffic and evaluated alternative goods movement strategies. CS also evaluated representative alternative strategy packages to demonstrate how the modal and associated analytical tools could be used to select and prioritize projects. This evaluation provided guidance to regional transportation planners in the selection of high-priority projects.

In Phase III, the truck model was updated. One such task included converting the “Commodity Flow GIS Tool” from the ArcView GIS platform into TP+. The conversion created an integrated planning process and improved the efficiency of the tool. Other key Phase III objectives included air toxics emissions, congestion on major truck routes, land use conflicts between residential or commercial developments and truck intensive land uses, access to activity centers for heavy trucks, and a truck model maintenance plan for each of the eight Valley RTPAs and Caltrans.

Final Truck Model Network



Source: *San Joaquin Valley Goods Movement Study Phase III, 2008.*



California Statewide Travel Demand Model for High-Speed Rail

For the California High-Speed Rail Authority (CAHSRA) and Metropolitan MTC, CS developed an innovative statewide model to support evaluation of high-speed rail alternatives in the State of California. This statewide model also supports future planning activities of Caltrans. The approach to this statewide model differs from other statewide models in the U.S. because it explicitly recognizes the unique characteristics of urban area travel demand and interregional travel demand. Both are directly represented in this statewide model; interregional models estimate trip frequency, destination choice, and mode choice of all interregional trips. The models are stratified by trip purpose, as well as by distance and by location. Urban models, which are based on trip tables generated from the MPO models, estimate mode choice of urban area trips. Urban travel is stratified by trip purpose. The mode choice models reflect local urban area highway and transit systems, and options for high-speed rail within the region.

COMPASS Cube Land Evaluation

For COMPASS, CS is evaluating Cube Land, a new land-use (LU) modeling software from Citilabs, for integration into the COMPASS travel demand forecast (TDF) model. CS has developed a proof-of-concept Cube Land model using only existing land-use data. The Cube Land model will be integrated with the COMPASS TDF model via a feedback loop. In this integrated modeling process, travel demand is a function of existing and future land-uses and economic activities. In turn, future land-uses and economic activities also are functions of the transportation system, as well as demand on the system. These interactive analytical processes are replicated through numerous iterations. The sensitivity of the integrated LU/TDF model to smart growth LU policies will be evaluated and compared to the elasticities used in the 4D model.

Caltrans Strategic Model Improvement Program

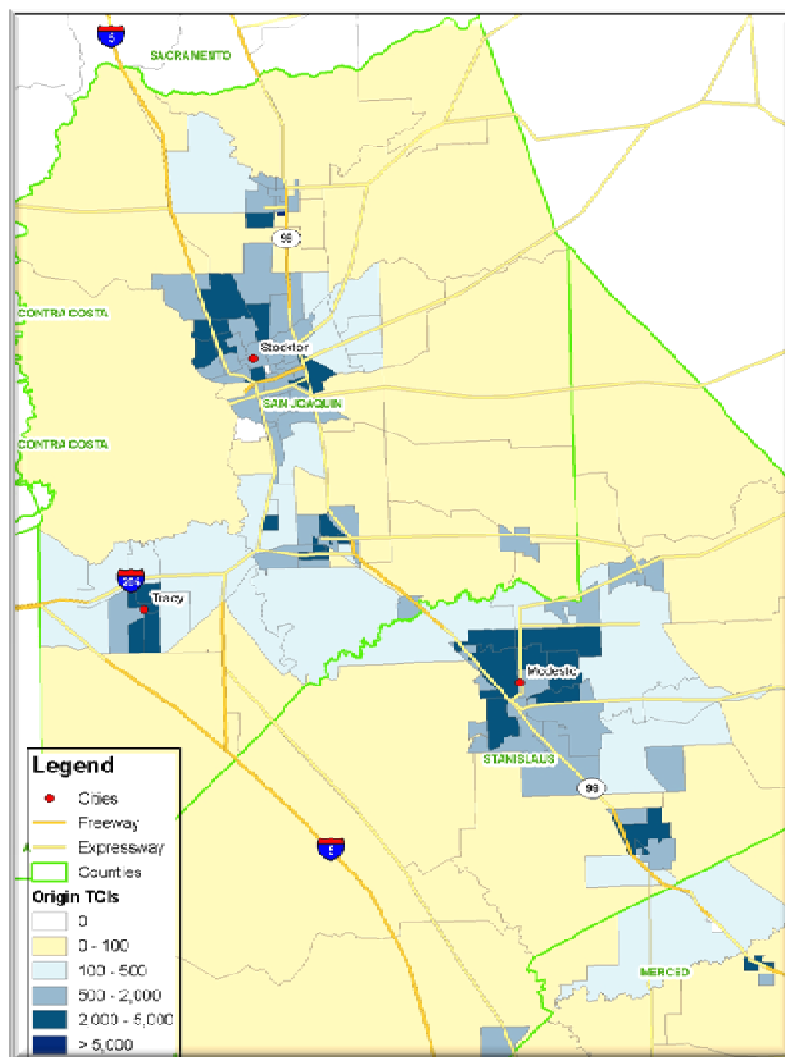
For Caltrans Office of Transportation Systems Information (TSI), CS developed the California Strategic Model Improvement Program (CSMIP), which provides analysis tools applicable to travel demand modelers and model users from regional agencies, modal divisions, decision-makers, districts, and other stakeholders. The program serves as the vision for TSI, guiding their activities and informing interacting agencies of TSI's specific roles and responsibilities. The plan covers the new statewide travel model, traffic microsimulation, the Freight Model, data collection, GIS/data sharing, the Integrated Transportation Land Use Model, the California Inter-Agency (CIA) Modeling Forum, and staff retention. The intention of the project is to guide Caltrans' travel modeling staff on key activities and funding priorities for both the immediate and long-term futures.



