



Association of Monterey Bay Area Governments

Request for Proposals

for

Regional Travel Demand Model (RTDM) Technical Support Services

5 year contract period of April 15, 2021- June 30, 2026

Not to Exceed \$250,000

Issued: March 10, 2021

Questions Due: March 19, 2021

Deadline (received by AMBAG): April 1, 2021

Submit all questions and proposals to:

Gina Schmidt | AMBAG | 24580 Silver Cloud Court, Monterey, CA 93940 | gschmidt@ambag.org |
fax 831.883.3755

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Introduction

The Association of Monterey Bay Area Governments (AMBAG) is accepting proposals for a five-year contract to provide Regional Travel Demand Model (RTDM) Technical Support Services to ensure AMBAG's RTDM is fully functional and provide smooth continuance of modeling needs.

The selected consultant will serve at the discretion of the Board of Directors and work under the direction of the AMBAG Executive Director.

The Association of Monterey Bay Area Governments operates under a Joint Powers Agreement with local jurisdictions (cities) and the Counties of Monterey, San Benito and Santa Cruz. The Board is comprised of one representative member from each City and two supervisors from each of the counties.

AMBAG is a public agency funded through a combination of federal transportation funds, grants and membership dues. Policy direction is provided by a twenty-four (24) member Board of Directors. The Executive Director reports directly to the Board of Directors and performs all duties necessary for the proper and efficient management of AMBAG, as determined by the Board and State and Federal law. A small professional staff provides support to the Board of Directors.

Scope of Work & Project Deliverables

The following provides details of the scope of services required under this contract. Respondents to this RFP should build on this general description by proposing a scope of work with specific sub-tasks as deemed appropriate. Respondents should also refer to the Proposal Requirements, and Evaluation and Selection Process sections for additional requirements.

Additional tasks and work elements may be added or deleted during contract negotiations. Upon conclusion of the negotiation process, the selected consultant will be required to prepare a final work plan, schedule, and budget for inclusion into a final contract. If additional tasks are identified, the contract may be amended in the future.

Consultant shall provide RTDM Technical Support Services remotely by virtual meetings, phone calls, and emails to ensure the AMBAG RTDM functions properly for AMBAG Metropolitan Planning needs. Consultants shall also be available by telephone or email to resolve RTDM problems and provide immediate service within same day to ensure functionality, when required by AMBAG. AMBAG may also seek advice on technical aspects to

improve and update the RTDM (using most current TransCAD version) to meet current and future needs in this scope of work.

Goals

AMBAG is maintaining the RTDM designed in TransCAD platform. Technical Support Services contractor must work within AMBAG's current RTDM in TransCAD 8.0 (or newest version) platform. Consultant will provide technical support service to maintain AMBAG RTDM on an as needed basis, as requested by AMBAG. The Technical Support Services contract account manager will work with AMBAG to test upgrades, manage RTDM maintenance, maintain and install upgrades compatible with RTDM, assess future RTDM needs and its enhancements. The RTDM Technical Support Services contractor shall provide support by a dedicated account team who is qualified and able to work with AMBAG's RTDM, Activity Base Model framework and TransCAD 8.0 (or newest version).

Requirements

Consultant must provide substantive responses on how they would maintain the AMBAG RTDM in TransCAD (8.0 or newest version), manage the contract work, deliverables, provide and manage qualified staff /services. Describe any additional tasks and deliverables they would deem appropriate for current AMBAG RTDM (RFP Attachment D: RTDM Technical Documentation) and future updates in relation to Central Coast Activity Base Model (CCABM) framework and application of new technological advancements in travel demand forecasting. Knowledge of most ABMs applied in current practice by various MPOs in California.

AMBAG is seeking proposals from qualified individuals or firms for consultant services to assist with travel demand modeling. AMBAG is seeking a consultant to make improvements to, calibrate, and validate the current AMBAG RTDM. Provide technical assistant to update and apply the draft CCABM model framework for AMBAG region. Assist on an as-needed basis for analyses and performing model enhancement related tasks; as well as train and instruct AMBAG staff. AMBAG anticipates the contract period to be approximately 5 years for an on-call basis.

The following are minimum performance specifications. Your proposals may be more inclusive.

Task 1: Update and maintain current AMBAG Regional Travel Demand Model (RTDM)

Deliverables:

- Update and maintain current AMBAG RTDM in TransCAD 8.0 (or newest version)
- Plan, Provide and Discuss with AMBAG any TransCAD Incompatibilities with AMBAG RTDM and recommend System Upgrades
- Designated Account Manager and Dedicated Technical Support Team
- Redesigning RTDM interface as needed
- Train AMBAG staff on RTDM using TransCAD as needed
- Respond and Resolve RTDM Issues Same business day for Emergency
- Respond and Resolve RTDM Issues Within 7 business days for Non-Emergency

- Assist AMBAG RTDM Project Manager in Resolving RTDM Issues by Phone or Email and to Troubleshoot Issue Remotely

Task 2: Provide technical assistance for 2045 MTP/SCS modeling activities

- Development of Land use and transportation scenarios
- Network coding, model runs and evaluating model performance
- Preparation of performance indicator reports and post processing tasks
- Applying off model adjustments if required

Task 3: Provide technical assistant to update/apply the draft CCABM model framework for AMBAG region.

Consultants should demonstrate knowledge of most ABMs applied in current practice by various MPOs in California. With consultant’s assistance, AMBAG in partnership with central coast MPOs has developed the common transportation modeling platform referred to as CCABM in TransCAD platform.

ABM implementation for AMBAG region should be built upon the framework and capabilities as established in CCABM or similar platform. Apply the draft CCABM model framework (Attachment D: RTDM Technical Documentation) to AMBAG region in specific to including but not limited to below listed topics:

- Improving the core behavioral model system components to meet or exceed current state-of-the-practice and building up staff capacity.
- Enhance existing CCABM framework to make it robust and easy-to-use.
- Review of current ABM and improve/enhance models appropriate sensitivities to transportation and land use investment and policy strategies.
- Evaluate current ordering of model components and evaluate internal demand model consistency
- Re-specification and re-estimation of model components as appropriate
- Identification and addition of missing model components
- Explore the possibility of explicitly addressing TNC and telework in the CCABM.
- Recommend and implement the spatial aggregation as required to evaluate various policies specific to AMBAG region.
- Review/implement an auto ownership model that includes appropriate sensitivities to land use, accessibility, and demographic attributes.
- Review/implement driver’s license model to include sensitivity to land use and transportation accessibility variables.
- Calibration and validation of ABM model system for 2020 base year
- Perform systematic dynamic model sensitivity testing
- Provide staff support to integrate land use models and other tools with new ABM platform.

Deliverables:

- Migration of Base Year from 2015 to 2020 (after release of 2020 Census data)
- Update dPopulation Synthesis Module
- Updated Base and Future Year Road and transit Networks
- Redeveloped Auto Ownership Module
- Redeveloped Household Vehicle Ownership Module
- Integrated Seat Utilization for Transit
- Investigate and Incorporate Induced Travel (if feasible)
- Functionality to Incorporate Land Use Forecast Disaggregation
- Fully functional 2020 ABM for AMBAG region and staff training

Schedule

Task	Completion Date
Release RFP	March 10, 2021
Questions Due	March 19, 2021
Post responses to questions/addendum (as needed)	March 23, 2021
Proposals Due	April 1, 2021
Evaluation Committee Completes Proposal Review	April 5, 2021
Consultant Selection and Notice of Intent	April 6, 2021
Candidates Not Recommended for Selection Notified	April 7, 2021
Notice of Intent to Protest Deadline	April 12, 2021
AMBAG Board Approval of Consultant	April 14, 2021 or May 12, 2021
Execute Contract	April 15, 2021 or May 13, 2021

Proposal Submittal

Interested consultants must submit a digital copy of the proposal to the Project Manager as follows:

Digital: Send as a single PDF or PDF portfolio

All proposal submissions must be received by AMBAG on or before April 1, 2021 at 4:00 p.m. Pacific Daylight Time (PDT). By submitting a proposal, the Proposer certifies that his or her name or the consultant firm's name, as well as the name of Proposer's subcontractors, does not appear on the Comptroller General's list of ineligible contractors for federally assisted projects.

Until award of the contract, the proposals shall be held in confidence and shall not be available for public review. Upon award of a contract to the successful Proposer, all proposals shall become public record. No proposal shall be returned after the date and time set for opening thereof.

Submittal Questions and Addenda

All questions regarding this RFP should be received no later than March 19, 2021 at 4:00 p.m. PDT by e-mail to Gina Schmidt at gschmidt@ambag.org or by fax to (831) 883-3755.

Responses that require that an addendum be issued to the RFP will be posted on the AMBAG website at www.ambag.org on or before March 23, 2021 at 6:00 p.m. PDT. It is the responsibility of proposers to check the AMBAG website to determine if any addenda have been issued. Any addenda to the RFP will become part of the RFP.

AMBAG reserves the right to revise the RFP prior to the date that proposals are due. It is the responsibility of proposers to check the AMBAG website to determine if a modified RFP has been issued.

Notice of Award

The final recommended consultant shall be informed by phone and confirmed in writing by email on or before April 6, 2021. Candidates not recommended for contract award shall be informed by April 7, 2021.

Project Manager

Gina Schmidt, GIS Coordinator
Association of Monterey Bay Area Governments
24580 Silver Cloud Court, Monterey, CA 93940
Email | gschmidt@ambag.org (preferred communication)
Phone | 831.883.3750
Fax | 831.883.3755

Proposal Requirements

- A. Proposals should be concise, well organized and demonstrate the proposer's qualifications and experience applicable to the project. Proposals shall be limited to 25 one-sided pages (8.5 inches x 11 inches) with font size of 12 or larger. The proposal must include a discussion of the proposer's approach to the project, a description of the firm's qualifications for the scope of work, a schedule of contract performance and a cost estimate.
- B. The proposal and any required certifications shall be signed by an individual or individuals authorized to execute legal documents on behalf of the proposer.
- C. Failure to comply with the requirements of the RFP may result in disqualification. AMBAG is not responsible for finding, correcting, or seeking clarification regarding ambiguities or errors in proposals. If a proposal is found to contain ambiguities or errors, it may receive a lower score during the evaluation process. AMBAG may, but is not required to, seek clarification from a proposer regarding information in a proposal. Errors and ambiguities in proposals will be interpreted in favor of AMBAG.

Proposals and/or modifications received subsequent to the hour and date specified above will not be considered.

- D. The proposer shall certify whether it takes no exception(s) to this RFP and the draft contract. If the proposer does take exception(s) to any portion of the RFP or the draft contract, the specific portion to which exception(s) is taken must be identified and explained. Failure to make exceptions to the RFP or draft contract within the proposal will be deemed a waiver of any objection. Exceptions will be considered during the proposal evaluation process.
- E. AMBAG reserves the right to reject any or all proposals and to waive irregularities contained therein and to accept any proposals deemed most advantageous to AMBAG.

Evaluation and Selection Process

- A. Based upon the proposals and other appropriate evaluation factors, the top-ranked proposer will be identified. Negotiations with the selected firm may cover: scope of work, contract schedule, contract terms and conditions, technical specifications, level of effort, and price.
- B. Proposers will be evaluated on the following criteria according to the weights assigned below based on the written proposal.
- C. All proposals must be completed and convey all of the information requested in order to be considered responsive. The proposals then will be evaluated on the basis of the criteria listed below. The total number of points used to score the proposals is 100.
- D. Evaluation factors and point values will be as follows:

Criteria	Description	Points
Proposed method to accomplish the work	<ul style="list-style-type: none"> ▪ Professional qualifications ▪ Relevant experience 	25
Project experience	<ul style="list-style-type: none"> ▪ Nature, quality, and relevance of recently completed projects 	25
Staff Qualifications	<ul style="list-style-type: none"> ▪ Unique qualifications of key personnel 	20
Cost or Best Value	<ul style="list-style-type: none"> ▪ Ranking of comparative costs among proposed firms, providing the best value of services offered 	30
Total		100

All proposers must complete a Cost Estimate form (see RFP Attachment A) in addition to the written proposal.

The Evaluation Committee will review all submitted proposals. Proposers may be emailed and asked for further information, if necessary. The Evaluation Committee will make recommendations to AMBAG’s Executive Director on the basis of the proposal and reference check. AMBAG’s Executive Director will review the Evaluation Committee’s recommendation and make the final recommended selection to the AMBAG Board of Directors. If the Board of Directors selects a different consultant than the one recommended by the Evaluation Committee, the Project Manager, in consultation with the AMBAG Executive Director, will prepare a memo explaining the selection.

Contractual Information and Payment Schedule

The contract agreement for the Demographic Forecast Services will be between AMBAG and the Consultant. The consultant will invoice AMBAG for services rendered, and AMBAG will compensate the consultant for these services as set forth in the agreement. Funding for the consultant services will be provided by AMBAG. The project deliverables will be reviewed by the AMBAG Project Manager.

The Consultant will be paid based on work actually performed, and accepted in writing by AMBAG, during the preceding month. The consultant should forward a copy of all invoices for payment for work performed, associated expenses and a percentage of work completed by the 15th day of the month.

Terms & Conditions

A. Limitations

This request for proposal (RFP) does not commit AMBAG to award a contract, to pay any pre-contractual expenses, or to procure or contract for services or supplies. AMBAG expressly reserves the right to reject any and all proposals or to waive any irregularity or informality in any proposal or in the RFP procedure and to be the sole judge of the responsibility of any Proposer and of the suitability of the materials and/or services to be rendered. AMBAG reserves the right to withdraw this RFP at any time without prior notice. Further, AMBAG reserves the right to modify the RFP schedule described above.

B. Award

AMBAG may ask RFP finalists to present oral briefings of their proposals. All finalists may be required to participate in negotiations and submit such price, technical, or other revisions of their proposals as may result from negotiations. AMBAG also reserves the right to award the contract without oral briefings or discussion, based upon the initial written proposals. Accordingly, each initial proposal should be submitted on the most favorable terms from a price and a technical viewpoint.

C. Verbal Agreement or Conversation

No prior, current, or post award verbal conversations or agreement(s) with any officer, agent, or employee of AMBAG shall affect or modify any terms or obligations of the RFP, or any contract resulting from this RFP.

D. Pre-contractual Expenses

Pre-contractual expenses include any expenses incurred by Proposers and selected contractor in:

- Preparing proposals in response to this RFP
- Submitting proposals to AMBAG
- Negotiations with AMBAG on any matter related to proposals.
- Other expenses incurred by a contractor or Proposer prior to the date of award of any agreement.

In any event, AMBAG shall not be liable for any pre-contractual expenses incurred by any Proposer or selected contractor. Proposers shall not include any such expenses as part of the price proposed in response to this RFP. AMBAG shall be held harmless and free from any and

all liability, claims, or expenses whatsoever incurred by, or on behalf of, any person or organization responding to this RFP.

E. Signature

The proposal will also provide the following information: name, title, address, and telephone number of individual with authority to bind the consultant or consultant firm and also who may be contacted during the period of proposal evaluation. The proposal shall be signed by an official authorized to bind the consultant or consulting firm and shall contain a statement to the effect that the proposal is a firm offer for at least a ninety (90) day period. Execution of the contract is expected by no later than May 14, 2021.

F. Conflict of Interest Statement

Consultants and consultant firms submitting proposals in response to this RFP must disclose to AMBAG any actual, apparent, perceived, or potential conflicts of interest that may exist relative to the services to be provided under Agreement for consultant services to be awarded pursuant to this RFP. If the consultant or firm has no conflict of interest, a statement to that effect shall be included in the proposal. The selected consultant shall refrain from and disclose subsequent potential conflicts during this contract. Consultant shall at all times avoid conflicts of interest, or the appearance of conflicts of interest, in the performance of this contract. Consultant shall file statements of financial interest on forms provided by AMBAG to the extent and at all times required by AMBAG's Conflict of Interest Code and applicable law.

G. Contract Arrangements

The successful consultant is expected to utilize the AMBAG Agreement for Services which included as Attachment B.

G1. Disadvantaged Business Enterprise (DBE) Policy: It is the policy of the U.S. Department of Transportation (USDOT) that minority-and women-owned business enterprises (hereby referred to as DBEs) as defined in 49 CFR Part 23 shall have the maximum opportunity to participate in the performance of contracts financed in whole or in part with Federal funds.

G2. DBE Obligation: The recipient or its subcontractor agrees to ensure that DBEs have the maximum opportunity to participate in the performance of contracts and subcontracts financed in whole or in part with Federal funds provided under this agreement. In this regard, all recipients or subcontractors shall take all necessary and reasonable steps in accordance with 49 CFR Part 23 to ensure that DBEs have the maximum opportunity to compete for and perform contracts. Recipients and their subcontractors shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of USDOT assisted contracts.

G3. Title VI of the Civil Rights Act of 1964: The contractor agrees to comply with all the requirements imposed by Title VI of the Civil Rights Act of 1964 (49 USC 2000d) and the regulations of the U.S. Department of Transportation issued there under in 49 CFR Part 21.

G4. Equal Employment Opportunity: In connection with the performance of the contract, the contractor shall not discriminate against any employee or applicant for employment because of race, color, age, creed, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

Each proposal, to be considered responsive, must include the following:

(1) A copy of the consultant's affirmative action policy (applicable for firms with 50 or more employees)

(2) Discussion of the consultant's program for use of DBEs in the performance of this work, including the following:

- The names and addresses of DBE firms that will participate
- The description of the work each named firm will perform
- The dollar amount of participation by each DBE firm

H. Americans with Disabilities Act (ADA) Provisions

To comply with the nondiscrimination requirements of the Americans with Disabilities Act (ADA), it is the policy of AMBAG to make every effort to ensure that its programs, activities and services are available to all persons, including persons with disabilities. For persons with a disability needing a reasonable modification to participate in the procurement process, or for persons having questions regarding reasonable modifications of the procurement process, you may contact the AMBAG representative listed in this RFP.

IMPORTANT: To ensure that we can meet your need for ADA accommodations, it is best that we receive your request for reasonable modification at least 10 working days before the scheduled event (i.e., meeting, conference, workshop, etc.) or deadlines due date for procurement documents. In order to ensure the proposal is in compliance with Federal ADA guidelines, Proposers should review the Federal ADA guidelines at <http://www.ada.gov/>.