San Joaquin Valley Express Transit Study

CS, as part of a team, conducted an evaluation of the market demand for regional express transit services between the eight-county Valley, and activity and employment centers in the Bay Area, Sacramento, and Los Angeles Regions. Two CS initiatives were used: traveler information from the California statewide travel model for HSR, and transit competitiveness factors initially developed for CS' transit market research efforts in the San Francisco Bay Area and other urban areas throughout the United States.

North San Joaquin Valley Production Transit Competitiveness Indices (TCIs)



Source: *San Joaquin Valley Express Transit Study, 2008.*



MARK BRADLEY & JOHN BOWMAN

Mark Bradley and John Bowman are independent consultants whose collaboration is focused on designing, implementing, and applying activity-based travel demand forecasting techniques to support sound public sector transportation planning and decision-making. Mr. Bradley and Dr. Bowman have developed many of the essential activity-based modeling techniques employed in the activity-based models currently in use in the United States, and have a long and distinguished track record of innovation and efficiency in realizing activity-based travel forecast models for planning agencies across the country. They have a proven track record of successfully developing, implementing, and applying activity-based model systems in regions such as Sacramento, San Francisco, Seattle and Portland, and in supporting the design and development of activity-based model components in Columbus, Atlanta, Denver, and the San Francisco Bay Area. The core of the “full-day activity pattern” approach used in Sacramento, San Francisco, Denver, Seattle and Portland was originally proposed and demonstrated in Dr. Bowman’s doctoral thesis at MIT.

As a result of our participation in numerous activity-based model development efforts, we have extensive experience in all aspects of advanced travel demand forecast model development, including:

- Design and implementation of flexible, validatable population synthesizers that transform land use and demographic forecasts into synthetic populations used by the activity-based model system;
- Design of simulation-based forecasting model systems that integrate long-term choices, such as workplace location and auto ownership, with short-term choices, such as person and household tour and trip generation, destination choices and mode choices, and traffic assignment models;
- Estimation of the model system component models, including extensive experience working with traditional household survey data and integration of this data with the collection and analysis of supplementary stated preference data;
- Software development to implement the component models, including the over-arching day-activity pattern models, spatially disaggregate (parcel-level) destination choices and temporally disaggregate time-of-day models, and significant experience in the development of new techniques to optimize the speed at which the simulations run without compromising the quality of the outputs;
- Ongoing use and refinement of the model systems to answer new policy questions, address performance issues and add analytic capabilities, including the application of these models to support FTA New Starts efforts.



Bowman and Bradley Participation in Existing U.S. Activity-Based Model Systems

Region (start date)	Bradley	Bowman
Portland (1997)	Lead role in design, estimation, implementation	Developed day-pattern approach. Lead role in design. Role in estimation.
San Francisco (1999)	Lead role in design, estimation and implementation of day-pattern and time of day models. Also validation.	
Atlanta (2001)	Lead role in model design and estimation	Lead role in model design and population synthesis
Columbus (2002)	Assistance in model estimation and design of activity scheduling models	Assistance in model estimation
Sacramento (2005)	Lead role in design, estimation, implementation, testing, validation	Lead role in design, estimation, implementation, testing, validation
Denver (2006)	Lead role in design, estimation, oversight	Key role in design, estimation, population synthesis
Bay Area MTC (2007)	Collaborative role in model design	
Seattle (2008)	Lead role in model estimation and implementation. Assistance in design, testing, validation	Lead role in design. Assistance in estimation, implementation, validation
Sacramento (2010)	Lead role in design, model estimation. Assistance in software, implementation, validation.	Lead role in project management, design, model estimation. Assistance in software, implementation, validation.

Mark Bradley has been developing and applying tour-based travel demand models for more than 20 years, the first ten years in Europe (beginning with the Dutch National Model in 1984), and the last ten years in the US. He is well known for bridging the gaps between theory and practice by providing practical and efficient implementation of state-of-the-art modeling techniques. Mark Bradley Research and Consulting is based at 524 Arroyo Ave. in Santa Barbara, California (93109). The telephone number is (805) 564-3908.

John Bowman earned MST and PhD degrees at MIT, with concentrations in advanced econometrics and demand modeling, studying under faculty advisor Moshe Ben-Akiva. In his academic research at MIT, Bowman developed the activity schedule approach that is used in many of the activity-based model implementations in the United States. Since 1998 he has been actively involved in the enhancement and practical deployment of this approach, and he continues to teach graduate level demand modeling occasionally at MIT. Dr. Bowman is based at 28 Beals Street in Brookline, MA (02446), with telephone number (617) 232-8189.



MICHAEL MCCOY & NATHANIEL ROTH

Blueprints

California Regional Blueprints: (from <http://calblueprint.dot.ca.gov/>)

Regional Blueprints are collaborative planning processes that engage residents of a region in articulating a vision for the long term future of their region. The regional vision is developed from residents' values and priorities, and informed by advanced GIS modeling and visualization tools that demonstrate the impacts of growth and planning decisions. The process leads to the development of alternative growth scenarios for the region, and through a public process a preferred growth scenario is selected that can then guide regional and local land use and transportation decisions for a future that is sustainable, while meeting residents' needs and providing a high quality of life for all.

The Caltrans Regional Blueprints program supports collaborative regional planning efforts across California through grants, support services and interagency coordination.

San Joaquin Valley Blueprint:

The San Joaquin Valley Regional Blueprint brought the eight Councils of Government (COG) together to consider the future of the San Joaquin Valley as a region. By 2050 the San Joaquin Valley population is expected to more than double to more than 7 million inhabitants. How and where these people work and live and the transportation options available to them will dramatically influence the quality of life in the San Joaquin Valley. Through a process of community outreach within each county, the local residents met to discuss their land use and transportation choices. Building on these workshops, the COGs in the SJV developed a suite of county scenarios using a common growth model and selected one as the preferred scenario for the county. These scenarios were combined with projections of what might become of the region if growth continued as it has in the recent past, and what it might be with very aggressive growth containment policies. After analyzing the impacts of these scenarios on the region's agricultural land, environmental spaces, housing mix, air quality, and travel behavior, the San Joaquin Regional Policy Council adopted a list of Smart Growth Principles to guide land use planning in the San Joaquin Valley and a merged version of the counties' preferred scenarios with enhanced interregional transit infrastructure as the region's preferred growth scenario. These decisions laid the groundwork for making land use and transportation decisions that support a common view of the valley and provide for a positive future for the region's residents.

The Information Center for the Environment (ICE) at UC Davis, produces and maintains the UPlan urban growth model used in the San Joaquin Valley Blueprint. Through the course of the SJV Blueprint, ICE provided training, technical support, data development assistance and analytical help to the eight COGs participating in the San Joaquin Valley Blueprint.



Projects with ICE/ULTRANS as partners that cover the San Joaquin Valley:

Listed in Chronological order.

Merced Partnership in Planning (McCoy)

This project used existing database and GIS-based data and developed decision support tools to assist Caltrans State Office and District office staff and the constituent groups of Partnership in Planning Project (Merced County Association of Governments, U.S. EPA Region IX, FHWA) in examining possible scenarios for land use in Merced County. The developed tools included land use modeling (UPlan v 1.0) and an environmental factors modeling tools that were a precursor to our current Universal Model Builder (UMB). We supported scenario building for the preliminary evaluation of the potential iterative effects of land use and transportation alternatives. These tools and data were used to support the Partnership in Planning (PIP) pilot project in Merced County.

Great Places Program: San Joaquin Valley Pilot Area (McCoy, Roth)

The Great Places Program initiative is a public-private collaborative effort that is designed to improve the protection and conservation of natural resources in California. Its aim is to enhance the effectiveness and efficiency of land use and transportation decision-making. The program will provide up-to-date natural resource data, develop GIS analytical tools for better decision-making, and enhance access to natural resource and other data by the public and local, regional and state decision makers.

The Great Places Program (GPP) is jointly directed by the Resources Agency, California Business, Transportation and Housing Agency, California Environmental Protection Agency and Office of Planning and Research.

The Information Center for the Environment (ICE) at UC Davis under the direction of the participating state agencies coordinated geospatial data and tool development. The initial study area was the eight San Joaquin Valley counties.

Highway 99 Corridor Study (McCoy, Roth)

In order to support future environmental analysis of potential transportation project impacts on the Highway 99 corridor from the southern edge of Sacramento County to the junction with Interstate 5, south of Bakersfield, this project mapped landuse/landcover within the +/- 600-800 meter highway buffer covered by the California Department of Transportation's Digital Highway Inventory Photography Program (DHIPP). DHIPP is true color orthorectified digital imagery with a ~1-ft pixel resolution.

Urban land use is mapped using the USGS Anderson Level 2 classification. Agricultural land use was mapped using the closest Wildlife Habitat Relationship classification, using ancillary data from the California Department of Conservation's Farmland Mapping & Monitoring Program and the Department of Water Resource's agricultural water use maps. Natural vegetation was mapped using the National



Vegetation Classification System and the Department of Fish and Game's Manual of California Vegetation classification system.

This project used the following technologies: Digital Highway Inventory Photography Program (DHIPP) imagery, Heads-up on-screen polygon delineation using air photo interpretation, and species distribution modeling.