I. Alternative Protest Process

This procurement is being conducted under the provisions of the Alternative Protest Process. By submitting a proposal to this solicitation conducted under the Alternative Protest Process, the Proposer agrees that all protests of the proposed award shall be resolved by the Executive Committee of AMBAG, whose decision will be final. During the protest period, any participating Proposer may protest the proposed award on the following grounds:

For major information technology acquisitions – that there was a violation of the solicitation procedure(s) and that the protesting Proposer's proposal should have been selected; or For any other acquisition – that the protesting Proposer's proposal should have been selected in accordance with the selection criteria in the solicitation document.

A written notice of intent to protest the proposed award of this solicitation must be received (facsimile acceptable) by the project manager before the close of business 4:00 p.m. PDT on the third (3rd) business day after notifying the Proposer of intent to award, as specified in the solicitation timeline. Failure to submit a timely, written notice of intent to protest waives the Proposer's right to protest. The Proposer is to send the notice of intent to protest to the project manager at the following address:

Gina Schmidt
GIS Coordinator
Association of Monterey Bay Area Governments
24580 Silver Cloud Court, Monterey, CA 93940
Fax: 831-883-3755

Within seven (7) business days after the last day to submit a notice of intent to protest, the AMBAG project manager must receive from the protesting Proposer the complete protest filing including the signed, written, detailed statement of protest including exhibits, filing fee and deposit or small business certification, as applicable. Untimely submission of the complete protest filing waives the Proposer's right to protest.

The protest bond amount for this Alternative Protest Process shall be ten percent (10%) of the contract amount as specified in the solicitation.

J. Requirements Protests

Protests regarding any issue other than selection of the successful Proposer are "requirements protests" to be heard by the Executive Director, or his or her designee, and may be appealed to, heard, and resolved by the Executive Committee of AMBAG, whose decision will be final. Before a requirements protest is submitted, the Proposer must make full and timely use of the procedures outlined in this RFP. This procurement procedure is designed to give the Proposer and AMBAG adequate opportunity to submit questions and discuss the requirements, proposals and counter proposals before the Final Proposal is due. The protest procedure is made available in the event that a Proposer cannot reach a fair agreement with AMBAG after exhausting these procedures.

All protests to the RFP requirements must be received by the Executive Committee as promptly as possible, but not later than the respective time and date as noted in this RFP for such protests.

Requirements protests must be mailed or delivered to:

AMBAG Executive Committee
24580 Silver Cloud Court
Monterey, CA 93940

Incorporation of Attachments

The following documents are attached and incorporated by reference if the box next to document title is marked.

- RFP Attachment A – Cost Estimate
- RFP Attachment B – Subconsultant List
- RFP Attachment C – Draft Agreement for Services
- RFP Attachment D – RTDM Technical Documentation

SUBCONSULTANT LIST – RFP ATTACHMENT B

The proposal shall include a complete list of all proposed subconsultants. All subconsultants listed must be provided a meaningful element of work within the defined scope of work. Changes to this Subconsultant List will not be allowed without prior written approval from AMBAG.

PROPOSED SUBCONSULTANTS

Subconsultant Firm Name and Address	Scope of Work	Dollar Amount of Work

Name of Firm

Printed name and Title of Signatory

Signature

Date

DRAFT AGREEMENT FOR SERVICES – RFP ATTACHMENT C

THIS AGREEMENT is made and entered into this xxx day of April 2021, by and between the **Association of Monterey Bay Area Governments**, hereinafter called "**AMBAG**," and the xxx, hereinafter called "**CONTRACTOR**."

WITNESSETH

WHEREAS, as the Metropolitan Planning Organization (MPO) for Monterey, Santa Cruz and San Benito Counties, AMBAG is charged with maintaining a level of Regional Travel Demand Model (RTDM) Technical Support Services to serve the Board of Directors; and

WHEREAS, AMBAG needs to obtain certain technical and/or specialized services of an independent contractor to assist AMBAG in the most economical manner; and

WHEREAS, the CONTRACTOR is qualified and experienced and has necessary technical and personnel resources to provide such RTDM Technical Support Services; and

WHEREAS, pursuant to its annual Overall Work Program (OWP), AMBAG will be engaged in many activities and projects that will require certain RTDM Technical Support Services to complete the goals of AMBAG; and

NOW, THEREFORE, AMBAG and CONTRACTOR for the considerations hereinafter set forth, mutually agree as follows:

THE PARTIES HEREBY AGREE AS FOLLOWS:

1. SCOPE OF WORK.

Consultant shall perform those services as specified in detail in Exhibit "A," entitled "Project Tasks/Services, Timeline and Budget," which is attached hereto and incorporated herein.

2. TERM.

A. The term of this Contract shall be from the date of its execution until the completion of the work contemplated by this Contract and its final acceptance by AMBAG unless terminated earlier as provided herein. CONTRACTOR shall complete all tasks **on or before June 30, 2026** unless otherwise extended by written authorization.

B. Services performed under this Contract shall commence only upon written Notice to Proceed by AMBAG to CONTRACTOR.

This Contract includes the following Exhibits:

Exhibit A. Project Tasks/Services, Timeline and Budget

Exhibit B. Debarment and Suspension Certification

Exhibit C. Federal Tax Form W-9, Request for Taxpayer Identification Number and Certification

Exhibit D: Disadvantaged Business Enterprises (DBE) Information Form

Exhibit E: Certifications

3. SCHEDULE OF PERFORMANCE.

The services of Consultant are to be completed according to the schedule set out in Exhibit "A," entitled "Project Tasks/Services, Timeline, and Budget," which is attached hereto and incorporated herein. Consultant will diligently proceed with the agreed Scope of Services and will provide such services in a timely manner in accordance with the "Project Tasks/Services, Timeline, and Budget."

4. CHANGE IN TERMS

- A. This contract may be amended or modified only by mutual written agreement of the parties.
- B. CONTRACTOR shall only commence work covered by an amendment after the amendment is executed and written notification to proceed has been provided by AMBAG.

5. COORDINATION/STAFFING

- A. CONTRACTOR shall assign **xxx xxxx, as Project Manager** to personally participate in said project. AMBAG also retains the right to approve any substitution of the Project Manager. No portion of the work included in this Contract shall be subcontracted, except as provided herein, without the prior, written authorization of the AMBAG.
- B. Services described in the Scope of Work shall be performed by Contractor's staff, Subcontractor(s) or other members of the project team, hereinafter referred to as "Subcontractor(s)," listed in the "Project Tasks/Services, Timeline, and Budget," Exhibit A, attached hereto and incorporated by this reference.

6. COMPENSATION

- A. CONTRACTOR will be reimbursed for hours worked at the hourly rates specified in CONTRACTORs Cost Proposal (Exhibit A). The specified hourly rates shall include direct salary costs, employee benefits, overhead, and fee. These rates are not adjustable for the performance period set forth in this contract.
- B. In addition, CONTRACTOR will be reimbursed for incurred (actual) direct costs other than salary costs that are in the cost proposal and identified in the cost proposal and in the executed contract.
- C. Reimbursement for transportation and subsistence costs shall not exceed the rates as specified in the approved Cost Proposal.

- D. CONTRACTOR will be reimbursed, as promptly as fiscal procedures will permit. Invoices shall be submitted no later than 45 calendar days after the performance of work for which CONTRACTOR is billing, or upon completion of the Contract. Invoices shall detail the work performed on each task/milestone. Invoices shall follow the format stipulated for the approved Cost Proposal and shall reference this contract number and project title.
- E. CONTRACTOR shall not commence performance of work or services until this contract has been approved by AMBAG and written notification to proceed has been issued by AMBAG. No payment will be made prior to approval of any work, or for any work performed prior to approval of this contract.
- F. In no event shall compensation as described in Exhibit A exceed FIFTY THOUSAND DOLLARS (\$50,000) per fiscal year or TWO-HUNDRED AND FIFTY THOUSAND DOLLARS (\$250,000) total over the five year term of years for fiscal years ending in June 30, 2021 to June 30, 2026 without prior written consent of AMBAG.

It is mutually understood between the parties that funding for this contract is contingent on State Budget passage and federal and state funding as well as reimbursement from Caltrans.

7. INVOICING

- A. Invoices for services must be presented to AMBAG no later than the fifteenth day of each month for the month prior. CONTRACTOR shall submit an invoice to AMBAG stating the amount due for such services on a monthly basis throughout the duration of the project. Said monthly invoicing shall reflect the task worked on, the percentage of the task completed, and the total dollar amount for the task in comparison to the invoiced amount based upon the percentage of the task then completed. AMBAG shall reimburse the CONTRACTOR as promptly as its fiscal procedures permit, upon receipt of itemized invoices submitted in accordance with this Contract. Payment of the invoices will be made to CONTRACTOR after acceptance of work product and approval by AMBAG and upon reimbursement by the State of California. AMBAG will withhold 10% of each invoice until fully reimbursed by the State of California. Such reimbursements shall be based upon actual eligible costs incurred by the CONTRACTOR consistent with the "Project Tasks/Services, Timeline, and Budget," Exhibit A. No interest or carrying charges shall accrue to CONTRACTOR by reason of delayed payment.
- B. Prompt Payment to Subcontractor(s): A CONTRACTOR shall pay any Subcontractor(s) for satisfactorily completed work no later than ten (10) days of receipt of each payment from AMBAG. The ten (10) day period is applicable unless a longer period is agreed to in writing. Any delay or postponement of payment over thirty (30) days may take place only for good cause and with AMBAG's prior written approval. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the CONTRACTOR or Subcontractor in the event of a dispute involving late payment

or nonpayment by the CONTRACTOR, deficient Subcontractor performance, and/or noncompliance by a Subcontractor. This clause applies to both DBE and non-DBE Subcontractor.

- C. Invoicing Format and Content: All invoices submitted to AMBAG for payment shall be sent directly to:

Association of Monterey Bay Area Governments
ATTN: Accounts Payable
P.O. 2453
Seaside, CA 93955

1. The invoice shall be entitled "Invoice" or otherwise clearly identify that the document is an Invoice, and shall contain the following information:
 - i. AMBAG's "Bill To" information as stated in the above paragraph;
 - ii. Invoice number and/or billing number specified by CONTRACTOR. The invoice number must be unique for each invoice submitted;
 - iii. Invoice date;
 - iv. Billing period specified with beginning and ending dates. The beginning date must not be sooner than the Notice to Proceed date of the Contract, or within any previous billing dates;
 - v. Percent of Task Completed;
 - vi. Total amount due for the billing period;
 - vii. Total Contract Value (as identified in 4A. above); and
 - viii. AMBAG Project Manager

8. FUNDING REQUIREMENTS

It is mutually understood between the parties that this contract may have been written before ascertaining the availability of funds or appropriation of funds, for the mutual benefit of both parties, in order to avoid program and fiscal delays that would occur if the contract were executed after that determination was made.

This contract is valid and enforceable only, if sufficient funds are made available to AMBAG for the purpose of this contract. In addition, this contract is subject to any additional restrictions, limitations, conditions, or any statute enacted by the Congress, State Legislature, or AMBAG governing board that may affect the provisions, terms, or funding of this contract in any manner.

It is mutually agreed that if sufficient funds are not appropriated, this contract may be amended to reflect any reduction in funds.

AMBAG has the option to void the contract under the termination clause, or by mutual agreement to amend the contract to reflect any reduction of funds.

9. CONTRACT COMPLETION RETAINER

CONTRACTOR is prohibited from holding retainage from Subcontractor(s). Any delay or postponement of payment may take place only for good cause and with AMBAG's prior written approval. Any violation of these provisions shall subject the violating CONTRACTOR to the penalties, sanctions, and other remedies specified in Section 7108.5 of the California Business and Professions Code, if applicable. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies, otherwise available to the CONTRACTOR in the event of a dispute involving late payment or nonpayment by the CONTRACTOR, deficient Subcontractor(s) performance, and/or noncompliance by Subcontractor(s). This clause applies to both DBE and non-DBE Subcontractor(s).

10. SATISFACTORY PERFORMANCE

Payment for services under this Contract is contingent upon AMBAG's determination that the performance of the CONTRACTOR has been satisfactory and beneficial to AMBAG in the sole discretion of the Executive Director.

11. COVENANT AGAINST CONTINGENT FEES

The CONTRACTOR warrants that he/she has not employed or retained any company or person, other than a bona fide employee working for the CONTRACTOR; to solicit or secure this contract; and that he/she has not paid or agreed to pay any company or person other than a bona fide employee, any fee, commission, percentage, brokerage fee, gift, or any other consideration, contingent upon or resulting from the award, or formation of this contract. For breach or violation of this warranty, AMBAG shall have the right to annul this contract without liability, or at its discretion; to deduct from the contract price or consideration, or otherwise recover the full amount of such fee, commission, percentage, brokerage fee, gift, or contingent fee.

12. OWNERSHIP, CONFIDENTIALITY AND USE OF WORK PRODUCTS

- A. Ownership of any reports, data, studies, surveys, charts, memoranda, and any other documents, which are developed, compiled, or produced as a result of this Contract, whether or not completed, shall vest with AMBAG. AMBAG reserves a royalty-free, nonexclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use the data.
- B. AMBAG shall receive copyright and ownership to all data and materials delivered under this contract upon formal acceptance, except for those data and materials that are subject to ownership or copyright of others prior to the execution of this contract. No distribution of the original or derived works shall be made prior to acceptance by AMBAG unless specified in the task order or authorized by the contracting officer.

The contractor may maintain copyright and ownership of all original or derived works which are not required submittals under this contract.

- C. Methodology and materials developed under this Contract are the property of AMBAG and may be used by AMBAG as it sees fit, including the right to revise or publish the same without limitation. CONTRACTOR shall not be liable for use of such methodology, materials, software logic, and systems for purposes other than that for which it is developed.
- D. Subject to the California Public Records Act, all Work Products and Related Work Materials including Intellectual Property shall be held confidential by CONTRACTOR. Nothing furnished to CONTRACTOR, which is otherwise known to CONTRACTOR or is generally known, or has become known, to the related industry shall be deemed confidential.
- E. The CONTRACTOR shall not use, release, reproduce, distribute, publish, adapt for future use or otherwise use Work Products and Related Work Materials for purposes other than the performance of the Scope of Work, nor authorize others to do so, without prior written permission of AMBAG Legal Counsel; nor shall such materials be disclosed to any person or entity not connected with the performance of the work. CONTRACTOR shall also safeguard such confidential materials from unauthorized disclosure, using the same standard of care to avoid disclosure, as the CONTRACTOR treats its confidential information, but in no case less than reasonable care.
- F. All equipment, including, but not limited to, computer hardware, printing and duplication equipment, multimedia equipment, software tools and programs, and upgrade packages to existing equipment, procured in whole or part by funds provided under this Contract, are the property of AMBAG. AMBAG shall determine the disposition of all such property upon completion or termination of this Contract.
- G. AMBAG may utilize any Work Products or Related Work Materials provided by CONTRACTOR pursuant to this Contract, in any manner which AMBAG deems appropriate without additional compensation to CONTRACTOR.

13. TERMINATION

A. Termination of Convenience of AMBAG

AMBAG may terminate this Contract at any time by giving notice to the CONTRACTOR of such termination (including the effective termination date) at least thirty (30) calendar days before the effective date of such termination. In such event, all finished or unfinished documents and other materials as described in this Contract, at the option of AMBAG, become AMBAG's property. If this Contract is terminated by AMBAG, as provided herein, AMBAG's only obligation shall be the payment of fees and expenses incurred prior to the termination date, for work deemed satisfactory and a benefit to AMBAG, in accordance with the cost provisions of this Contract.

B. Termination for Cause

If through any cause, the CONTRACTOR shall fail to fulfill in a timely and proper manner its obligations under this Contract, or if the CONTRACTOR violates any of the covenants, terms, or stipulations of this Contract, AMBAG shall thereupon have the right to terminate the Contract by giving not less than ten (10) calendar days written notice to the CONTRACTOR of the intent to terminate and specifying the effective date thereof. In such event, all finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs, reports or other materials prepared by the CONTRACTOR under this Contract shall, at the option of CONTRACTOR, become AMBAG's property.

14. DISPUTES

AMBAG and CONTRACTOR are fully committed to working with each other throughout the Term of this Agreement and agree to communicate regularly with each other at all times so as to avoid and minimize disputes. AMBAG and CONTRACTOR agree to act in good faith to prevent and resolve potential sources of conflict before they escalate into a question or controversy. AMBAG and CONTRACTOR each commit to resolving such dispute in an amicable, professional, and expeditious manner and agree to use the following procedure for resolving the dispute: (a) either party may give notice to the other of the dispute and will meet within three (3) business days to attempt to resolve the dispute; (b) a meeting or meetings shall be promptly between the representatives of the parties regarding the dispute to attempt in good faith to negotiate a resolution of the dispute; (c) if within thirty (30) days after a dispute has arisen, the parties have not succeeded in negotiating a resolution of the dispute, they agree to submit the dispute to mediation; (d) the mediator shall be jointly selected by the parties, or failing agreement on the selection of a mediator within thirty (30) days after the parties fail to negotiate an informal resolution of any dispute, the mediator shall be a retired judge or justice selected by the supervising judge of the Civil Division of the Monterey County California Superior Court. In any mediation conducted pursuant to this section, the provision of the California Evidence Code section 1152 shall be applicable to limit the admissibility of evidence disclosed by the parties in the course of the mediation; and € if the parties are not successful in resolving the dispute through the mediation, then the parties agree that the dispute shall be submitted to binding arbitration to a single arbitrator in accordance with the existing Rules of Practice of Judicial Arbitration and Mediation Services, Inc. (JAMS) within thirty (30) days of the close of mediation as declared by the mediator.

15. AMENDMENT OF SCOPE OF WORK

The parties may amend the Scope of Work subject to mutual prior written modification of the Contract.

16. CORRECTION OF WORK

The performance of services or acceptance of information furnished by CONTRACTOR shall not relieve the CONTRACTOR from obligation to correct any defective, inaccurate or

incomplete work subsequently discovered and all such work shall be remedied by the CONTRACTOR on demand without cost to AMBAG.

17. DELAYS AND EXTENSIONS

Time is of the essence concerning performance of this Contract; however, the CONTRACTOR will be granted time extensions for delays beyond the Contractor's control. Time extensions will be equal to the length of the delay or as otherwise agreed upon in writing between the CONTRACTOR and AMBAG.

18. RETENTION OF RECORDS/AUDITS

For the purpose of determining compliance with Public Contract Code 10115, et seq. and Title 21, California Code of Regulations, Chapter 21, Section 2500 et seq., when applicable and other matters connected with the performance of the contract pursuant to Government Code 8546.7; CONTRACTOR, subcontractor, and AMBAG shall maintain and make available for inspection all books, documents, papers, accounting records, and other evidence pertaining to the performance of the contract, including but not limited to, the costs of administering the contract. All parties shall make such materials available at their respective offices at all reasonable times during the contract period and for three years from the date of final payment under the contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case Contractor agrees to maintain same until AMBAG, Caltrans, the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 49 CFR 18.39(i)(11).

The State of California, Office of the State Controller, California Department of Transportation (Caltrans), FHWA, or any duly authorized representative of the Federal or State Government shall have access to any books, records, and documents of CONTRACTOR and its certified public accountants (CPA) work papers that are pertinent to the contract and indirect cost rates (ICR) for audit, examinations, excerpts, and transactions, and copies thereof shall be furnished if requested.

19. SUBCONTRACTING

In accordance with Government Code Section 7550, CONTRACTOR agrees to state in a separate section of any filed report the numbers and dollars amounts of all contracts and subcontracts relating to preparation of the report.

A. Nothing contained in this contract or otherwise, shall create any contractual relation between AMBAG and any subcontractor(s), and no subcontract shall relieve CONTRACTOR of its responsibilities and obligations hereunder. CONTRACTOR agrees to be as fully responsible to AMBAG for the acts and omissions of its subcontractor(s) and of persons either directly or indirectly employed by any of them as it is for the acts and omissions of persons directly employed by CONTRACTOR.

CONTRACTOR'S obligation to pay its subcontractor(s) is an independent obligation from AMBAG'S obligation to make payments to the CONTRACTOR.

- B. CONTRACTOR shall perform the work contemplated with resources available within its own organization and no portion of the work pertinent to this contract shall be subcontracted without written authorization by AMBAG, except that, which is expressly identified in the contract.

20. ASSIGNMENT

The Contract shall not be assigned by the CONTRACTOR, in whole or in part, without the prior written consent of AMBAG.

21. INDEMNIFICATION

To the full extent permitted by law, CONTRACTOR shall indemnify, hold harmless, release and defend AMBAG (with legal counsel acceptable to AMBAG), its officers, employees and agents from and against any and all actions, claims, demands, damages, disability, losses, expenses including attorney's fees and other defense costs and liabilities of any nature that may be asserted by any person or entity including CONTRACTOR, in whole or in part, arising out of Contractor's activities hereunder, including the activities of other persons employed or utilized by CONTRACTOR in the performance of this Contract (including design defects and regardless of AMBAG's approval, use or acceptance of the work or work product hereunder) excepting liabilities due to the admitted or adjudicated sole negligence or willful misconduct of AMBAG. If the adjudicated or admitted sole negligence or willful misconduct of AMBAG has contributed to a loss, CONTRACTOR shall not be obligated to indemnify AMBAG for the proportionate share of such loss caused by such sole negligence or willful misconduct. This indemnification obligation is not limited in any way by any limitation on the amount or type of damages or compensation payable by or for CONTRACTOR under Worker's Compensation, disability or other employee benefit acts or the terms, applicability or limitations of any insurance held or provided by CONTRACTOR and shall continue to bind the parties after termination/completion of this Contract.

22. STATEMENT OF COMPLIANCE

- A. CONTRACTOR'S signature affixed herein, and dated, shall constitute a certification under penalty of perjury under the laws of the State of California that CONTRACTOR has, unless exempt, complied with, the nondiscrimination program requirements of Government Code Section 12990 and Title 2, California Administrative Code, Section 8103. During the performance of this Contract, CONTRACTOR and its subcontractor(s) shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, physical disability (including HIV and AIDS), mental disability, medical condition (e.g., cancer), age (over 40), marital status, and denial of family care leave. CONTRACTOR and subcontractor(s) shall insure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and

harassment. CONTRACTOR and subcontractor(s) shall comply with the provisions of the Fair Employment and Housing Act (Gov. Code §12990 (a-f) et seq.) and the applicable regulations promulgated there under (California Code of Regulations, Title 2, Section 7285 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code Section 12990 (a-f), set forth in Chapter 5 of Division 4 of Title 2 of the California Code of Regulations, are incorporated into this Contract by reference and made a part hereof as if set forth in full.

CONTRACTOR and its subcontractor(s) shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement(s).

CONTRACTOR shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under this contract.

In addition, the CONTRACTOR agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

The CONTRACTOR shall comply with regulations relative to Title VI (nondiscrimination in federally-assisted programs of the Department of Transportation – Title 49 Code of Federal Regulations, Part 21 - Effectuation of Title VI of the 1964 Civil Rights Act). Title VI provides that the recipients of federal assistance will implement and maintain a policy of nondiscrimination in which no person in the state of California shall, on the basis of race, color, national origin, religion, sex, age, disability, be excluded from participation in, denied the benefits of or subject to discrimination under any program or activity by the recipients of federal assistance or their assignees and successors in interest.

The CONTRACTOR, with regard to the work performed by it during the Contract shall act in accordance with Title VI. Specifically, the CONTRACTOR shall not discriminate on the basis of race, color, national origin, religion, sex, age, or disability in the selection and retention of subcontractor(s), including procurement of materials and leases of equipment. The CONTRACTOR shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the U.S. DOT's Regulations, including employment practices when the Contract covers a program whose goal is employment.

- B. Equal Employment Opportunity - The following equal employment opportunity requirements apply to the underlying contract:
1. Race, Color, Creed, National Origin, Sex - In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, and Federal transit laws at 49 U.S.C. § 5332, the CONTRACTOR agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The

CONTRACTOR agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the CONTRACTOR agrees to comply with any implementing requirements FTA may issue.

2. Age - In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § 623 and Federal transit law at 49 U.S.C. § 5332, the CONTRACTOR agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the CONTRACTOR agrees to comply with any implementing requirements FTA may issue.
3. Disabilities - In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the CONTRACTOR agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the CONTRACTOR agrees to comply with any implementing requirements FTA may issue.
4. The CONTRACTOR also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.

23. FEDERAL CHANGES

Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Contract between Purchaser and FTA, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

24. ENERGY CONSERVATION

The contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

25. NO OBLIGATION BY THE FEDERAL GOVERNMENT

A. AMBAG and CONTRACTOR acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be

subject to any obligations or liabilities to AMBAG, CONTRACTOR, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

- B. The CONTRACTOR agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by the Federal Transit Administration (FTA). It is further agreed that the clause shall not be modified, except to identify the Subcontractor who will be subject to its provisions.

26. PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS OR RELATED ACTS

- A. The CONTRACTOR acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the CONTRACTOR further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the CONTRACTOR to the extent the Federal Government deems appropriate.
- B. The CONTRACTOR also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n)(1) on the CONTRACTOR, to the extent the Federal Government deems appropriate.
- C. The CONTRACTOR agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the Subcontractor who will be subject to the provisions.

27. DEBARMENT AND SUSPENSION CERTIFICATION

CONTRACTOR'S signature affixed herein, shall constitute a certification under penalty of perjury under the laws of the State of California, that the CONTRACTOR has complied with Title 2 CFR, Part 180, "OMB Guidelines to Agencies on Government wide Debarment and Suspension (nonprocurement)", which certifies that he/she or any person associated therewith in the capacity of owner, partner, director, officer, or manager, is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any

federal agency; has not been suspended, debarred, voluntarily excluded, or determined ineligible by any federal agency within the past three (3) years; does not have a proposed debarment pending; and has not been indicted, convicted, or had a civil judgment rendered against it by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three (3) years. Any exceptions to this certification must be disclosed to AMBAG.

Exceptions will not necessarily result in denial of recommendation for award, but will be considered in determining CONTRACTOR responsibility. Disclosures must indicate to whom exceptions apply, initiating agency, and dates of action.

Exceptions to the Federal Government Excluded Parties List System maintained by the General Services Administration are to be determined by the Federal Highway Administration.

By signing and submitting the contract, the CONTRACTOR shall certify those clauses described in the "Debarment and Suspension Certification," Exhibit B attached hereto and incorporated herein by this reference and shall comply with all relevant conditions as set forth in the CONTRACT.

28. CONTRACTS INVOLVING FEDERAL PRIVACY ACT REQUIREMENTS

The following requirements apply to the Contractor and its employees that administer any system of records on behalf of the Federal Government under any contract:

- A. The CONTRACTOR agrees to comply with, and assures the compliance of its employees with, the information restrictions and other applicable requirements of the Privacy Act of 1974, 5 U.S.C. § 552a. Among other things, the CONTRACTOR agrees to obtain the express consent of the Federal Government before the CONTRACTOR or its employees operate a system of records on behalf of the Federal Government. The CONTRACTOR understands that the requirements of the Privacy Act, including the civil and criminal penalties for violation of that Act, apply to those individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of the underlying contract.
- B. The CONTRACTOR also agrees to include these requirements in each subcontract to administer any system of records on behalf of the Federal Government financed in whole or in part with Federal assistance provided by FTA.

29. INSURANCE/NOTIFICATION

Prior to the beginning, and throughout the duration, of the work, CONTRACTOR shall maintain insurance in conformance with the requirements set forth below. CONTRACTOR will use existing coverage to comply with these requirements. If that existing coverage does not meet the requirements set forth here, it will be amended to do so. CONTRACTOR acknowledges that the insurance coverage and policy limits set forth in this section constitute the minimum amount of coverage required. Any insurance proceeds in excess of the limits and coverage required in this contract and which is applicable to a given loss, will be available to AMBAG.

CONTRACTOR is covered by, and agrees to maintain, general liability insurance for bodily injury and property damage arising directly from its negligent acts or omissions with limits as specified below. Certificates of insurance shall be provided to AMBAG prior to commencement of work by CONTRACTOR. CONTRACTOR agrees to indemnify, protect, defend and name AMBAG, its public officials, officers and employees as additional insured on the Commercial General Liability and Business Auto Insurance and hold harmless from any loss, damage or liability arising directly from any negligent act or omission by CONTRACTOR. CONTRACTOR shall not be responsible for any loss, damage or liability arising from any act or omission by AMBAG, its officials, officers or employees.

CONTRACTOR shall provide the following types and amounts of insurance:

- A. Commercial General Liability Insurance using Insurance Services Office "Commercial General Liability" policy form CG 00 01, with an edition date prior to 2004, or the exact equivalent. Coverage for an additional insured shall not be limited to its vicarious liability. Defense costs must be paid in addition to limits. Limits shall be no less than \$1,000,000 per occurrence for all covered losses and no less than \$2,000,000 general aggregates.
- B. Workers' Compensation on a state-approved policy form providing statutory benefits as required by law with employer's liability limits no less than \$1,000,000 per accident for all covered losses.
- C. Business Auto Coverage on ISO Business Auto Coverage form CA 00 01 including owned, non-owned and hired autos, or the exact equivalent. Limits shall be no less than \$1,000,000 per accident, combined single limit. If CONTRACTOR owns no vehicles, this requirement may be satisfied by a non-owned auto endorsement to the general liability policy described above. If CONTRACTOR or CONTRACTOR'S employees use personal autos in any way on this project, CONTRACTOR shall obtain evidence of personal auto liability coverage for each such person.
- D. Errors and Omissions Liability CONTRACTOR shall provide evidence of professional liability insurance on a policy form appropriate to Contractor's profession. Limits shall be no less than \$1,000,000/claim.
- E. Certificate of Insurance CONTRACTOR shall file a certificate of insurance completed and filed with AMBAG within fifteen (15) days of execution of this Contract and prior to engaging any operation or activities set forth in this Contract. The foregoing policies shall provide that no cancellation, major change in coverage, or expiration by insurance company or insured during the term of this contract shall occur without thirty (30) days written notice to AMBAG prior to the effective date of such cancellation or change in coverage.
- F. All such insurance shall be written on an occurrence basis, or, if the policy is not written on an occurrence basis, such policy with the coverage required herein shall continue in effect for a period of two (2) years after completion of the contract.
- G. The Commercial General Liability and Business Auto insurance policies shall provide an endorsement naming AMBAG, its officers, agents, employees and volunteers as Additional Insured, and shall further provide that such insurance is

primary insurance to any insurance or self-insurance maintained by AMBAG and that the insurance of the Additional Insured shall not be called upon to contribute to a loss covered by the insurance AMBAG.

30. CONFLICT OF INTEREST

CONTRACTOR shall disclose any financial, business, or other relationship with AMBAG that may have an impact upon the outcome of this contract, or any ensuing AMBAG project. CONTRACTOR shall also list current clients who may have a financial interest in the outcome of this contract, or any ensuing AMBAG project, which will follow.

CONTRACTOR covenants that it presently has no interest and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of its services hereunder. CONTRACTOR further covenants that in the performance of this Contract, no person having any such interest shall be employed.

CONTRACTOR shall at all times avoid conflicts of interest, or the appearance or perceived conflicts of interest, in the performance of this contract. CONTRACTOR shall file statements of financial interest on forms provided by AMBAG to the extent and at the times required by AMBAG's Conflict of Interest Code and applicable law.

CONTRACTOR hereby certifies that it does not now have, nor shall it acquire any financial or business interest that would conflict with the performance of services under this contract.

31. STATEMENT OF ECONOMIC INTEREST

If AMBAG determines CONTRACTOR comes within the definition of CONTRACTOR under the Political Reform Act (Government Code §87100), CONTRACTOR shall complete and file and shall require any other person doing work under this Contract to complete and file a "Statement of Economic Interest" with AMBAG disclosing CONTRACTOR and/or such other person's financial interests.

32. MERGER

This Contract shall constitute the entire Contract between the parties and shall supersede any previous contracts, whether verbal or written, concerning the same subject matter. No modification of this Contract shall be effective unless and until evidence by a writing is signed by both parties.

33. DEFAULT

If CONTRACTOR should fail to perform any of his obligations hereunder, within the time and in the manner herein provided or otherwise violate any of the terms of this Contract, AMBAG may terminate this Contract by giving CONTRACTOR written notice of such termination, stating the reason for such termination. In such event, CONTRACTOR shall be entitled to receive as full payment for all services satisfactorily rendered and beneficial to AMBAG and expenses incurred hereunder, an amount which bears the same ratio to the

total fees specified in the contract as the services satisfactorily rendered hereunder by CONTRACTOR bear to the total services otherwise required to be performed for such total fee; provided, however, that AMBAG may withhold payments not yet made to CONTRACTOR for the purpose of setoff until such time as the exact amount of damages due AMBAG from CONTRACTOR is determined.

34. NO WAIVER OF BREACH/TIME

The waiver by AMBAG of any breach of any term or promise contained in this Contract shall not be deemed to be a waiver of such term or provision or any subsequent breach of the same or any other term or promise contained in this Contract. Time is of the essence in carrying out the duties hereunder.

35. THIRD PARTY BENEFICIARIES

Nothing contained in this Contract shall be construed to create and the parties do not intend to create any rights in third parties.

36. ATTORNEYS' FEES, APPLICABLE LAW AND FORUM

In the event either party brings an action or proceeding for damages arising out of the other's performance under this Contract or to establish the right or remedy of either party, the prevailing party shall be entitled to recover reasonable attorneys' fees and costs as part of such action or proceeding, whether or not such action or proceeding is prosecuted to judgment. This Contract shall be construed and interpreted according to California law, and any action to enforce the terms of this Contract or for the breach thereof shall be brought and tried in the County of Monterey.

37. INDEPENDENT CONTRACTOR

The parties intend that CONTRACTOR, in performing the services specified herein, shall act as an independent contractor and shall have control of the work and the manner in which it is performed. CONTRACTOR is not to be considered an agent or employee of AMBAG and is not entitled to participate in any pension plan, insurance, bonus or similar benefits AMBAG provides its employees. In the event AMBAG exercises its right to terminate this Contract, CONTRACTOR expressly agrees that he/she shall have no recourse nor right of appeal under rules, regulations, ordinances or laws applicable to employees.

38. TAXES

CONTRACTOR agrees to file tax returns and pay all applicable taxes on amounts paid pursuant to this Contract and shall be solely liable and responsible to pay such taxes and other obligations, including, but not limited to, state and federal income and FICA taxes. CONTRACTOR agrees to indemnify and hold AMBAG harmless from any liability which

it may incur to the United States or to the State of California as a consequence of CONTRACTOR'S failure to pay, when due, all such taxes and obligations.

39. FEDERAL TAX FORMS

Prior to issuing the initial claim under this Contract, the CONTRACTOR shall submit Federal Tax Form W-9, Request for Taxpayer Identification Number and Certification to the following address:

**Association of Monterey Bay Area Governments
ATTN: Accounts Payable
P.O. 2453
Seaside, CA 93955**

or by FAX to: (831) 883-3755. Unless AMBAG receives a completed Tax Form W-9, payments for services performed under this CONTRACT shall be subject to federal backup withholding.

40. COMPLIANCE WITH LAWS, RULES AND REGULATIONS

- A. CONTRACTOR shall study and comply with all applicable federal, state and local laws, rules and regulations affecting the CONTRACTOR and his/her work hereunder. CONTRACTOR represents and warrants to AMBAG that CONTRACTOR has and will keep in effect during the term of this Contract all licenses, permits, qualifications and approvals of whatsoever nature which are legally required for CONTRACTOR to practice Contractor's profession and to do the work hereunder.
- B. CONTRACTOR agrees to abide by the requirements of the Immigration and Control Reform Act pertaining to assuring that all employees of CONTRACTOR performing any services under this Contract have a legal right to work in the United States of America, that all required documentation of such right to work is inspected, and that INS Form 1-9 (as it may be amended from time to time) is completed and on file for each employee. CONTRACTOR shall make the required documentation available upon request to AMBAG for inspection.
- C. CONTRACTOR warrants that this contract was not obtained or secured through rebates kickbacks or other unlawful consideration, either promised or paid to any AMBAG employee. For breach or violation of this warranty, AMBAG shall have the right in its discretion; to terminate the contract without liability; to pay only for the value of the work actually performed; or to deduct from the contract price; or otherwise recover the full amount of such rebate, kickback or other unlawful consideration.