California Partnership for the San Joaquin Valley (McCoy, Roth)

The information Center for the Environment provided support to the Land Use Housing and Agriculture Committee (LUHA) of the California Partnership for the San Joaquin Valley. ICE provided simple land use scenario modeling using UPlan to the 8 county region, developing a set of scenarios based on requests from the LUHA that spanned the range of current trend growth to compact growth, various forms of agricultural land protection, new cities and the concentration of growth into a few large urban areas. ICE also provided support for a pair of workshops collecting key indicators of high value species habitat in the San Joaquin Valley from State and Federal agencies and non-profit environmental groups. These data were then combined to create a preliminary map of core habitat areas that could be prioritized for conservation and a network of habitat providing the best connectivity between these core areas.

SJV Blueprint (McCoy, Roth)

In collaboration with eight San Joaquin Valley Councils of Government (COG) and the Great Valley Center (GVC), the Information Center for the Environment will supply data, modeling tools and modeling support to the collaborative eight county views of current conditions and future alternatives. These pieces will contribute to the valley-wide view, or a blueprint. "The blueprint that should emerge is one that will suggest how to foster more efficient land use patterns, which support improved mobility and reduce dependency on single-occupant vehicle trips; accommodate an adequate supply of housing for all incomes; reduce impacts on valuable habitat, productive farmland and air quality; increases resource use efficiency and results in safe and vibrant neighborhoods." Additional goals are to create ways to Provide consumers more housing and transportation choices; improve economic competitiveness and quality of life for California; for transportation projects, reduce costs and construction times.

Safe Passages (Roth)

Incorporation of landscape connectivity is critical to conservation planning in working landscapes. Safe Passages is a 3-phase partnership among land use planners, conservation non-profits, and UC Davis to develop and demonstrate a framework to promote landscape connectivity and facilitate the movement of species in one of the most intensively managed agricultural landscapes in the USA, the San Joaquin Valley (SJV) of California. The first phase identified opportunities and constraints encountered in previous connectivity planning and implementation efforts through workgroups and a statewide forum. The next step focused on the ecoregional scale, and presented concepts, benefits and approaches to connectivity implementation to a multi-jurisdictional, land-use and transportation planning group in the



San Joaquin Valley. The third step is a local pilot implementation project with one of several willing participants from the regional group, the City of Riverbank. The partners in the pilot selected four focal species to represent a cross-section of ecological needs in local modeling. We used multiple, overlapping GIS-based least cost corridor analyses to create species-specific connectivity surfaces. These analyses were conducted at 5, 10, and 20 kilometer radii centered on the City of Riverbank and used raster cells of 10, 30, and 100 meter size in order to test the effects of spatial grain and extent on connectivity modeling. We found that the 100 meter cell size failed to adequately capture the remaining natural vegetation in this highly fragmented working landscape. Further, we found that change of analysis extent affected the relative importance to overall study area connectivity of the Stanislaus River riparian corridor. Results gleaned from both the forum and connectivity analyses will serve to inform the ongoing collaborative planning process in Riverbank, which has passed a resolution to include Safe Passages findings in its collaborative planning process.

Statewide Projects:

CalSIIM/PECAS (McCoy)

PECAS stands for Production, Exchange, and Consumption Allocation System. The PECAS Project is a collaboration between the University of California and Caltrans to develop models for spatial economic analysis and prediction. The project is currently funded by the [California Department of Transportation](#), [the William & Flora Hewlett Foundation](#), [the Surdna Foundation](#) and [the Rockefeller Foundation](#) through 2010.

The [California Statewide Interregional Integrated Model](#), known as CalSIIM, integrates transportation, economic, demographic, and land use information to predict the exchange of goods and services across space and time. It could also be used to assess the potential effects of various types of large-scale policies, programs, and strategies, such as:

- Costs and benefits of major infrastructure investments
- Travel between California's regions and counties
- Habitat and species protection strategies
- Preservation of agriculture areas
- Clean Air policies and programs
- Clean Water Act compliance
- Economic Development Programs
- Jobs/Housing Proximity
- Various housing policies and programs
- Redevelopment and urban infill strategies



- Regional job production and job creation programs

California Statewide Transportation Mode 2009 (McCoy, Roth)

ULTRANS at University of California at Davis and HBA Spectro Incorporated are refining the California High Speed Rail (HSR) travel model, to enhance its suitability for supporting CalTrans in its transportation planning and forecasting activities. This project is part of the larger overall “Statewide Integrated Land Use And Transportation Model” Project. These enhancements include:

- Development of explicit representations of all inter-regional and intra-regional travel and their critical interactions
- Implementation of a suitable network representation - a much greater level of spatial detail is required in the model networks, for the road system in particular
- Implementation of an iterative traffic assignment process that works to identify a network level and a system level converged equilibrium solution
- Development of a tighter integration with the PECAS land use model - where more of the inputs to the transportation model are direct outputs from PECAS; and the outputs from the transportation model are in forms that allow PECAS to provide a more extensive representation of the influences of transportation on the land use system.