41. FEDERAL AND STATE LOBBYING ACTIVITIES CERTIFICATION (43 CFR PART 18)

By signing this CONTRACT, the CONTRACTOR certifies, to the best of its knowledge and belief, that no State or Federal funds have been paid or will be paid, by or on behalf of CONTRACTOR, to any person for influencing or attempting to influence an officer or employee of any state or federal agency; a Member of the State Legislature or United States Congress, an officer or employee of the Legislature or Congress; or any employee of a Member of the Legislature or Congress, in connection with the awarding of any state or federal contract; the making of any state or federal grant, the making of any state or federal loan; the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any state or federal contract, grant, loan, or cooperative agreement.

If any funds other than federal appropriated funds have been paid, or will be paid to any person for influencing or attempting to influence an officer or employee of any federal agency; a Member of Congress; an officer or employee of Congress, or an employee of a Member of Congress; in connection with this federal contract, grant, loan, or cooperative agreement; CONTRACTOR shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying", in accordance with its instructions.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The CONTRACTOR also agrees by signing this Contract that it will require that the language of this certification be included in all subcontracts funded wholly or in part by any funds provided herein and which exceed \$100,000 and that all such Subcontractor(s) shall certify and disclose accordingly.

42. CERTIFICATIONS AND ASSURANCES

A. CONTRACTOR shall adhere to the requirements contained in AMBAG's annual Certification and Assurances (FHWA and FTA "Metropolitan Transportation Planning Process Certification") submitted as part of AMBAG's OWP, pursuant to 23 CFR 450.334 and 23 U.S.C. 134. This Certification shall be published annually in AMBAG's OWP. Such requirements shall apply to CONTRACTOR to the same extent as AMBAG and may include, but are not limited to:

1. Title VI of the Civil Rights Act of 1964 and Title VI Assurance executed by California under 23 U.S.C. 324 and 29 U.S.C. 794;
2. Pub. Law 105-178, 112 Stat. 107 and any successor thereto, regarding the involvement of disadvantaged business enterprises in FHWA and FTA funded projects (Sec. 105(f), Pub. L. 970424, 96 Stat. 2100, 49 CFR part 26); and
3. The Americans with Disabilities Act of 1990 (Pub. L. 101-336, 104 Stat. 327, as amended) and the United States Department of Transportation (US DOT) implementing regulations (49 CFR 27, 37, and 38).

- B. CONTRACTOR shall additionally comply with the requirements contained in the annual FTA “Certifications and Assurances for FTA Assistance,” including “Certifications and Assurances Required of Each Applicant” and the “Lobbying Certification” in compliance with 49 U.S.C. Chapter 53; published annually in AMBAG’s OWP. Such assurances shall apply to CONTRACTOR to the same extent as AMBAG, and include but are not limited, the following areas:
1. Standard Assurances
 2. Debarment, Suspension, and Other Responsibility Matters for Primary Covered Transactions
 3. Drug Free Work Place Agreement
 4. Intergovernmental Review Assurance
 5. Nondiscrimination Assurance
 6. DBE Assurance
 7. Nondiscrimination on the Basis of Disability
 8. Certification and Assurances required by the U.S. Office of Management and Budget
- C. The CONTRACTOR shall require its Subcontractor(s) to comply with these Certifications, and agrees to furnish documentation to AMBAG to support this requirement that all of its contracts with Subcontractor(s) contain provisions requiring adherence to this section in its entirety.

43. COST PRINCIPLES AND ADMINISTRATIVE REQUIREMENTS

- A. CONTRACTOR agrees that the Contract Cost Principles and Procedures, 48 CFR, Federal Acquisition Regulations System, Chapter 1, Part 31.000 et seq., shall be used to determine the cost allowability of individual items.
- B. CONTRACTOR also agrees to comply with federal procedures in accordance with 2 CFR, Part 200, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards.
- C. Any costs for which payment has been made to CONTRACTOR that are determined by subsequent audit to be unallowable under 2 CFR, Part 200 and 48 CFR, Federal Acquisition Regulations System, Chapter 1, Part 31.000 et seq., are subject to repayment by CONTRACTOR to AMBAG.

44. DISADVANTAGED BUSINESS ENTERPRISE (DBE)

- A. The CONTRACTOR, subrecipient, or subcontractor(s) shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The CONTRACTOR shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of State or United States Department of Transportation (DOT) assisted contracts or in the administration of AMBAG’s DBE Program. Failure by the

CONTRACTOR to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as AMBAG deems appropriate, which may include but is not limited to:

1. Withholding monthly progress payments
 2. Assessing sanctions
 3. Liquidated damages
 4. Disqualifying the contractor from future bidding as non-responsible
- B. The contractor must make available to the Caltrans contract manager a copy of all DBE subcontracts upon request.
- C. The contractor must utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the contractor obtains authorization from Caltrans. Unless the Department provides prior authorization approving a request for termination or substitution of a listed DBE, the Contractor shall not be entitled to any payment for work or materials unless it is performed or supplied by the listed DBEs.
- D. It is the policy of AMBAG, Caltrans, and DOT, that the Disadvantaged Business Enterprises (DBEs), as defined in 49 CFR Part 26, shall have an equal opportunity to receive and participate in DOT-assisted contracts. The CONTRACTOR and its Subcontractor(s) shall comply with the requirements of 49 CFR Part 26 and with AMBAG's DBE Program, as amended.
- E. A "DBE Information Form" is attached hereto and incorporated herein by this reference as Exhibit D. Even if no DBE participation will be reported, the CONTRACTOR shall complete and sign such form at the time this Contract is executed
- F. During the period of this Contract, the CONTRACTOR shall maintain records of all applicable subcontracts advertised and entered into germane to this Contract, documenting the actual DBE participation and records of materials purchased from DBE suppliers. Such documentation shall show the name and business address of each DBE Subcontractor(s) or vendor, and the total dollar amount actually paid each DBE Subcontractor(s) or vendor. Upon completion of the Contract, regardless of whether DBE participation is obtained, a summary of the DBE records shall be prepared, certified correct, and submitted on a form that shall be provided by AMBAG.

45. FLOW-DOWN PROVISIONS

Any subcontract entered into that exceeds \$10,000 as a result of this CONTRACT shall contain the following provisions of this Contract:

Section 4 (Coordination/Staffing); Section 6 (Invoicing); Section 8 (Contract Completion Retainer); Section 9 (Satisfactory Performance); Section 11 (Ownership, Confidentiality, and Use of Work Products); Section 12 (Termination); Section 13 (Disputes); Section 17 (Retention of Records/Audits); Section 20 (Indemnification); Section 21 (Statement of Compliance); Section 22 (Federal Changes); Section 23 (Energy Conservation); Section 24 (No Obligation by the Federal Government); Section 25 (Program Fraud and False or Fraudulent Statements and Related Acts);

Section 26 (Debarment and Suspension Certification); Section 27 (Contracts Involving Federal Privacy Act Requirements); Section 28 (Insurance/Notification); Section 29 (Conflict of Interest); Section 36 (Independent Contractor); Section 39 (Compliance with Laws, Rules, and Regulations); Section 40 (Federal and State Lobbying Activities Certification (43 CFR Part 18)); Section 41 (Certifications and Assurances); and Section 42 (Cost Principles and Administrative Requirements); Section 43 (Disadvantaged Business Enterprise (DBE)).

46. INTERPRETATION

Notwithstanding the fact that one or more provisions of this Contract may have been drafted by one of the parties to this Contract, such provisions shall be interpreted as though they were a product of a joint drafting effort and no provisions shall be interpreted against a party on the ground that said party was solely or primarily responsible for drafting the language to be interpreted.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed the day and year first above written.

AMBAG:

Signature: _____

Name: Maura F. Twomey

Title: Executive Director

Association of Monterey Bay Area Governments (AMBAG)

24580 Silver Cloud Court, Monterey, CA 93940

Signature: _____

Name: Steve McShane

Title: Board President

Association of Monterey Bay Area Governments (AMBAG)

24580 Silver Cloud Court, Monterey, CA 93940

CONSULTANT:

Signature: _____

Name:

Title:

Company/Agency
Address

APPROVED TO AS TO FORM:

By: _____

Don Freeman, AMBAG Legal Counsel

P.O. Box 805, Carmel CA 93921

**EXHIBIT A. PROJECT TASKS/SERVICES,
TIMELINE, AND BUDGET**

**EXHIBIT B. DEBARMENT AND SUSPENSION
CERTIFICATION**

**TITLE 49, CODE OF FEDERAL REGULATIONS, PART 29
DEBARMENT AND SUSPENSION CERTIFICATION**

1. All persons or firms, including Subcontractor(s), must complete this certification and certify, under penalty of perjury, that, except as noted below, he/she or any person associated therewith in the capacity of owner, partner, director, officer, or manager:
 - a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any federal department or agency;
 - b. Have not, within the three (3) year period preceding this certification, been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state, or local) transaction or contract under a public transaction, violation of Federal or state antitrust statutes, or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - c. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state, or local) with commission of any of the offenses listed in subparagraph (1)(b) of this certification; and
 - d. Have not, within the three (3) year period preceding this certification, had one or more public transactions (Federal, state, and local) terminated for cause or default.
2. If such persons or firms later become aware of any information contradicting the statements of paragraph (1), they will promptly provide that information to AMBAG.

If there are any exceptions to this certification, insert the exceptions in the following space.

Exceptions will not necessarily result in denial of award, but will be considered in determining bidder responsibility. For any exception noted above, indicate below to whom it applies, initiating agency, and dates of actions.

The certification in this clause is a material representation of fact relied upon by AMBAG. If it is later determined that the CONTRACTOR knowingly rendered an erroneous certification, in addition to remedies available to AMBAG, the Federal Government may pursue available remedies, including but not limited to suspension

and/or debarment. The CONTRACTOR agrees to comply with the requirements of 49 CFR 29, Subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The CONTRACTOR further agrees to include a provision requiring such compliance in its lower tier covered transactions.

Name of Firm

Signature (original signature required)

Date

**EXHIBIT C. FEDERAL TAX FORM W-9,
REQUEST FOR TAXPAYER
IDENTIFICATION NUMBER AND
CERTIFICATION**

**EXHIBIT D. DISADVANTAGED BUSINESS
ENTERPRISES (DBE) INFORMATION FORM**

EXHIBIT E. CERTIFICATIONS

CALIFORNIA LEVINE ACT DISCLOSURE STATEMENT

California Government Code § 84308, commonly referred to as the “Levine Act,” precludes an Officer of a local government agency from participating in the award of a contract if he or she receives any political contributions totaling more than \$250 in the 12 months preceding the pendency of the contract award, and for three months following the final decision, from the person or company awarded the contract. This prohibition applies to contributions to the Officer, or received by the Officer on behalf of any other Officer, or on behalf of any candidate for office or on behalf of any committee. The Levine Act also requires disclosure of such contributions by a party to be awarded a specified contract. Please refer to the attached code for the complete statutory language.

Current members of the AMBAG Board of Directors are attached.

- 1. Have you or your company, or any agent on behalf of you or your company, made any political contributions of more than \$250 to any AMBAG Director(s) in the 12 months preceding the date of the issuance of this request for proposal or request for qualifications?

YES NO

If yes, please identify the Director(s): _____

- 2. Do you or your company, or any agency on behalf of you or your company, anticipate or plan to make any political contributions of more than \$250 to any AMBAG Director(s) in the three months following the award of the contract?

YES NO

If yes, please identify the Director(s): _____

Answering yes to either of the two questions above does not preclude RAPS from awarding a contract to your firm. It does, however, preclude the identified Director(s) from participating in the contract award process for this contract.

DATE

(SIGNATURE OF AUTHORIZED OFFICIAL)

(TYPE OR WRITE APPROPRIATE NAME, TITLE)

(TYPE OR WRITE NAME OF COMPANY)

California Government Code Section 84308

- (a) The definitions set forth in this subdivision shall govern the interpretation of this section.
- (1) "Party" means any person who files an application for, or is the subject of, a proceeding involving a license, permit, or other entitlement for use.
 - (2) "Participant" means any person who is not a party but who actively supports or opposes a particular decision in a proceeding involving a license, permit, or other entitlement for use and who has a financial interest in the decision, as described in Article 1 (commencing with Section 87100) of Chapter 7. A person actively supports or opposes a particular decision in a proceeding if he or she lobbies in person the officers or employees of the agency, testifies in person before the agency, or otherwise acts to influence officers of the agency.
 - (3) "Agency" means an agency as defined in Section 82003 except that it does not include the courts or any agency in the judicial branch of government, local governmental agencies whose members are directly elected by the voters, the Legislature, the Board of Equalization, or constitutional officers. However, this section applies to any person who is a member of an exempted agency but is acting as a voting member of another agency.
 - (4) "Officer" means any elected or appointed officer of an agency, any alternate to an elected or appointed officer of an agency, and any candidate for elective office in an agency.
 - (5) "License, permit, or other entitlement for use" means all business, professional, trade and land use licenses and permits and all other entitlements for use, including all entitlements for land use, all contracts (other than competitively bid, labor, or personal employment contracts), and all franchises.
 - (6) "Contribution" includes contributions to candidates and committees in federal, state, or local elections.
- (b) No officer of an agency shall accept, solicit, or direct a contribution of more than two hundred fifty dollars (\$250) from any party, or his or her agent, or from any participant, or his or her agent, while a proceeding involving a license, permit, or other entitlement for use is pending before the agency and for three months following the date a final decision is rendered in the proceeding if the officer knows or has reason to know that the participant has a financial interest, as that term is used in Article 1 (commencing with Section 87100) of Chapter 7. This prohibition shall apply regardless of whether the officer accepts, solicits, or directs the contribution for himself or herself, or on behalf of any other officer, or on behalf of any candidate for office or on behalf of any committee.
- (c) Prior to rendering any decision in a proceeding involving a license, permit or other entitlement for use pending before an agency, each officer of the agency who received a contribution within the preceding 12 months in an amount of more than two hundred fifty dollars (\$250) from a party or from any participant shall disclose that fact on the record of the proceeding. No officer of an agency shall make, participate in making, or in any way attempt to use his or her official position to influence the decision in a proceeding involving a license, permit, or other entitlement for use pending before the agency if the officer has willfully or knowingly received a contribution in an amount of more than two hundred fifty dollars (\$250) within the preceding 12 months from a party or his or her agent, or from any participant, or his or her agent if the officer knows or has

reason to know that the participant has a financial interest in the decision, as that term is described with respect to public officials in Article 1 (commencing with Section 87100) of Chapter 7. If an officer receives a contribution which would otherwise require disqualification under this section, returns the contribution within 30 days from the time he or she knows, or should have known, about the contribution and the proceeding involving a license, permit, or other entitlement for use, he or she shall be permitted to participate in the proceeding.

- (d) A party to a proceeding before an agency involving a license, permit, or other entitlement for use shall disclose on the record of the proceeding any contribution in an amount of more than two hundred fifty dollars (\$250) made within the preceding 12 months by the party, or his or her agent, to any officer of the agency. No party, or his or her agent, to a proceeding involving a license, permit, or other entitlement for use pending before any agency and no participant, or his or her agent, in the proceeding shall make a contribution of more than two hundred fifty dollars (\$250) to any officer of that agency during the proceeding and for three months following the date a final decision is rendered by the agency in the proceeding. When a closed corporation is a party to, or a participant in, a proceeding involving a license, permit, or other entitlement for use pending before an agency, the majority shareholder is subject to the disclosure and prohibition requirements specified in subdivisions (b), (c), and this subdivision.
- (e) Nothing in this section shall be construed to imply that any contribution subject to being reported under this title shall not be so reported.

For more information, contact the Fair Political Practices Commission,
428 J Street, Suite 800,
Sacramento, CA 95814,
(916) 322-5660.

AMBAG Board of Directors

Agency	Representative	Agency	Representative
Capitola	Kristen Petersen	County of Monterey	John Phillips
Carmel-by-the-Sea	Karen Ferlito	County of Monterey	Mary Adams
Del Rey Oaks	Kim Shirley	County of Santa Cruz	Greg Caput
Gonzales	Scott Funk	County of Santa Cruz	Manu Koenig
Greenfield	Lance Walker	County of San Benito	Bob Tiffany
Hollister	Rick Perez	County of San Benito	Mark Medina
King City	Carlos Victoria		
Marina	Lisa Berkley	<u>Ex-Officio</u>	
Monterey	Ed Smith	<u>Members:</u>	
Pacific Grove	Jenny Mc Adams	3CE (Central Coast	
Salinas	Steve McShane	Community Energy)	
San Juan Bautista	John Freeman	Caltrans District 5	
Sand City	Mary Ann Carbone	MBARD	
Santa Cruz	Justin Cummings	Monterey Peninsula	
Scotts Valley	Derek Timm	Airport District	
Seaside	Jon Wizard	MST	
Soledad	Carla Strobridge	SBtCOG	
Watsonville	Eduardo Montesino	SCCRTC	
		SCMETRO	
		TAMC	

CERTIFICATION OF RESTRICTIONS ON LOBBYING

Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

<p>1. Type of Federal Action:</p> <p>a. contract _____ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance</p>	<p>2. Status of Federal Action:</p> <p>a. bid/offer/application _____ b. initial award c. post-award</p>	<p>3. Report Type:</p> <p>a. initial filing _____ b. material change</p> <p>For material change only: Year _____ quarter _____ Date of last report _____</p>
<p>4. Name and Address of Reporting Entity:</p> <p>_____ Prime _____ Subawardee Tier _____, if Known:</p> <p>Congressional District, if known:</p>		<p>5. If Reporting Entity in No. 4 is Subawardee, Enter Name and Address of Prime:</p> <p>Congressional District, if known:</p>

6. Federal Department/Agency:	7. Federal Program Name/Description: CFDA Number, <i>if applicable</i> : _____
8. Federal Action Number, if known:	9. Award Amount, if known: \$ _____
10. a. Name and Address of Lobbying Registrant <i>(if individual, last name, first name, MI):</i>	b. Individuals Performing Services <i>(including address if different from No. 10a)</i> <i>(last name, first name, MI):</i>
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.	Signature: _____ Print Name: _____ Title: _____ Telephone No.: _____ Date: _____
Federal Use Only	Authorized for Local Reproduction Standard Form - LLL (Rev. 7-97)

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitations for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Included prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

(b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503

Technical Summary Document - **RFP ATTACHMENT D**

Association of Monterey Bay Area Governments Regional Travel Demand Model Technical Report



2018 Report



24580 Silver Cloud Ct
Monterey, California 93940
831.883.3750
www.ambag.org

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Introduction

The Association of Monterey Bay Area Governments (AMBAG) is the federally designated Metropolitan Planning Organization (MPO) for Monterey, San Benito and Santa Cruz Counties to carry out metropolitan transportation planning activities, including implementation of California Senate Bill 375 (SB 375) and the Sustainable Community Strategies (SCS), and to develop and maintain a Regional Travel Demand Model (RTDM). In addition to working with the 18 cities and 3 counties within the region, AMBAG works closely with the following public agencies within the MPO region that have an interest in or are users of the AMBAG RTDM:

Regional Transportation Planning Agencies (RTPA)

- Council of San Benito County Governments (SBtCOG)
- Santa Cruz County Regional Transportation Commission (SCCRTC)
- Transportation Agency for Monterey County (TAMC)

Transit Agencies

- Monterey-Salinas Transit (MST)
- Santa Cruz Metropolitan Transit District (SCMETRO)

Air Quality Agency

- Monterey Bay Air Resources District (MBARD)

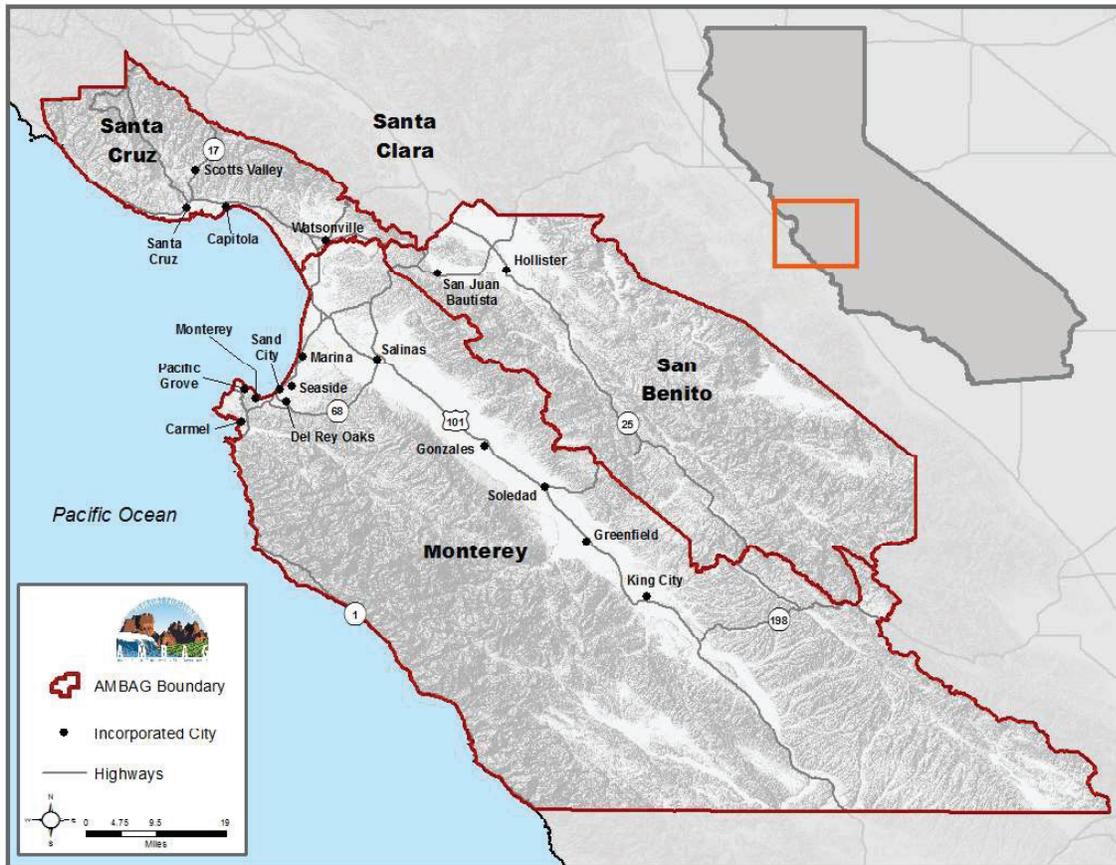
State Department of Transportation

- California Department of Transportation (Caltrans)

Aside from several cities that have developed local-scale models, the AMBAG RTDM serves as the primary forecasting tool for the jurisdictions in the Monterey Bay Region.

Monterey Bay Region

The AMBAG planning area is situated between Silicon Valley and the San Francisco Bay Area to the north and San Luis Obispo County to the south in California's North Central Coast area. Monterey and Santa Cruz counties are situated along the coast and contain most of the area's population and employment. Monterey County also supports a significant agricultural industry that is generally located in the Salinas River Valley. San Benito County is located to the east of Monterey County and is mostly rural. Monterey and Santa Cruz Counties tend to include more higher-income households.



AMBAG Region

In 2015 the population of the AMBAG region was just over 762,676 with 240,278 households. Most of the population (over half a million) is concentrated into the 18 cities covering approximately 5,157 square miles. In 2040 the population is expected to exceed 883,300, representing a 16% increase from 2015, and with 279,499 households and a population density of 171 people per square mile. Employment in the region is expected to increase from over 337,600 in 2015 to approximately 395,000 in 2040, a 17% increase.

AMBAG Growth Forecast: 2015-2035-2040

Year	2015	2035	2040
Population	762,676	862,200	883,300
Households	240,278	272,686	279,499
Employment	337,600	384,800	395,000

AMBAG RTDM Update for 2015 Base Year

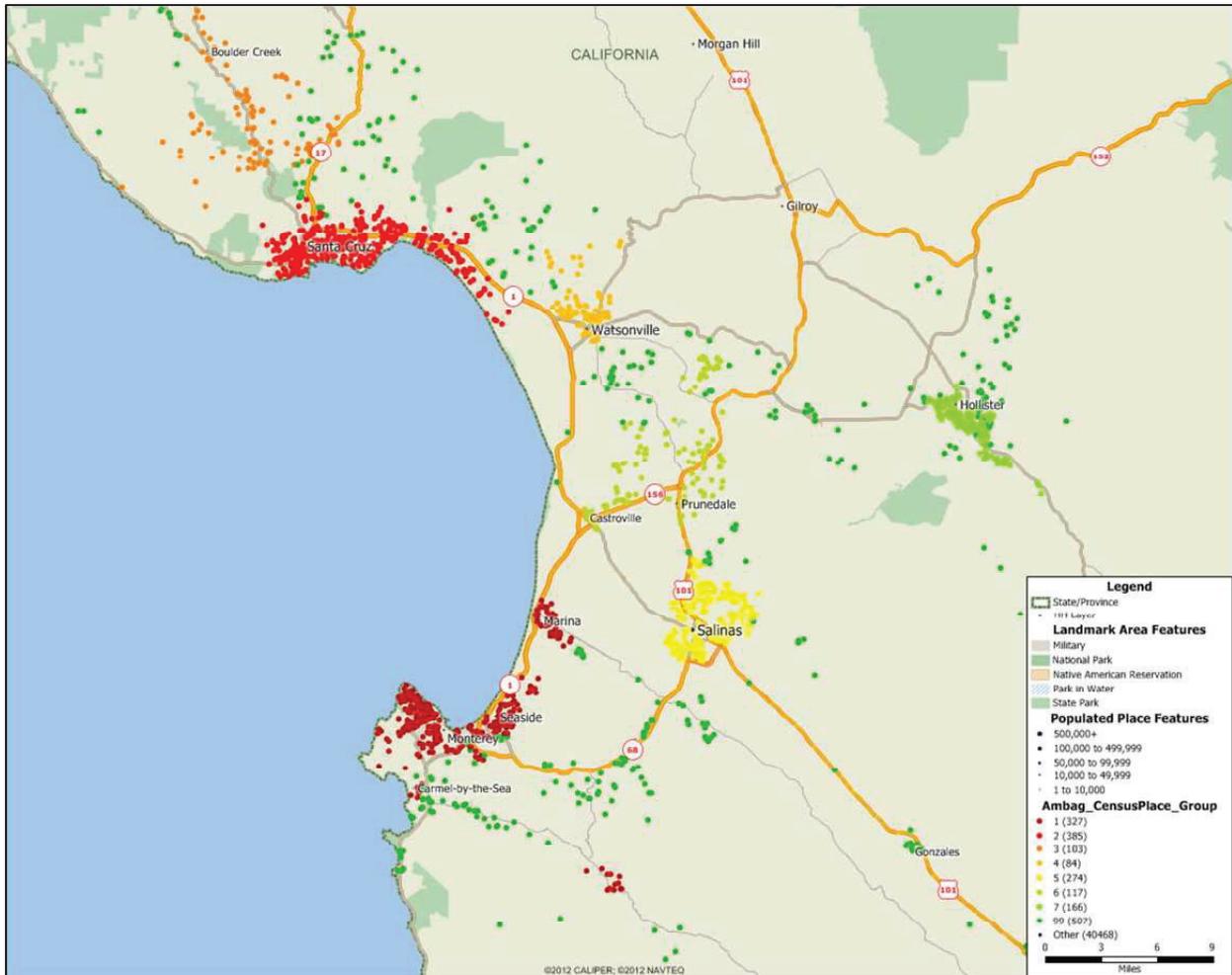
The 2018 AMBAG Regional Travel Demand Model is a technical update only to the previously used 2014 RTDM. The technical update to the 2018 RTDM uses a new base year of 2015 to incorporate land use and transportation network changes. The 2015 base year was not re-estimated, re-calibrated, or re-validated. The 2014 RTDM was estimated and calibrated to 2010 conditions using data from the 2010 California Household Travel Survey (CHTS), Census, employment, and traffic data from that same year. The model utilizes advanced techniques to capture travel behavior at a more individual-based level and incorporates disaggregate level data into some of the modeling stages. The primary reasons for introducing more disaggregate level data into the model was to assist in addressing elements of SB 375, and to pave the way for a possible transition to a tour-based modeling approach in the future. The 2014 RTDM is a traditional four-step trip-based approach, and as such includes models for Trip Generation, Trip Distribution, Mode Choice, and Trip Assignment. Specific differences compared with traditional approaches, and described in more detail later in this document, include a population synthesis to drive the trip generation socioeconomic variables, calculation of the 4D variables (Density, Diversity, Design, and Destinations) using GIS techniques to support inputs to various model stages, the use of person-based trip rates, destination choice model for the trip distribution, and a mode choice component designed and estimated entirely from the survey. The model also employs a highly convergent traffic assignment algorithm.

The model is comprised of four primary time periods, an AM Peak Period defined as 6:00 AM to 9:00AM, a PM Peak Period from 4:00 PM to 7:00PM, a Mid-day Period from 9:00AM - 4:00PM and an Evening Period from 7:00PM to 6:00AM. The model is calibrated to Average Annual Daily Traffic (AADT) count data wherever available. The AADT calibration is based on summing the assigned flows for the four periods and comparing them against the AADTs from Caltrans and local jurisdictional count sources. The Percent Root Mean Square Error (%RMSE) is 28.94% system-wide, 17.91% on the highways, and 20.96% on major arterials. As per the modeling guide established by FHWA and various peer MPOs, the level of calibration of the current AMBAG RTDM is within the acceptable range (per the 2014 RTDM calibration) and has taken care not to over fit the base year model to observed conditions. Overall, the AMBAG RTDM maintains appropriate levels of sensitivity and forecasting ability.

The 2014 RTDM represents a significant improvement in functionality to the 2010 RTDM. The 2014 RTDM has implemented most of the short-term and medium-term model improvement recommendations from the 2011 Travel Model Improvement Program (TMIP) peer review. A peer review of the updated RTDM took place in August of 2013, and recommendations were incorporated into the 2014 RTDM.

California Household Travel Survey

The CHTS dataset for the AMBAG region was comprised of approximately 2000 Household records, of which approximately 1800 were related to weekday travel. The household weights were calculated using household size and Census-designated regions from the 2010 Census.



Dispersion of survey households

The model utilizes household size categories (1- 5+) from the 2010 Census Summary File 1 dataset at the block level, along with a combination of Urban Area Clusters and Census Place boundaries in generating the survey weights. Prior to adopting this methodology, other classification combinations were tried, but none seemed to fit as reasonably as the chosen means.

Weights by geographic region and household size

Area	1	2	3	4	5
Hollister	104.2	73.8	89.7	102.2	224.3
Monterey Peninsula	233.6	141.6	199.3	182.7	338.8
North Hills Santa Cruz	183.6	148.0	177.2	171.4	171.4
Prunedale	57.1	68.5	103.0	295.8	295.8
Salinas	178.8	146.1	203.4	238.8	346.0
Santa Cruz	169.9	159.7	191.9	208.6	208.6
Watsonville	285.7	231.9	305.1	492.1	492.1
All Others	195.1	98.5	126.9	171.3	461.0

Travel behavior in the AMBAG region is especially difficult to simulate for a number of reasons. First, the region has a high variability in residential density and has a very large rural component, particularly in the eastern and southern sections of the area. The region also has high income variability, which further complicates the process of linking the residential and employment zones so necessary to explaining travel behavior in the region. Heavy commuter travel and interregional travel to the San Francisco Bay Area and a high number of people telecommuting complicate matters further. In addition, the region has a rich collection of tourist activities and special events occurring on weekends, and during different seasons. There are also significant agriculture activities from farm workers making seasonal transient (field-to-field) trips and goods movements by freight modes such as trucks. The region experiences a wide variation in rural and urban characteristics with significantly longer trip lengths in rural areas resulting in higher VMT and peak spreading and a more rapidly aging population in and around coastal communities. The AMBAG RTDM has addressed these aspects well through the deployment of a disaggregated person based trip generation model and a destination choice model for many of the home-based trip purposes. The next sections will explain the critical inputs, model components, and the supporting sub-routines.

Travel Analysis Zones (TAZ) and Network Geography

TAZ Geography

The TAZ Geography used in the AMBAG RTDM is an aggregation of 2010 Census Block boundaries. The geography is very similar to that submitted to the Census by AMBAG as part of the TAZ delineation process. The zone structure is comprised of 1710 zones including 10 external zones that serve as the primary gateways to the study area. Although many of the TAZ boundaries are irregular in shape, they meet the population and household threshold guidelines set forth by the Census and are consistent with the measures of contiguousness and compactness. For this model, geographic consistency with the Census Block and Block Group layers is critical for proper evaluation of the population synthesis. Since a disaggregate population drives the trip generation, the TAZ boundaries are not critical for the production trip end. They are necessary for the evaluation of the attraction model, which is more traditional in nature and includes employment aggregated to the TAZ level by employment sector. Although the current TAZ layer has slightly fewer zones than the previous model, the zone size is appropriate for the resolution of the model.

Highway Network Geography

The network geography is based on individual county centerline files merged together to form a single connected layer for the three-county region. The line geography was conflated using recent aerial photography for the AMBAG region and other sources such as Google Earth. There were varying resolution qualities throughout the three country region, with San Benito County requiring the most attention and effort. The critical attributes of functional class, number of lanes, and posted speed were all verified and adjusted as necessary based on AMBAG, consultant, and stakeholder review. In addition, appropriate parameters for the volume delay function are coded as link attributes and populated using a look-up table that varies these parameters by functional class of roadway.

The line layer used in the model is an all-streets network, although for the highway mode component of the model, centroid connectors generally connect to the more major local roads and other higher classified facilities such as collectors and minor arterials. The remaining local streets do remain in the model network and do not seem to create any problems, and are primarily used as access links for other modes such as walking and bicycling. In addition, the roadway network is consistent with the bike network and includes bike-only facilities (such as paths), and attributes that denote links as bike routes and their type (e.g. bike route, bike lane on street, etc.).

Transit Network Geography

The transit network for the updated model includes an inventory of all the bus routes and stops and their variations derived from the General Transit Feed Specification (GTFS) submitted by the three various transit agencies (Monterey-Salinas Transit, Santa Cruz Metro, and San Benito Express). The GTFS data was imported directly into TransCAD and conflated to the highway network. The routes were then verified one by one, along with a tabulation of

the headways by time of day. The route system is believed to be an accurate representation of the multi-agency transit system. It consists solely of bus routes, although the model structure supports inclusion of additional modes. The use of GTFS data in developing the model saved significant person hours of route and stop coding.

Link Capacity

The link capacity per direction of travel utilized in the Traffic Assignment stage of the RTDM is calculated using a combination of link characteristics, each of which has an effect on reducing the capacity from its ideal capacity. These reductions are based on adjustments to the maximum hourly service flow prescribed in the 2010 Highway Capacity Manual (HCM). The link capacities are based on the factors described below.

Functional Class - The roadway Federal or State Functional Classifications (FC) are assigned to each link as follows:

- 1 - Interstate
- 2 - Other Freeways and Expressways
- 3 - Other Principal Arterial
- 4 - Minor Arterial
- 5 - Major Collector
- 6 - Minor Collector
- 7 - Local
- 33 - Proposed Facility
- 44 - Transit Only Link
- 77 - Ramp
- 88 - Bike or Pedestrian Trail
- 99 - Centroid Connector

Posted Speed - The posted speed of the roadway facilities are measured in miles per hour. The ranges of speed for each facility type are:

- 0-25 mph
- 25-35 mph
- 35-45 mph
- 45-55 mph
- Over 55 mph

The following table illustrates the capacities in passenger cars per hour per lane (pcphpl) by functional class and posted speed prior to any area type or lane width adjustments.