COLBY BROWN, PTP, CITILABS

Colby Brown, PTP is currently Citilabs' Regional Director for North America. Since 2007, he has served the firm in a variety of roles, assisting with software training and user support as well as marketing, sales, and consulting projects. Before joining Citilabs, Mr. Brown was a senior planner at the Metropolitan Council, where he assisted with development and application of the regional travel demand forecasting model, in addition to coordinating with other agencies on air quality conformity analysis of the transportation improvement program and long-range systems planning studies. Previously, Mr. Brown was a toll industry consultant with Wilbur Smith Associates, for whom he managed a number of major traffic and revenue forecasting studies around the country. Mr. Brown holds an M.S. in Transportation Technology and Policy from UC-Davis, where he studied integrated land-use/transportation forecast modeling with Dr. Bob Johnston and Michael Clay, including local applications such as UPlan, PLACE3s and PECAS. For his undergraduate Sociology thesis about comparative urban expressway development, Mr. Brown received University Honors, the highest award granted by Wesleyan University.

Twin Cities Metropolitan Council Cube Land Model Development

Mr. Brown is leading a team that is developing a socioeconomic land use allocation forecasting model for the Twin Cities of Minneapolis and St. Paul, Minnesota based upon the Cube Land framework. This model is part of a new suite of forecasting models for the Twin Cities, including regional economic and demographic models as well as a tour-based disaggregate travel demand forecasting model.

KernCOG Cube Land Pilot Study

Developed a proof-of-concept Cube Land model for Kern COG, integrated with UPlan and the COG's Cube Voyager travel demand model and D's processor. This Cube Land model was developed in close coordination with Troy Hightower at Kern COG with advisory assistance from Mike Wallace of Fehr and Peers.

Cubetown Activity-Based Model Script

Implemented a disaggregate travel demand forecasting model coded entirely in Cube Voyager script for the Cubetown demonstration model and tutorial. The model structure and coefficients are based upon research performed by Mark Bradley and John Bowman in northern California. Mr. Brown contributed scripting enhancements to improve performance and efficiency, as well as a simple population synthesizer implemented in Cube Voyager script.



FSUTMS/Cube GIS and Avenue Workshop

Developed and taught a two-day in-person workshop for FDOT about ArcGIS and DTA/simulation features in Cube for FSUTMS models. This work included adaptation of the Olympus training model to use geodatabase storage of networks and zonal data, and a set of instructions and guidelines for Florida models to use when replicating this process in other areas.

Solano County, CA Model Training

Developed a custom training program for new modeling staff including a training/best practices model derived from local data, self-study tutorial, and in-person as well as web-based instruction. The training model was created by converting the existing model scripts from TP+ to Voyager using Cube's Application Manager and Scenario Manager interfaces, including Cube wrappers for third-party programs such as BAYCAST.



CARI ANDERSON CONSULTING

Ms. Cari Anderson has been providing technical assistance to the San Joaquin Valley MPOs in developing positive conformity demonstrations, ensuring compliance with transportation regulations, since 2001. This technical assistance has included developing protocols and programs to facilitate the use of transportation data in air quality modeling. In addition, Ms. Anderson developed the SB 375 baseline data for 6 of the 8 San Joaquin Valley MPOs provided to ARB for establishing the “placeholder” targets. As a result, Cari is uniquely qualified to assist in this evaluation and provides invaluable continuity with upcoming San Joaquin Valley coordination efforts. It is important to note that coordination efforts will continue to be important to the entire San Joaquin Valley since the multijurisdictional requirements continue to apply and indicate that if a subarea (individual MPO) cannot make a positive conformity determination and enters into a conformity lapse, no other subarea (other MPOs) can make new conformity determinations until the issues are resolved.



FEHR & PEERS PROJECT REFERENCES

Project: San Joaquin Valley Model Improvement Plan – Model Evaluation and Scope of Work
Client: Fresno COG
Contact: Mr. Mike Bitner, Principal Planner
(559) 233-4148
mbitner@fresnocog.org

Project: Sacramento Regional Blueprint Project
Client: SACOG
Contact: Mr. Mike McKeever, Executive Director
(916) 340-6205
MMcKeever@sacog.org

Project: Santa Barbara Travel Demand Forecast Model and General Plan Update
Client: City of Santa Barbara
Contact: Mr. Robert Dayton, Principal Transportation Planner
(805) 564-5390
RDayton@santabarbaraca.gov

Project: SEGA Specific Plan
Client: City of Fresno
Contact: Mr. Bryan Jones, P.E., PTP, Transportation Engineering Manager
(559) 621-8792
bryan.jones@fresno.gov

Project: Proposition 1C Statewide TOD Evaluation Tool
Client: California Department of Housing and Development Community
Contact: Craig Morrow, Manager, Transit Oriented Development (TOD) Housing Program
(916) 324-1565
Linda Wheaton, Assistant Deputy Director
(916) 327-2642



DOWLING ASSOCIATES PROJECT REFERENCES

Project: San Joaquin Valley Blueprint Study
Client: Tulare County Association of Governments
5961 South Mooney Boulevard | Visalia, CA 93277
Contact: Mr. Mark Hays
(559) 733-6653 x4880
mahays@co.tulare.ca.us

Project: San Joaquin Valley Wide Air Quality Planning and Coordination Services
Contact: Ms. Cari Anderson, (602)-277-1640