Functional Class	FC Code	Ideal Capacity (pcphpl)	Speed ranges in miles per hour (mph)				
			0-25	25-35	35-45	45-55	> 55
Interstate	1	2200	1600	1800	1900	2000	2200
Expressways/Freeways	2	2350	1600	1800	2000	2200	2350
Principal Arterial	3	2000	1500	1700	1800	1900	2000
Minor Arterial	4	1800	1400	1500	1600	1700	1800
Major Collector	5	1600	1200	1300	1400	1500	1600
Minor Collector	6	1400	850	900	1000	1000	1000
Local	7	1000	850	900	1000	1000	1000

Area Type - The area type classification of each link is based on the number of access points to abutting land uses along the link. The classifications and the reductions in ideal capacity based on the HCM are as follows:

	Area Type	Access Points per Mile	Reductions
1	Rural	0 to 10	1.0 (no reduction)
2	Suburban	10 to 20	0.94
3	Urban	20 to 30	0.90
4	Dense Urban	30 +	0.88
9	Commercial	30 +	0.88

Lane Width - The width of the each travel lane is measured in feet, with the following adjustments:

Lane Width	Freeway and Multi-Lane Roadways	Two-Lane Roadways
12 feet or more	1.0 (No adjustment)	1.0 (No adjustment)
11 feet	0.97	0.94
10 feet	0.91	0.87
9 feet or less	0.87	0.76

The factors above are applied to the following ideal capacities (or maximum service flow rates, in passenger cars per hour per lane (pcphpl)):

Facility	PCPHPL
Interstate	2,200
Expressways/Freeways	2,350
Principal Arterial	2,000
Minor Arterial	1,800
Major Collector	1,600
Minor Collector	1,400
Local	1,000

It is imperative that users of the model provide values for Functional Class, Posted Speed, Area Type, and Lane width.

Using the above classifications of link parameters and all possible combinations, there are 700 possibilities for link capacity on a per lane bases. (7 Function classes x 5 speed categories x 5 Area Type classifications x 4 lane width categories = 700)

The final lane level capacity based on functional class and speed is calculated using the following expression:

$$\text{Capacity per Lane} = \text{Ideal Capacity} \times f_w \times f_{acc}$$

where:

f_w = Adjustment due to lane width

f_{acc} = Adjustment due to access point density (area type)

To obtain the total directional hourly capacity, the Capacity per Lane is multiplied by the number of lanes in each respective direction (AB and BA)

Period Multipliers - Since the RTDM is divided into four time periods, each of varying length, the hourly capacity is multiplied by a factor representative of that period. For the three-hour AM (6:00-9:00 AM) and PM periods (4:00-7:00 PM), the multiplier is 2.5. This provides a slight reduction in the overall capacity to account for the shoulder periods in the AM and PM peak periods, which do not exhibit as heavy of a flow pattern as the heaviest two hours. The mid-day period, occurring between 9:00 AM and 3:00 PM utilizes a multiplier of 4, and for Night, (7:00 PM - 6:00 AM) the period capacity multiplier is 5.

Special Links - The RTDM also includes links that are utilized for specific purposes such as walk access and transit-only links.

Centroid Connectors - These links provide a connection from the node in the line layer that represents the TAZ centroid to the main model network, typically comprised of Collector or high classified roads.

Transit-only Links - These links provide a route for fixed-bus route service to use and are generally excluded from use by non-transit vehicles. They are in the model line layer to help provide access to the transit system.

Bike or Pedestrian Paths - These links represent exclusive rights-of-way for the pedestrian and bike modes. They are used in the walk and bicycle skimming process and not available for use by motorized vehicles.

Model Components

Trip Generation

The Trip Generation model forecasts trip productions and trip attractions at the zonal level for seven primary trip purposes: Home-Based Work (HBW), Home-Based Shopping (HBShop), Home-Based School (HBSchool), Home-Based University (HBUniv), Home-Based Other (HBOther), Non-Home-Based-Work (NHBW), and Non-Home-Based-Other (NHBO), and Visitors (to shopping and tourism sites). NHBW refers to trips that at are Non-Home-Based but have one trip end at a work location. NHBO trips are similar except that neither end of the trip is a work location. The visitor model is split into two market segments: Visitors to Shopping sites (Visitor_Shop) and Visitor to Tourism sites (Visitor_Tourist). The visitor purposes are the only models not fully supported by the travel survey. They are based on previous AMBAG modeling efforts with some modification.

Population Synthesis

Anchoring the socioeconomic component of the model is a sophisticated nested population synthesis routine. This routine utilizes data at three levels to derive a synthetic population consistent with attributes found at the Census Block and Block Group levels. The routine utilizes the 5% Public Use Microdata Sample (PUMS) from the Census and consistent with the Public Use Microdata Area (PUMA) boundaries. CHTS data points were also utilized to augment the PUMS data, requiring household weights to be re-calculated the for input PUMS data set. The population synthesis utilizes input data at the block and block group level and matches those household characteristics where ever possible. For example, since the household size variable is available at the block level, the procedure matches the household size distribution at the block level, whereas income is only available at the block group level, so the synthesis matches this at the block group level.

The following attributes are output at the person and household levels and matched against the appropriate census aggregation (block or block group) and are later used as inputs into the trip generation model:

For Households:

- Household Size
- Vehicles in Household
- Income Category
- Tenure (own or rent)
- Number of Children under 18 in Household
- Number of persons above 65 years of age in household

For Persons:

- Age
- Employment Status

- Sex
- Enrolled in School
- Education Level Attained
- Race
- Worker Status

The population synthesis outputs a synthetic population of 237,221 households, which compares favorably with the 2010 Census Block-based tabulation of households.

Since the population synthesis generates a disaggregate and relational population of households and persons, we can utilize variables at either level for input into the trip generation. In addition, this approach allows us to introduce additional lifestyle-based explanatory attributes into the trip generation model to seek a richer understanding of the underlying characteristics affecting travel choices. It also permits us to maximize our data availability and devise statistical correlations that may not have been readily apparent.

Trip Productions

Trip productions for the home-based trips are calculated at the person level using output obtained from the population synthesis described earlier. The overall structure of the trip production models are cross-classification models, which each purpose utilize a different set of classification variables. Below is a summary of the variables used for each purpose and the variability in the trip rate.

Purpose	Workers/H H	Autos/W orker	Autos/HH	Persons/HH	Worker Status	Income Group	Age	Area Type
HBW	x	x				x		
HBShop			x	x	x	x		
HBSchool							x	
HBUniv							x	x
HBOther			x	x	x	x		

For the classification variables shown above, the following are the groupings possible using the CHTS and the Census data at the block and block group levels.

Workers/HH: 0, 1, 2, 3+ (discrete variable)

Autos/Worker: 0, <1, 1+ (category variable)

Autos/HH: 0, 1, 2, 3+ vehicles in household (discrete variable)

Persons/HH: 1, 2, 3+ (discrete variable)

Worker Status: 0 or 1; 0 - no, 1 - yes

Income Group (\$): 1: 0 - 25,000, 2: 25,000 - 50,000, 3: 50,000 - 75,000, 4: 75,000 - 100,000, 5: 100,000 - 150,000, 6: 150,000 - 200,000, 7: 200,000+ (discrete variable)

Age: 1: 0-2, 2: 3-14, 3: 14-17, 4: 18+ (discrete variable)

Area Type: Urban or Rural (discrete variable)

Purpose	Low Rate	High Rate	Average Rate	Standard Deviation
HBW	0.398894	1.805014	0.926493	0.309866
HBShop	0.06539	1.013438	0.336513	0.195458
HBSchool	0	0.6650	0.2377	0.2946
HBUniv	0	0.382599	0.082486	0.124927
HBOther	0.636969	4.635215	1.31889	0.6134

Non-Home-Based trips are calculated using employment and number of households in a regression formulation.

Below is a table that illustrates the correspondence of the forecasted Productions against those found in the weighted travel survey:

Purpose	Modeled	Survey
HBW	301,392	325,436
HBShop	192,839	180,236
HBSchool	99,049	100,272
HBUniv	36,836	25,202
HBOther	826,599	766,438
NHBW	186,336	189,997
NHBO	560,304	575,720
Visitor Shop	164,070	n/a
Visitor Tourist	82,497	n/a

Since most travel surveys exhibit trip under-reporting, especially for non-work related trip purposes, the estimated trip rates seem entirely reasonable for this region.

Trip Attractions

Trip attractions are computed using purpose-based regression models with the number of employees in each sector (based on NAICS code) as the explanatory variable. There are six sectors in the model: Agricultural Employment, Construction Employment, Industrial Employment, Retail Employment, Service Employment, and Public Employment. In addition, school enrollment, university enrollment, and average number visitors present in the zone during a typical weekday are included as variables in the trip attraction model. All trip rates used in the attraction models are estimated from the CHTS records. The following are the trip rates used in the model:

Purpose	AG	CONST	IND	RET	SERV	PUB	K-12	UNIV	VIS	HOTEL
HBW	0.1282	1.5278	1.5278	1.7565	0.6299	1.073	0	0.1743	0	0
HBSshop	0	0	0	4.4792	0.3043	0	0	0	0	0
HBSchool	0	0	0	0	0	0	0.8113	0	0	0
HBUniv	0	0	0	0	0	0	0	0.4128	0	0
HBOther	0	0	0	0.8948	3.6454	0.7953	1.5430	0.1112	0	0
NHBW_P	0	0	0	1.9579	0.3455	0.4030	0.3284	0.0929	0	0
NHBO_P	0.8260	0	0	6.2930	0.9383	0.6606	0.8041	0.2311	0	0
NHBW_A	0	0	0	1.6116	0.5777	0.4498	0.1184	0.0887	0	0
NHBO_A	0.6052	0	0	6.1136	0.9690	0.6398	1.0437	0.2306	0	0
Visitor_Shop_P	0	0	0	0	0	0	0	0	2	2
Visitor_Shop_A	0	0	0	2.55	1.9	0	0	0	0	0
Visitor_Tourist_P	0	0	0	0	0	0	0	0	0	3.75
Visitor_Tourist_A	0	0	0	0	0	0	0	0	1.32	0

The trip rates were estimated using the observed attractions in the travel survey. Caution should be exercised as the attraction rates are not as reliable as the production rate calculations, simply because the number of observations (e.g. zones with attractions) in the survey is far fewer and with inconsistent geographic dispersion. Further, travel behavior on the attraction end of the trip requires a richer set of explanatory variables than only number of employees. Overall, the attraction equations provide reasonable trip totals in relation to the calculated productions and describe the relative attractiveness of a given zone, as shown in the next section.

Trip Balancing

The following table illustrates the aggregate production and attraction totals prior to trip balancing.

Purpose	Total Production	Total Attraction
HBW	301,392	274,981
HBShop	192,839	200,925
HBSchool	99,049	101,094
HBUniv	36,836	24,910
HBOther	826,599	698,773
NHBW	191,332	181,339
NHBO	554,139	566,470
Visitor Shop	164,070	167,384
Visitor Tourist	73,264	82,497

This table indicates the desired balancing technique by trip purpose and the final total.

Purpose	Balance Technique	Final Total
HBW	Hold Productions	301,392
HBShop	Hold Productions	192,839
HBSchool	Hold Attractions	99,049
HBUniv	Hold Attractions	36,836
HBOther	Hold Productions	826,599
NHBW	Weighted Sum	186,336
NHBO	Weighted Sum	560,304
Visitor Shop	Hold Productions	164,070
Visitor Tourist	Hold Attractions	82,497

After Balancing, the productions and attractions are split into Peak and Off-Peak periods based on the observed time of day factor and input into the appropriate distribution model. After balancing, the summary of trips per household is as follows:

Purpose	Trips/HH
HBW	1.27
HBSshop	0.81
HBSchool	0.42
HBUniv	0.16
HBOther	3.49
NHBW	0.79
NHBO	2.36
Total	10.33

The overall average trip rate of 10.33 trips per household is reasonable when compared to locally observed data and national guidance.

IX-XI Trips

IX -XI trips are calculated directly by subtracting the through trip percentage of flow at the external station. These calculations are based solely on the external station survey completed in 2010-2011. The trips are then distributed using a calibrated gamma function based on the zone's proximity to the external station. This method proved to be a flexible and sensible way to create the IX-XI trip interactions. Multiple attempts were made to try to calculate attractions from an internal zone to external using regression, but these efforts proved to be very unreliable.

Below is a graphic showing a key result of the external station survey conducted for the update of this model:

Destination Survey Data Location												
		Destination Locations										
Origin Locations	118,682	AMBAG	1	2	3	4	5	6	7	8	9	10
	AMBAG	--	1,399	947	25,160	1,805	10,847	8,830	2,933	151	3,588	709
	1	1,368	--	0	43	5	9	2	2	0	5	18
	2	1,008	2	--	18	0	2	0	0	0	0	0
	3	25,346	73	10	--	36	92	14	13	0	9	11
	4	1,365	3	0	20	--	43	11	1	1	0	0
	5	15,956	3	0	72	35	--	88	59	1	681	22
	6	8,812	0	0	18	3	94	--	46	2	2	0
	7	2,841	3	0	6	2	46	29	--	4	25	3
	8	209	0	0	0	0	0	1	3	--	12	0
	9	2,944	4	0	8	0	390	1	22	4	--	1
10	318	3	0	1	1	4	0	2	0	2	-	

Survey Data Location Descriptions: 1 – Hwy 1 North Gateway, 2 – Hwy 9 Gateway, 3 – Hwy 17 Gateway, 4 – Hwy 152 Gateway, 5 – Hwy 101 North Gateway, 6 – Hwy 25 Gateway, 7 – Hwy 156 Gateway, 8 – Hwy 198 Gateway, 9 – Hwy 101 South Gateway, 10 – Hwy 1 South Gateway

From this output, the through trip and IX-XI percentages were developed. Those percentages were then applied to the most recent Caltrans traffic counts at the external stations to provide the ultimate numbers used in the model. The final daily numbers used in the model are shown below:

External TAZ	External Name	AADT Caltrans	AADT O	AADT D	Fraction Through	Fraction Auto	Fraction Truck
9001	CA Route 1 (AMBAG North)	5600	2788	2810	0.06	0.94	0.06
9002	Congress Springs Road	2700	1411	1288	0.02	0.99	0.01
9003	Santa Cruz Hwy CA17	55000	28395	27605	0.01	0.97	0.03
9004	CA 152	6000	2668	3322	0.05	0.97	0.03
9005	CA 25	19900	9950	9950	0.02	0.95	0.05
9006	US 101 (AMBAG North)	57000	28500	28500	0.06	0.89	0.11
9007	CA 156	13900	6887	7009	0.04	0.72	0.28
9008	CA 198	1100	621	478	0.07	0.76	0.24
9009	US 101 (AMBAG South)	19200	9600	9600	0.15	0.79	0.21
9010	CA Route 1 (AMBAG South)	3200	1600	1600	0.06	0.96	0.04

Highway and Transit Skimming

Highway Skimming

Once the highway network is created, the model performs highway skims from centroid node to centroid node. Initially, free-flow travel times are used. Using the Method of Successive Averages (MSA) travel times output from the trip assignment stage are averaged to obtain congested travel time over a series of model feedback loops. Both peak and off-peak skim matrices are created. Peak skim matrices are based upon the AM (6AM-9AM) period, however only the 7AM-9AM period is used for the travel times input into distribution. Off-peak skim matrices are based upon the mid-day (9AM-4PM) period. The skims are based solely on travel time, and there no times (terminal or otherwise) added to this matrix prior to input into the distribution model.

After travel time matrices are calculated, intrazonal travel times are calculated using a methodology that considers the geographic area of the polygon and possible diagonal length, and then applies a constant speed across that length. This appears to work well for all zones in the AMBAG region.

Transit Skimming

Similar to highway skimming, transit skims are computed from centroid node to centroid node, however this process takes place on the transit route layer and its associated network. TransCAD minimizes generalized cost when determining the best path between origin to destination nodes. The generalized cost is a mix of in-vehicle travel times, access, egress and transfer times, waiting times and fares. The model uses the Pathfinder method for both skimming and assignment, which combines routes together into trunk links when determining best paths using a combined headway approach.

Similar to highway skimming, two skim matrices are calculated: one for the peak period and one for the off-peak period. The output skim matrices created in this stage are then utilized in the distribution and mode choice stages of the model.

The following fields are used when determining the best transit paths:

Field	Source	Used for
ABTRANSITTIME & BATRANSITTIME	Highway line database	Transit in-vehicle times for all skim matrices
WALKTIME	Highway line database	Access, egress and transfer links for walk-local and walk-express networks, transfer and egress links for drive-local and drive-transit networks
ABCONGTIME_AM/OP & BACONGTIME_AM/OP	Highway line database	Access links for drive-transit networks
PERIOD_HEADWAY (PERIOD = AM, PM, MD, OP)	Route layer field	Anticipated Headway by Route
FARE	Route layer field	Cost calculation, with conversion rate of 20 cents/minute or \$12.00/hour

The following tables are estimated for each skim matrix:

Table	Description
GENERALIZED COST	The total weighted cost from origin to destination
FARE	Total transit fare from origin to destination
IN-VEHICLE TIME	In vehicle transit travel time
INITIAL WAIT TIME	First transit combined waiting time
TRANSFER WAIT TIME	Total transfer waiting time on subsequent routes
TRANSFER WALK TIME	Walk times on transfers between routes
ACCESS TIME	Access times
EGRESS TIME	Egress times
DWELLING TIME	Total time spent dwelling on bus
NO OF TRANSFERS	Number of Transfers

Trip Distribution

The trip distribution model for the AMBAG RTDM is comprised of two primary models, a Traditional Gravity model and Destination Choice model. Traditional Gravity models calibrated to by trip purpose are utilized for HBSchool, HBUniv, NHBW, NHBO, and IX-XI trips. For the HBW, HShop, and HBOther trips, a Destination Choice model is employed. Overall, both models seem to perform quite well for their respective purposes. Both models are calibrated for both peak and off-peak periods.

Gravity Model

For trip distribution, the gravity model was implemented for the HBSchool, NHBWork , NHBOther, IX-XI, and Visitor trip purposes.

The following steps were used to obtain the gravity model for the AMBAG RTDM:

- Shortest paths were computed from zone to zone based on travel time and estimated congested travel times were skimmed from the least cost paths utilized in the traffic assignment stage. Intra-zonal travel times were computed based on the average time to the nearest 3 zones.
- The balanced productions and attractions were obtained from the trip generation stage.
- Friction Factor Computation

In order to compute the friction factors, the origin and the destination zone for each trip in the survey data was obtained using the analysis tools in TransCAD. The trip length for each trip

was determined based on the shortest path matrix. Using the survey weights, the trip length frequencies were determined on a minute by minute basis for each of the trip purposes. The trip frequencies were plotted versus trip travel time intervals, and gamma function curves were fitted to match the observations. It was generally observed that the best fit was obtained by using two sets of gamma curves for each trip purpose. One curve was used to model the initial and the peak region of the observations (generally around 1 – 15 minutes) and the other curve was employed to model the tail region of the observations (> 15 minutes). The fitted curves and the coefficients are illustrated below. The trip interval used to aggregate trip frequencies was 1 minute for all trip purposes. Friction factors were estimated for both Urban and Rural zone sets due to significant differences in observed trip lengths and travel behavior in the CHTS. The general form of the gamma friction factor curve employed is:

Equation 1: Friction Factor Equation

$$FF = \alpha * (Time)^{-\beta} * e^{-\gamma * Time}$$

Where

α = Alpha parameter

β = Beta parameter

γ = Gamma parameter

Different gamma function parameters for Beta and Gamma are used for different time regimes. The other parameters of the friction factor function are unchanged over the entire time interval. The variation of gamma function parameters allowed for a closer fit of the model trip length frequencies to the survey. Custom parameters were developed for each trip purpose and by urban and rural classification. This allowed urban and rural regions to have different trip lengths. The estimated functions for all purposes and regions are listed below.