Project: San Joaquin Valley Conformity Strategy Study
Client: Merced Council of Governments
Reference: Mr. Jesse Brown, (209) 723-3153

Project: San Joaquin Valley Goods Movement Study Phases 1 and 2
Client: Council of Fresno County Governments
Reference: Mr. Tony Boren, (559) 233-4148

Project: Caltrans Statewide Model
Client: California Department of Transportation (Caltrans) Headquarters
Office of Forecasting and Analysis, Division of Transportation System Information | P.O. Box
942874 MS 38 | Sacramento, CA 94274-0001
Contact: Mr. Frank Law, (916) 654-2940

Project: California Motor Vehicle Stock, Travel and Fuel Forecast (MVSTAFF) Model Improvements
Client: Caltrans
Reference: Ms. Soheila Kholi, (916) 651-7578



Project: Fresno Model Updates

Client: Council of Fresno County Governments
2035 Tulare St., Suite 201 | Fresno, CA 93721

Reference: Mr. Mike Bitner
(559) 233-4148
mbitner@fresnocog.org

Project: Kings County Association of Governments Regional Model Update

Client: Kings County Association of Governments
1400 W.Lacey Blvd., Bldg.6 | Hanford, CA 93230

Reference: Ms. Terri King, KCAG, (559) 582-3211, ext. 2678

Project: StanCOG On-Call Model Support

Client: Stanislaus Council of Governments (StanCOG)

Reference: Mr. Lark Downs, (209) 558-4841

Project: Tulare County Association of Governments Regional Land Use and Travel Model Update

Client: Tulare County Association of Governments

Contact: Mr. Mark Hays, TCAG, (559) 733-6653 ext. 4880



RESOURCE SYSTEMS GROUP (RSG) REFERENCES

Project: Development of a fully integrated disaggregate model system in Sacramento
Client: Sacramento Area Council of Governments
Contact: Gordon Garry, Director of Research and Analysis
(916) 340-6230
ggarry@sacog.org

Project: Travel Forecasting Guidance for NEPA Projects
Client: Federal Highway Administration
Contact: Michael Culp
202-366-9229
michael.culp@fhwa.dot.gov

Project: Utah MPO Modeling Retainer
Client: Wasatch Front Regional Council, Salt Lake City & Provo
Contact: Ned Hacker, Planning Manager
801-363-4250
nhacker@wfrc.org

Project: SACSIM Pricing, Cost, and Transit Enhancements
Client: Sacramento Area Council of Governments
Contact: Bruce Griesenbeck
916-340-6268
bgriesenbeck@sacog.org

Date: 2010-2011



CAMBRIDGE SYSTEMATICS (CS) REFERENCES

Project: Caltrans Technical Meetings Facilitation
Client: Caltrans - Division of Transportation Systems Information
Contact: Coco Briseno
916-654-6228
coco_briseno@dot.ca.gov

Project: San Joaquin Valley Goods Movement Study – Phases I, II, and III
Client: Council of Fresno County Governments
Contact: Mike Bitner
559-233-4148 x216
mbitner@fresnocog.org

Project: California Statewide Travel Demand Model for High-Speed Rail
Client: California High Speed Rail Authority
Contact: Dan Leavitt
916-324-1541
dleavitt@hsr.ca.gov

Project: San Joaquin Valley Express Transit Study
Client: Merced County Association of Governments
Contact: Jesse Brown
209-723-3153 x 302
Jesse.Brown@mcagov.org



MARK BRADLEY AND JOHN BOWMAN REFERENCES FROM PAST ACTIVITY-BASED MODELING PROJECTS

Client: Sacramento Area Council of Governments (SACOG), Sacramento, CA
Address: 1415 L Street, Suite 300, Sacramento, CA 95814
Contact: Gordon Garry, 916-340-6230

Client: San Francisco County Transportation Authority, San Francisco, CA
100 Van Ness Avenue, 26th Floor, San Francisco, CA 94102
Contact: Billy Charlton, 415-522-4816

Client: Metropolitan Transportation Commission, Oakland, CA
01 Eighth Street, Oakland, California 94607
Contact: Chuck Purvis, 510-817-5755

Client: Puget Sound Regional Council, Seattle, WA
1011 Western Avenue, Suite 500, Seattle, WA 98104
Contact: Maren Outwater, 206-464-7090

Client: Portland METRO, Portland, OR
600 NE Grand Ave., Portland, OR 97232-2736
Contact: Keith Lawton (now a consultant), 503-538-6509

Client: Denver Region Council of Governments (DRCOG), Denver, CO
4500 Cherry Creek Dr S, Suite 800, Denver, CO 80246
Contact: Erik Sabina, 303-480-6789

Client: Atlanta Regional Commission, Atlanta, GA
40 Courtland St, NE, Atlanta, GA 30303
Contact: Guy Rousseau, 404-463-3274



Bidders Listing

**TOTAL
BUDGET**

1. All contractors/subcontractors bidding on the project must provide the requested information.
2. Bidders claiming DBE status must attach a copy of a current Certification issued pursuant to 49 CFR Part 26.
3. Bidders claiming DBE status must attach written affirmation that they will participate in the project.
4. Each bidder must designate of Gross Annual Receipts are greater than or equal to \$750,000.

Detailed Budget Draft San Joaquin Valley Model Improvement Plan	FEHR & PEERS								DOWLING ASSOCIATES						CS									
			Jerry Walters	Richard Lee	Senior Advisors	Mike Wallace	Modelers	Laura Johnson			Mike Aronson	Kym Sterner	Senior Modelers	Associate Modelers				Ron West	Lawrence Liao	Youshuang Zhou	Modelers			
			Principal/ Chief Technical Officer	Associate	Ron Mliam Dave Robinson Jason Pack	Associate	Charlie Alexander Tamar Fuhrer	Admin/Graphics			Principal	Principal	Senior Engineer	Associate Engineer				Principal	Senior Associate	Principal	Modeler			
	Hourly Rate		\$100.00	\$48.56	\$68.83	\$48.56	\$31.25	\$34.86		Hourly Rate		\$67.27	\$67.27	\$46.80	\$34.50		Hourly Rate		\$69.44	\$58.15	\$53.33	\$36.41		
	Overhead Cost	54.77%	\$54.77	\$26.60	\$37.70	\$26.60	\$17.12	\$19.09		Overhead Cost	120%	\$80.72	\$80.72	\$56.16	\$41.40		Overhead Cost		\$0.00	\$0.00	\$0.00	\$0.00		
	Fringe Cost	136.08%	\$136.08	\$66.08	\$93.66	\$66.08	\$42.53	\$47.44		Fringe Cost	43%	\$28.93	\$28.93	\$20.12	\$14.84		Fringe Cost		\$0.00	\$0.00	\$0.00	\$0.00		
	Fringe + Overhead	190.85%	\$190.85	\$92.68	\$131.36	\$92.68	\$59.64	\$66.53		Fringe + Overhead	163%	\$109.65	\$109.65	\$76.28	\$56.24		Fringe + Overhead	175%	\$121.52	\$101.76	\$93.33	\$63.72		
	Total Cost		\$290.85	\$141.24	\$200.19	\$141.24	\$90.89	\$101.39		Total Cost		\$176.92	\$176.92	\$123.08	\$90.74		Total Cost		\$190.96	\$159.91	\$146.66	\$100.13		
	Profit Overhead	10.00%	\$29.09	\$14.12	\$20.02	\$14.12	\$9.09	\$10.14		Profit Overhead	10.00%	\$17.69	\$17.69	\$12.31	\$9.07		Profit Overhead	10.00%	\$19.10	\$15.99	\$14.67	\$10.01		
TASKS	Total Hourly Rate		\$320	\$155	\$220	\$155	\$100	\$112	Total	Total Hourly Rate		\$195	\$195	\$135	\$100	Total	Total Hourly Rate		\$210	\$176	\$161	\$110	Total	
									Hours	Cost						Hours	Cost						Hours	Cost
Task 1: Project Management																								
Task 1.1 Technical Coordination – Monthly webinars			48	50	50	60		80	288	\$76,051						0	\$0.00						0	\$0.00
Task 1.2 Administrative Coordination – Monthly Progress Reports			24	24				100	148	\$32,756						0	\$0.00						0	\$0.00
Task 1.3 On-Line Project Tracking Data – Wiki and Portal						100		40	140	\$29,035						0	\$0.00						0	\$0.00
Task 2: Land Use and Demographics																								
Task 2.1 Review Needs and Draft Land Use Specifications			2	4	4	16		2	28	\$4,851	8	8				16	\$3,113.79	5					5	\$1,050.28
Task 2.2 Finalize Land Use Specifications			2	4	4	8		1	19	\$3,497						0	\$0.00						0	\$0.00
Task 2.3 Review Needs and Draft Demographic and Employment Data Specifications			2	4	4	16		2	28	\$4,851	8	8				16	\$3,113.79	5					5	\$1,050.28
Task 2.4 Finalize Demographic and Employment Specifications			2	4	4	8		1	19	\$3,497						0	\$0.00						0	\$0.00
Task 2.5 Land Use Forecasting and Modeling			8	16	16	40	40	8	128	\$19,674						0	\$0.00						0	\$0.00
Task 3: Basic 4-Step model Improvements for all 8 MPOs																								
Task 3.1 – Transportation Analysis Zones			2	4	8	12	40	40	106	\$13,348	2	2	4	8	16	\$2,118.49		8	16	4	24	52	\$7,783.57	
Task 3.2 – Land Use Inputs			2	4	8	12	40	40	106	\$13,348	8	8	16	16	48	\$6,877.01		2	4	4	8	18	\$2,650.14	
Task 3.3 – Transportation Network (verification, detailing, and enhancement)			2	4	8	12	40	4	70	\$9,333	16	16	40	80	152	\$19,627.96		16	40	24	150	230	\$30,789.84	
Task 3.4 – Vehicle Available Model			2	4	24	24	24	4	82	\$13,121	8	8	16	16	48	\$6,877.01							0	\$0.00
Task 3.5 – Trip Generation			2	4	8	40	40	6	100	\$13,906	16	20	80	80	196	\$25,822.11							0	\$0.00
Task 3.6 – Trip Distribution			2	4	8	40	40	6	100	\$13,906	40	20	40	80	180	\$25,077.10		2	4	4	16	26	\$3,531.26	