Period	Purpose	Area Type	Gamma a	Gamma b1	Gamma c1	Gamma b2	Gamma c2	Curve Change 1 (min.)	Curve Change 2 (min.)	End Time (min.)
PK	HBSchool	Rural	2777.875378	0.327537	0.060707	0.327537	0.060707	10	20	30
OP	HBSchool	Rural	2777.875378	0.327537	0.060707	0.327537	0.060707	5	10	30
PK	HBSchool	Urban	12003.66575	-3.917881	1.769152	0.579636	0.073281	4	10	30
OP	HBSchool	Urban	29662.16926	-6.398231	3.431916	-0.136983	0.122341	2.629044	10	30
PK	HBUniv	Rural	54.853946	-17.003256	5.024656	1.060674	-0.001751	2.339751	25	40
OP	HBUniv	Rural	15.733933	4.135444	-1.765623	2.266813	0.022935	7.122649	25	40
PK	HBUniv	Urban	54.853946	-17.003256	5.024656	1.060674	-0.001751	2.339751	30	35
OP	HBUniv	Urban	15.733933	4.135444	-1.765623	2.266813	0.022935	7.122649	30	45
PK	NHBO	Rural	6848.892453	0.038301	0.113218	0.038301	0.113218	10	15	30
OP		Rural	6848.892453	0.038301	0.113218	0.038301	0.113218	10	20	30
PK	NHBO	Urban	19933.98133	-2.085528	0.826318	1.357719	0.046368	5.789854	20	45
OP	NHBO	Urban	26898.84605	-3.575873	1.852923	-0.468638	0.244993	2.999989	20	45
PK	NHBW	Rural	2192.992551	0.357246	0.045974	0.357246	0.045974	10	25	30
OP	NHBW	Rural	2192.992551	0.357246	0.045974	0.357246	0.045974	10	25	30
PK	NHBW	Urban	300.510939	1.99276	-1.70406	1.421039	0.003973	2.983617	30	45
OP	NHBW	Urban	6946.814051	-0.670151	0.305289	2.320353	0.016249	9.000004	35	45

Destination Choice Model

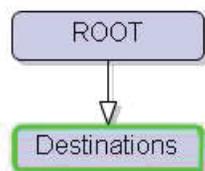
For the HBW, HBOther, and HBShop trip purposes, destination choice models were estimated. The following section summarizes the destination choice model estimation methodology and results for these purposes. Since one trip end is at a home location, it is intuitive to select the other end from a set of destinations.

The destination choice model estimation and evaluation consisted of two steps:

1. Estimating one or more disaggregate destination choice models using the CHTS data
2. Setting up the models for application at the aggregate (TAZ) level.

Estimation methodology

While destination choice models may appear simple in concept (i.e. a discrete choice model applied to a set of zones), they are unique in terms of the sheer number of alternatives that must be included in the choice set. It is therefore generally impractical to define such discrete choice models by creating a choice tree one alternative at a time as in traditional mode choice models. For this reason, TransCAD's destination choice tools were used to create a generic destination alternative with a utility specification that will apply across all zones:



Since the utilities have to be generic, they cannot involve an alternative specific constant. For the same reason, they cannot include origin attributes or socio-economic characteristics, since these data will be common across all alternative destinations (and hence cancel out of the calculation of utility differences). Further, since the destination alternatives are aggregated from the disaggregate level (e.g. a shop, parking lot, office, etc.) to the zone level, a size variable must be considered in order to maintain consistency with TAZ-level attractions (Ben-Akiva and Lerman, 1985).

Sampling

The choice set of available destination zones for each trip in the survey was carefully crafted to improve the chance that the model fit choice decisions from amongst realistic options. If we assumed that all TAZs were available to every trip maker, the onus of explaining the observed choices would fall on the few relevant independent variables contained in the survey. A better approach is to generate a list of possible destination zones for each survey respondent, sampling from the set of all available zones.

Several sampling strategies suggest themselves as possibilities for destination choice. A reasonable assumption is to conduct importance sampling, assigning higher weights to the destinations that are deemed to be more likely to feature in the set. The sampling approach, however, might require a correction term to remove estimation bias. In addition, given the determination of sampled choice sets through Monte Carlo simulation, replications are necessary in order to account for the inherent stochasticity.

The total number of zones (1710) in the AMBAG RTDM was well over the number of records in the household survey. While importance sampling of TAZs was attempted, this sparse coverage of chosen TAZs in the AMBAG household survey presented a unique challenge that required spatial aggregation to a higher level. This aspect is discussed next.

Zones vs. Census Tracts

The AMBAG tracts layer presented a logical aggregation level to pool the TAZs into larger destinations. The 1710 TAZs cover 156 tracts, each with at least one TAZ being chosen in the survey. Estimation with this full set of tracts (without sampling) was the most feasible option.

Model Results

This section describes the outputs of model estimation, including variables used, estimated coefficients, and model fit.

Independent variables

The Destination Choice models made use of the following variables:

1. The size variable for each tract is the natural logarithm of the total number of trips attracted to the tract. The component TAZ-level attractions were taken from the trip attraction model.
2. Weighted highway skims from origin TAZs to destination tracts. For a given origin TAZ, the skim to each destination tract was calculated as the average skim to all TAZs within the tract, weighted by the TAZ's attraction. It should be noted that the weighted skims were calculated by trip purpose, since the attractions vary across purposes.
3. Tracts were designated as urban or rural based on the dominant types of zones residing within the tracts. Two tract-level dummy variables corresponding to the CBD and Urban categories were computed.
4. Various 4D measures were averaged across the zones within the tracts. These included transit stop density, retail employment density and retail + service employment density.
5. An intra-zonal dummy variable was employed to capture the short range trips.

The estimation of the destination choice utilized TransCAD's destination choice procedure. A special script and data format was necessary to develop prior to commencing estimation. This required a significant effort, but we feel that it was a worthwhile endeavor that significantly improved our ability to capture the observed trip length distribution more accurately.

Estimated models

This section summarizes the destination choice model specifications and coefficients estimated. This list only includes coefficients for variables found to be significant.

Coefficient	Description
B_Time	Coefficient of travel time skim
B_RetailEmp	Coefficient of average retail employment density
B_RetailServiceEmp	Coefficient of average retail+service employment density
B_Size	Coefficient of size variable
B_IZDummy	Coefficient of flag indicating Intrazonal choice

It should be noted that the t-statistics for the size variable coefficient estimates are computed against the null hypothesis $H0: B_{Size} = 1$, while the other coefficients are tested against zero*.

Destination Choice HBW Model

Coefficient	Estimate	t-statistic
B_Time	-0.089403	-29.82
B_Size	0.704892	-8.26*
B_IZDummy	0.543847	4.04
Rho_bar_squared	0.2485	

Destination Choice HBShop Model

Coefficient	Estimate	t-statistic
B_Time	-0.18838	-22.77
B_RetailEmp	0.000347	3.52
B_Size	0.633851	-8.19*
B_IZDummy	0.51972	4.04
Rho_bar_squared	0.4204	

Destination Choice HBOther Model

Coefficient	Estimate	t-statistic
B_Time	-0.14836	-42.59
B_RetailServiceEmp	0.000128	7.43
B_Size	0.954718	-1*
B_IZDummy	1.006	16.43
Rho_bar_squared	0.3798	

According to destination choice theory, the coefficient of the size variable should be 1. We estimated a coefficient for the size variable to determine how different it was from 1 for this data set. We also made alternate estimations after fixing the size variable to 1 and received similar parameter estimates to those listed above. The final adopted coefficients will be determined prior to the final model delivery.

Destination Choice Model Application

While the destination choice models for AMBAG were estimated from the disaggregate household survey, they are applied at the aggregate level. The broad goal is to distribute a vector of trip productions across destination zones. There were a couple of noted issues however, during the implementation stage:

1. The estimates did not weight the survey records, so the applied destination splits could potentially deviate from those in the survey.
2. The models were estimated to distribute zone productions across tracts (not zones).

After applying the destination choice, the aggregated tract totals (columns) will not match the input tract attractions. To rectify this, a correction term was added to the utility formulation and the destination choice model was re-evaluated. This correction term was the natural logarithm (\ln) of the ration of the size variable to the computed tract total. This process was completed iteratively for a total of 10 times.

Once the models were adjusted to replicate the destination splits at the tract level, the TAZ-to-Tract flows were further split between the TAZs within the tract via a gravity-type function (Ben-Akiva and Lerman (1985), chapter 9):

$$P_o(d) = M_d e^{-\alpha (tt_{od})}$$

Where $P_o(d)$ is the probability that a trip originating in zone o will choose destination zone d ; M_d is the size of zone d ; tt_{od} is the travel time between zones o and d ; α is a coefficient set to two over the mean trip length and this varied by trip purpose and origin region (Urban or Rural). For a given origin zone o , the above probabilities over all zones d within a single tract will sum to unity.

A second round of iterative corrections was done to bring the zone-level destination shares closer to those in the survey. Modeled trips were compared with survey trips based upon average trip lengths and trip length frequencies. City-to-city trip distributions were also compared.

References

1. M. Ben-Akiva and S. Lerman (1985) "Discrete Choice Analysis: Theory and Application to Travel Demand". The MIT Press, Cambridge, MA.

Trip Lengths

One of the key measures of calibration in the trip distribution model is the comparison of modeled trip lengths, in minutes, and observed trip lengths derived from the travel survey. Below is a table illustrating the trip lengths in minutes after the fifth feedback loop by Urban and Rural classification.

Urban

Purpose	Peak (min.)	Off Peak (min.)
HBW	12.43	12.21
HBSshop	6.25	6.20
HBSchool	8.07	8.92
HBUniv	18.50	17.90
HBOther	7.25	7.23
NHBW	10.49	7.82
NHBO	7.86	6.94
Visitor Shop and Tourist	12.43	12.21

Rural

Purpose	Peak (min.)	Off Peak (min.)
HBW	21.91	21.83
HBSshop	12.67	12.68
HBSchool	14.66	14.99
HBUniv	28.35	29.15
HBOther	13.57	13.67
NHBW	15.75	15.49
NHBO	13.72	13.21
Visitor Shop and Tourist	38.6	39.2

Below are the trip lengths derived from the survey:

Urban

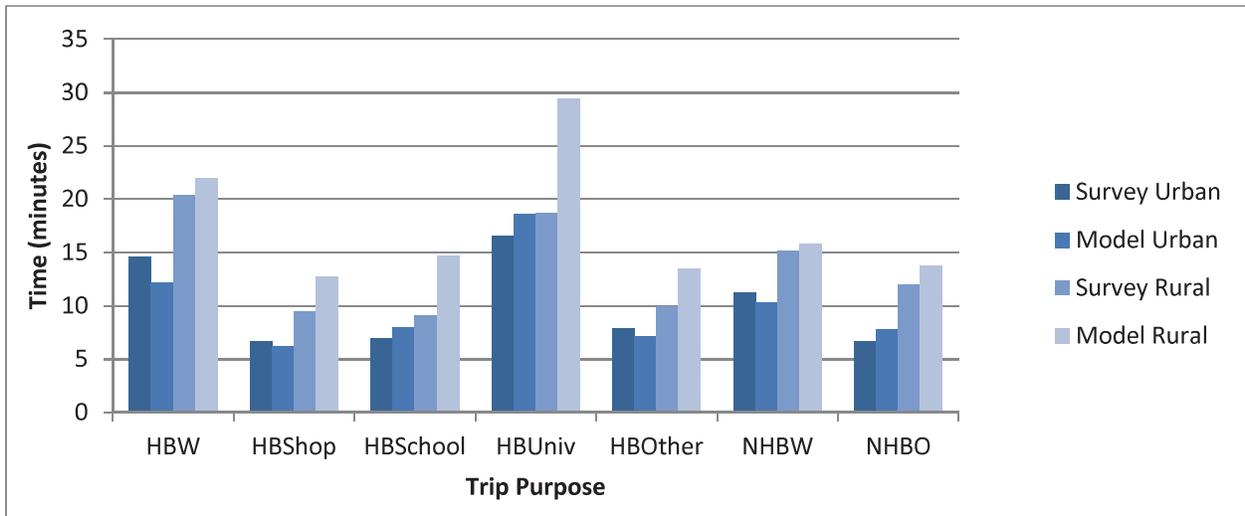
Purpose	Peak Survey (min.)	Off-Peak Survey (min.)
HBW	14.6	13.3
HBSshop	6.7	6.4
HBSchool	6.9	9.2
HBUniv	16.6	14.1
HBOther	7.9	9.6
NHBW	11.3	7.9
NHBO	6.7	8.9

Rural

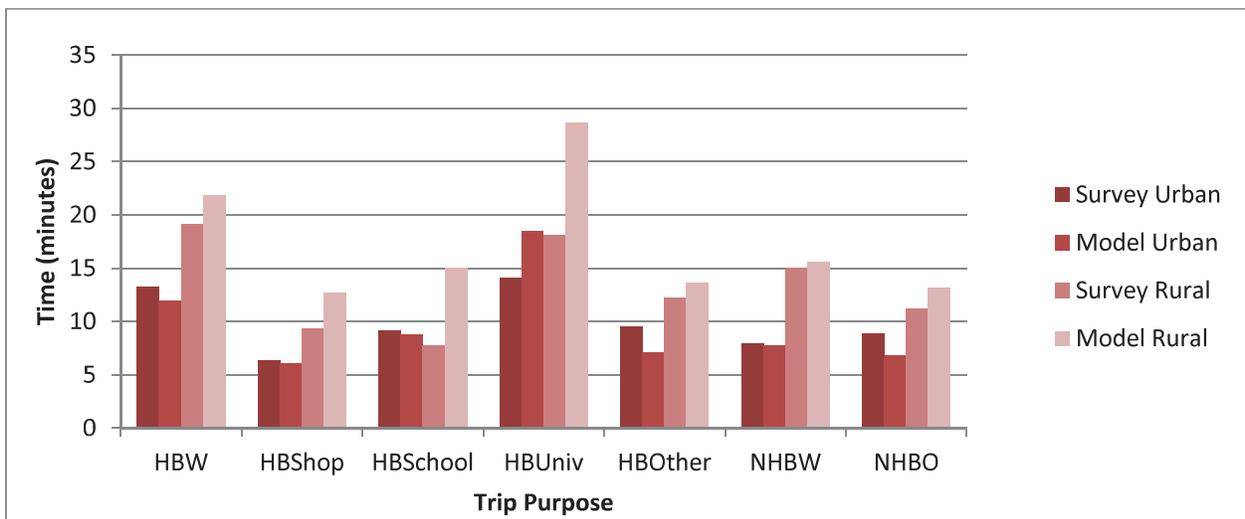
Purpose	Peak Survey (min.)	Off-Peak Survey (min.)
HBW	20.4	19.2
HBSshop	9.4	9.4
HBSchool	9.1	7.8
HBUniv	18.7	18.1
HBOther	9.9	12.2
NHBW	15.1	15.1
NHBO	12.0	11.3

Below are graphical displays of the above data for peak and off-peak periods:

Peak Period

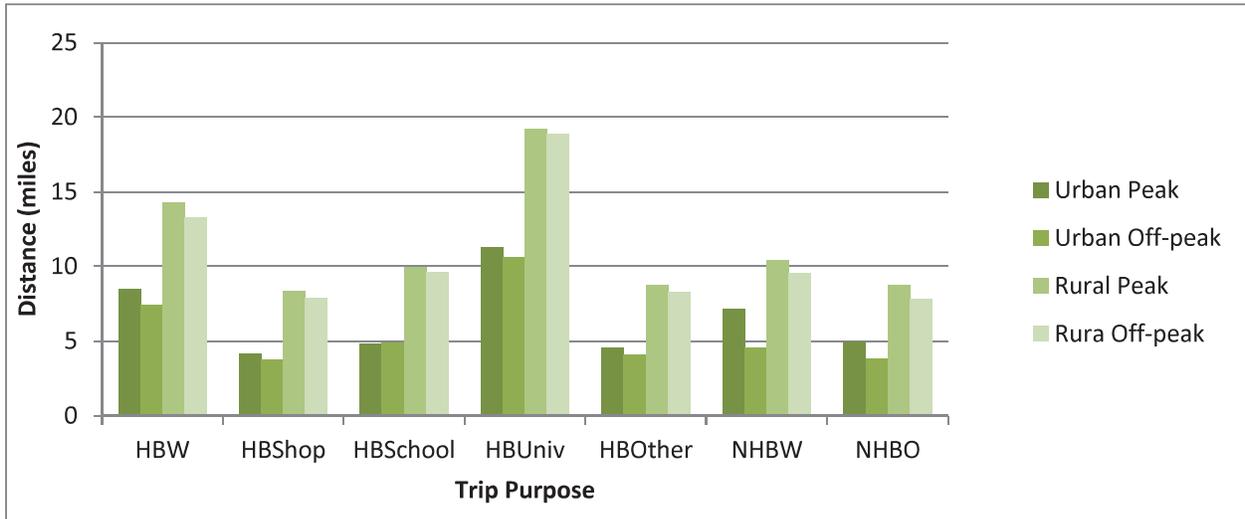


Off-peak Period



The following chart illustrates the modeled trip lengths. Due to differences in how the distances were calculated between the survey points (point-to-point) and in the model (centroid-to-centroid), comparison of the two is not consistent.

Modeled Trip Lengths



Mode Choice

The updated mode choice model for the AMBAG RTDM utilizes a nested logit based model structure. The model is fully estimated using the 2010 CHTS survey records and as such only includes variables found to be significant. For the model update, one of the objectives was to estimate mode choice models that include 4Ds explanatory variables, the idea being that the model should be responsive to these parameters.