Task 3.7 – Mode Choice			2	4	8	24	40	5	83	\$11,308	20	80	80	80	260	\$38,277.28							0	\$0.00
Task 3.8 – Pricing			2	4	8	16	40	4	74	\$9,954	2	2	4	8	16	\$2,118.49							0	\$0.00
Task 3.9 – Traffic Assignment			2	4	8	24	40	5	83	\$11,308	8	20	20	40	88	\$12,149.33		2	4	4	8	18	\$2,650.14	
Task 3.10 – Feedback Loop			2	4	8	16	40	4	74	\$9,954	2	2	4	8	16	\$2,118.49		2	4	4	8	18	\$2,650.14	
Task 4 – Estimation, Calibration, Validation, and Evaluation of Basic Improvements																								
Task 4.1 – Model Estimation			2	4	4	8	40	4	62	\$7,830	120	40	160	80	400	\$60,785.40			16	24			40	\$6,686.22
Task 4.2 – Model Calibration			24	40	40	200	300	40	644	\$88,228	80	80	120	120	400	\$59,362.05		60	100	80	200	440	\$65,127.65	
Task 4.3 – Model Static Validation			8	16	8	100	200	20	352	\$44,570	80	80	240	240	640	\$87,586.15							0	\$0.00
Task 4.4 – Model Dynamic Validation			8	16	8	100	200	60	392	\$49,031	8	8	16	16	48	\$6,877.01							0	\$0.00
Task 4.5 – Evaluation			4	8	8	40	100	10	170	\$21,612	16	16	24	24	80	\$11,872.41							0	\$0.00
Task 5 – Inter-regional and Statewide Integration of Model Information																								
Task 5.1 – Implement Interregional Trip Process			8	16	8	24	80	8	144	\$19,426	20	80	80	160	340	\$46,261.96							0	\$0.00
Task 5.2 – Interim Update of Statewide Model			8	16	8	24	80	8	144	\$19,426	20	40	40	40	140	\$21,084.76							0	\$0.00
Task 5.3 – StanCOG Origin-Destination Survey			8	8	16	32	48	8	120	\$17,989					0	\$0.00		48	106	100	230	484	\$120,193.07	
Task 6 – Quick-Response Tools																								
Task 6.1 – Estimate Local Input Variables			8	10	40	20	30	48	156	\$24,382					0	\$0.00							0	\$0.00
Task 6.2 – Develop BMP Factor Post-Processing Spreadsheets			8	10	10	110	200	20	358	\$45,631					0	\$0.00							0	\$0.00
Task 6.3 – Implement BMP Factor Adjustments in Travel Model			8	10	10	30	30	8	96	\$14,868					0	\$0.00							0	\$0.00
Task 6.4 – Calibrate and Test BMP Factor Components			4	5	10	20	20	4	63	\$9,812					0	\$0.00							0	\$0.00
Task 6.5 – Documentation			4	5	10	20	20	4	63	\$9,812					0	\$0.00							0	\$0.00
Task 7 – Goods Movement Modeling Improvement																								
Task 7.1 Valleywide Model			8	16	8	16	8	4	60	\$10,539	4	4			8	\$1,556.90		4					4	\$840.22
Task 7.2 County Models			8	16	8	16	8	4	60	\$10,539	4	4			8	\$1,556.90		4					4	\$840.22
Task 7.3 Integration with Statewide Freight Model			8	16	8	16	8	4	60	\$10,539	4	4			8	\$1,556.90		4					4	\$840.22
Task 8 – Advanced Modeling Projects (selected MPOs)																								
Task 8.1 – Cube Land and Geodatabase Integrated Land Use/Transportation Model			24	60	80	150	200	112	626	\$90,408					0	\$0.00							0	\$0.00
Task 8.2 – Activity Based Model Using Parcel Data (FresnoCOG) and Zonal Data (SJCOG, StanCOG, MCAG)			4	16	32	48	32	8	140	\$22,361					0	\$0.00							0	\$0.00
Task 9 – Data Center, Knowledge Management, and Training																								
Task 9.1 – Data Center and Training			40	60	24	40	24	36	224	\$50,033					0	\$0.00							0	\$0.00
Task 9.3 – Transfer the Project Wiki (Knowledge-Management System and Data Center)			2	4	8	16	24	8	57	\$8,243					0	\$0.00							0	\$0.00
Task 10 – Mid-to-Long Model Improvement Plan (post 2012)																								
Task 10.1 – Land Use Modeling and Basic Modeling Improvements			12	12	8	12	4	4	52	\$10,176	8	8			16	\$3,113.79		16	4	4			24	\$4,709.80
Task 10.2 – Activity-Based Modeling			12	12	8	12	4	4	52	\$10,176					0	\$0.00							0	\$0.00
Totals			328	522	542	1522	2084	778	5771	\$889,325	502	558	984	1096	3140	\$448,905.07		178	298	252	644	1372	\$251,393.07	