Independent variables, a priori hypotheses and estimation setup

The 2010 CHTS household survey was analyzed to identify variables that might be useful in explaining mode choice behavior in the AMBAG area. In addition, various zonal and OD-based skim variables were tagged to the survey in order to include the effects of geographic context, accessibility and network congestion.

At the zonal level, a CBD dummy was generated to capture the unobserved and perceived benefits of destinations in the more urbanized areas of Santa Cruz, the Monterey Peninsula, and Salinas. Average transit stop densities were also computed at both the origin and destination ends of trips. Parking cost at the destination trip end was considered for the auto modes, with half the cost used for carpool trips. However, these effects were found to be either insignificant or resulted in counter-intuitive coefficient signs.

Congested highway and transit skims (including in-vehicle and egress walk times) were tagged to the survey, making sure that AM and PM peak period trips used the skims from the appropriate time of day. Highway skims were used for the school bus mode.

The 2010 CHTS dataset contained limited trip records that used transit as the mode of travel. This data limitation meant that the transit mode could not be reliably estimated. A practical work-around to include transit in the mode choice models is discussed later.

Weighted nested and multinomial logit model estimations were conducted using the Nested Logit Estimation procedure. Adjusted rho squared ($\bar{\rho}^2$) values, denoted henceforth as rho_bar_squared, are reported as a measure of model fit to the survey data. Standard t-statistics are presented as an indicator of the relevance of the different variables in the mode choice context.

Model Estimation Results

This section summarizes the final estimated model specifications and utility coefficients identified for various trip purposes. One objective was to estimate separate mode choice models for the peak and off-peak periods. However, no significant difference was observed for any of the purposes. A combined model was therefore estimated for each of the purposes.

The estimated models are a series of logit models (multinomial or nested) that vary by trip purpose and by peak/off-peak periods. For most purposes, the following travel modes are estimated:

- Auto drive alone
- Auto shared ride (carpool)
- Walk
- Bike

School Bus and Other modes were added as needed to capture purpose-specific situations.

As stated earlier, the limited sample sizes in the travel survey (particularly with transit as the chosen mode) prevented a deeper nesting structure, the estimation of more sub-modes, and the inclusion of variables such as transit fare and transit in-vehicle travel time. Asserted models give you the ability to define more detailed and complex models, however their parameters and coefficients may not be consistent with survey observations.

A full complement of mode-specific constants was estimated in each case, typically using the bike mode as the base. Where the t-statistics of the constants were found to be low, they were still retained (at a lower confidence level) to maintain model estimation integrity in the face of missing variables.

In some cases, the Auto nest (comprised of Drive Alone and Shared Ride modes) was retained in the model while the corresponding logsum coefficient was fixed at 1. This was done because the estimation procedure did not identify a coefficient significantly different from 1.

Systematic utilities for the various modes are denoted by V_{DA} (Drive Alone), V_{SR} (Shared Ride), V_{Bike} , V_{Walk} , V_{SB} (School Bus) and $V_{Transit}$.

The mode choice constants were subsequently re-calibrated to better match the weighted shares observed in the household survey. Separate sets of constants were estimated to differentiate between peak and off-peak effects.

List of mode choice model coefficients

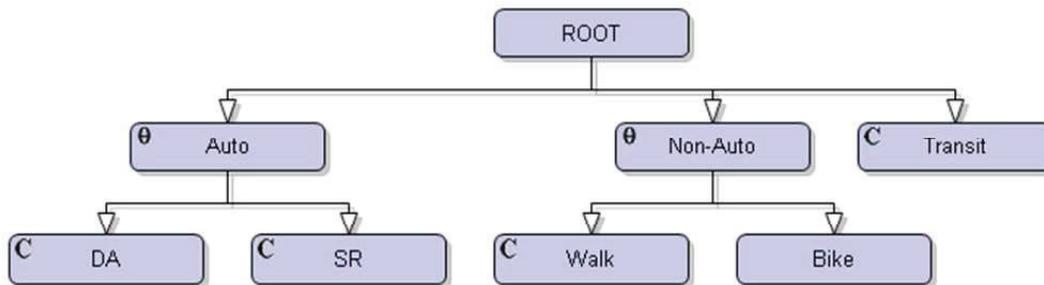
Coefficient	Description
C_DA	Mode-specific constant for Drive Alone
C_SR	Mode-specific constant for Carpool
C_Walk	Mode-specific constant for Walk
C_Bike	Mode-specific constant for Bike
C_SB	Mode-specific constant for School Bus
C_Transit	Mode-specific constant for Transit
B_Time	Generic travel time coefficient
B_Time_DA	Travel time coefficient for Drive Alone
B_Time_CP	Travel time coefficient for Carpool
B_Time_Other	Travel time coefficient for Transit and Non-Motorized modes
B_Egress	Coefficient for transit egress time
B_CBD	Coefficient for CBD dummy
B_Park	Coefficient for auto parking cost at the destination zone
B_Monterey	Coefficient used to better capture un-observed transit travel behavior unique to trips interacting within the MST service area (NHBO trips only) .
B_TotEmpDensity	Coefficient for total employment density at trip origin
B_IntDensity	Coefficient for intersection density at trip origin
B_Diversity1	Coefficient for retail, service employment and HH diversity at trip origin
B_Diversity2	Coefficient for retail employment and HH diversity at trip origin
B_RSE_Density	Coefficient for retail and service employment density at trip origin
Theta (Auto)	Logsum coefficient for Auto nest
Theta (Non-Auto)	Logsum coefficient for Non-Auto nest

Many 4Ds variables were considered in the mode choice models. Of the 4Ds variables tested, only the total employment density variable was ultimately included as the one having sufficient explanatory power and being statistically significant. The limited sample size of trip records in the survey may have played a role in the lack of 4Ds variables successfully

included, while the CBD dummy showed greater explanatory power than other 4D variables tested.

Note that the bus mode is used as the base alternative with a mode specific constant of zero. The nesting structure of each model, along with a list of each model variable and coefficient and rho-squared result, is presented below:

HBW Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot \text{Highway Skim}$$

$$V_{SR} = C_{SR} + B_{Time} \cdot \text{Highway HOV Skim}$$

$$V_{Transit} = C_{Transit} + B_{Time} \cdot \text{Bus}_{IVTT}$$

$$V_{Bike} = B_{Time} \cdot \text{Bike Time} + B_{TotEmpDensity} \cdot \text{Tot_Emp_Density}$$

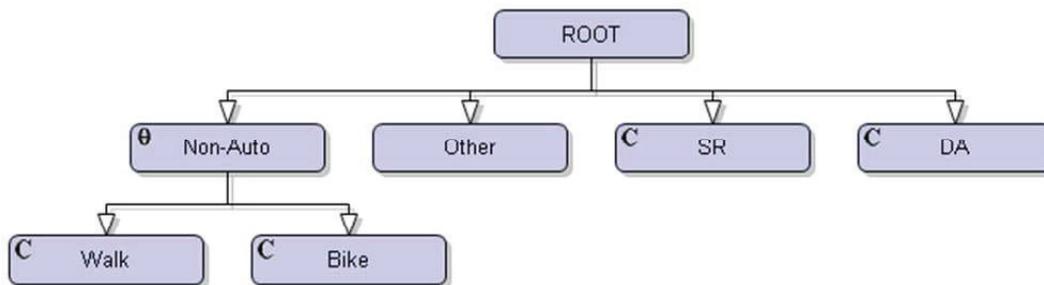
$$V_{Walk} = C_{Walk} + B_{Time} \cdot \text{Walk Time} + B_{TotEmpDensity} \cdot \text{Tot_Emp_Density}$$

While the equations above indicate separate skims for HOV and general-purpose travel lanes, no such distinction exists in the AMBAG highway network. The highway skims and highway HOV skims were assumed to be the same for model estimation. The utility specification still allows the flexibility to use HOV-specific skims in the future.

Coefficient	Estimate	t-statistic
C_DA	2.51	15.43
C_SR	1.55	1.85
C_Walk	0.859	3.97
B_Time	-0.0194	-4.69
B_TotEmpDesity	0.0002	5.43
Theta (Auto)	0.58	-1.06
Theta (Non-Auto)	0.25	-9.87
Rho_bar_squared	0.4223	

It should be noted that the transit mode was never chosen for any of the HBW trips in the survey. A transit mode was subsequently added to the estimated model to allow AMBAG to test for transit effects in scenario analysis. The generic travel time coefficient from the other modes was transferred to the transit mode, and local knowledge was used to estimate it's constant to produce a 1.5% transit mode share.

HBOther Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot Highway Skim$$

$$V_{SR} = C_{SR} + B_{Time} \cdot Highway HOV Skim$$

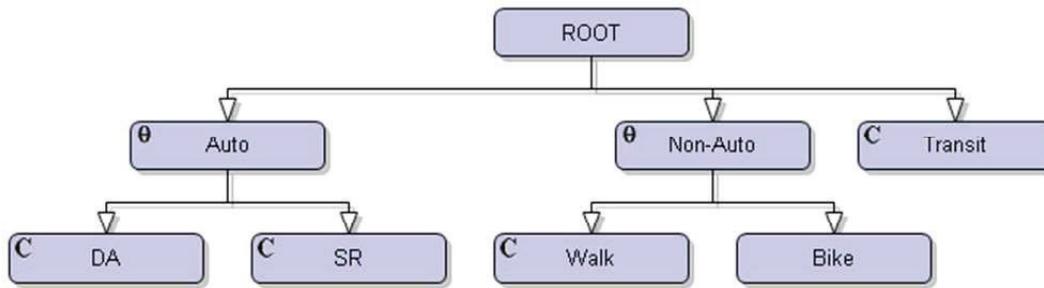
$$V_{Other} = 0$$

$$V_{Bike} = C_{Bike} + B_{Time} \cdot Bike Time + B_{IntDensity} \cdot O_{IntersectionDensity} + B_{Diversity1} \cdot O_{RSE_HH_Diversity}$$

$$V_{Walk} = C_{Walk} + B_{Time} \cdot Walk Time + B_{IntDensity} \cdot O_{IntersectionDensity} + B_{Diversity1} \cdot O_{RSE_HH_Diversity}$$

Coefficient	Estimate	t-statistic
C_DA	4.514	13.24
C_SR	5.179	18.42
C_Walk	5.55	5.62
C_Bike	2.939	-10.99
B_Time	-0.0562	-46.66
B_IntDensity	0.0022	2.31
B_Diversity1	0.4424	2.88
Theta (Non-Auto)	1.00	-
Rho_bar_squared	0.3234	

HBSHOP Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot \text{Highway Skim}$$

$$V_{SR} = C_{SR} + B_{Time} \cdot \text{Highway HOV Skim}$$

$$V_{Transit} = C_{Transit} + B_{Time} \cdot \text{Bus IVTT}$$

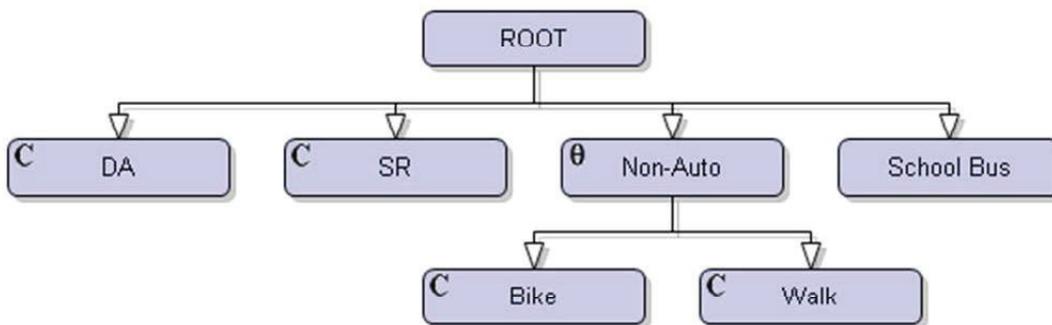
$$V_{Bike} = C_{Bike} + B_{Time} \cdot \text{Bike Time} + B_{IntDensity} \cdot O_{IntersectionDensity} \\ + B_{Diversity2} \cdot O_{RE_HH_Diversity}$$

$$V_{Walk} = C_{Walk} + B_{Time} \cdot \text{Walk Time} + B_{IntDensity} \cdot O_{IntersectionDensity} \\ + B_{Diversity2} \cdot O_{RE_HH_Diversity}$$

Coefficient	Estimate	t-statistic
C_DA	3.925	6.28
C_SR	3.9400	4.18
C_Walk	2.1355	5.63
C_Transit	-0.8200	n/a*
B_Time	-0.0512	-4.71
B_IntDensity	0.0068	3.41
B_Diversity2	2.0092	3.54
Theta (Auto)	0.7116	-0.25
Theta (Non-Auto)	1	-
Rho_bar_squared	0.3262	

As in the HBW case, transit was added after model estimation by transferring the generic travel time coefficient from the other modes and calculating a transit constant to match a perceived 2% share.

HB School Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot \text{Highway Skim}$$

$$V_{SR} = C_{SR} + B_{Time} \cdot \text{Highway HOV Skim}$$

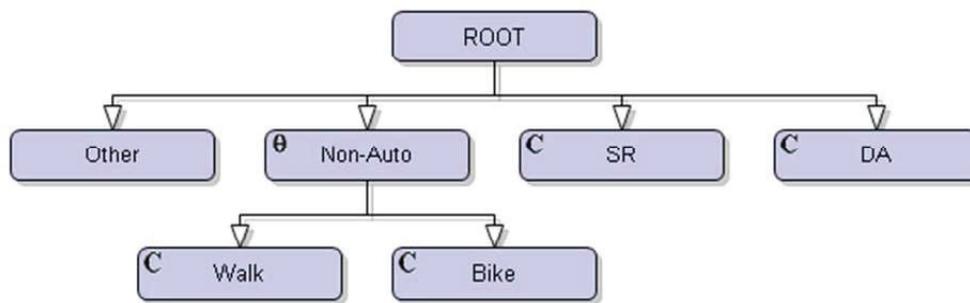
$$V_{Bike} = C_{Bike} + B_{Time} \cdot \text{Bike Time}$$

$$V_{Walk} = C_{Walk} + B_{Time} \cdot \text{Walk Time} + B_{IntDensity} \cdot O_{IntersectionDensity}$$

$$V_{SB} = B_{Time} \cdot \text{Highway Skim} + B_{IntDensity} \cdot O_{IntersectionDensity}$$

Coefficient	Estimate	t-statistic
C_DA	-0.8464	-0.98
C_SR	2.2315	10.72
C_Walk	2.6625	7.15
C_Bike	-0.2692	0.08
B_Time	-0.0472	-5.44
B_IntDensity	0.0033	1.62
Theta (Non-Auto)	0.8584	-0.31
Rho_bar_squared	0.3263	

NHBW Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot Highway\ Skim + B_{RSEDensity} \cdot O_{RSEDensity}$$

$$V_{SR} = C_{SR} + B_{Time} \cdot Highway\ HOV\ Skim$$

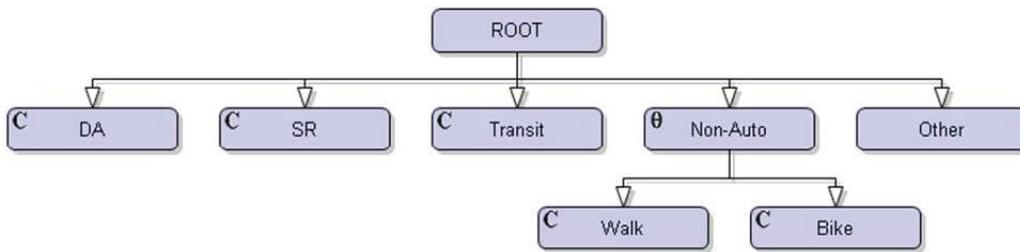
$$V_{Bike} = C_{Bike} + B_{Time} \cdot Bike\ Time$$

$$V_{Walk} = C_{Walk} + B_{Time} \cdot Walk\ Time + B_{RSEDensity} \cdot O_{RSEDensity}$$

$$V_{Other} = 0$$

Coefficient	Estimate	t-statistic
C_DA	5.4301	12.43
C_SR	3.9389	8.76
C_Walk	5.8298	8.44
C_Bike	2.5604	4.23
B_Time	-0.0472	-6.20
B_RSE_Density	0.0002	2.99
Theta (Non-Auto)	1	-
Rho_bar_squared	0.4807	

NHBO Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot \text{Highway Skim}$$

$$V_{SR} = C_{SR} + B_{Time} \cdot \text{Highway HOV Skim}$$

$$V_{Transit} = C_{Transit} + B_{Monterey} \cdot \text{Transit Preference Dummy}$$

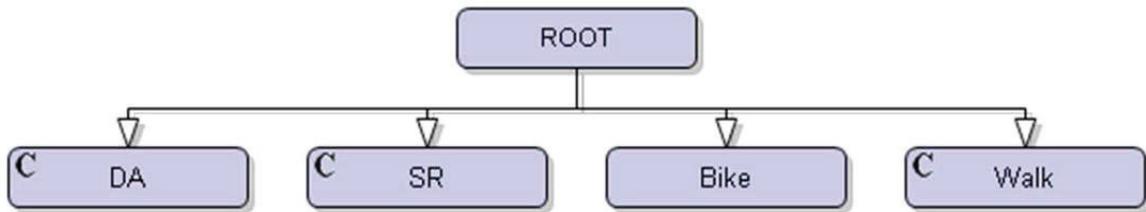
$$V_{Other} = 0$$

$$V_{Bike} = C_{Bike} + B_{Time} \cdot \text{Bike Time} + B_{IntDensity} \cdot O_{IntersectionDensity}$$

$$V_{Walk} = C_{Walk} + B_{Time} \cdot \text{Walk Time} + B_{IntDensity} \cdot O_{IntersectionDensity}$$

Coefficient	Estimate	t-statistic
C_DA	3.2161	16.63
C_SR	3.9514	18.75
C_Walk	4.8027	14.81
C_Bike	0.3893	2.44
C_Transit	2.3039	7.99
B_Time	-0.0757	-11.99
B_IntDensity	0.0051	5.29
B_Monterey	-1.3	n/a
Theta (Non-Auto)	0.8839	-0.84
Rho_bar_squared	0.3401	

HBUniv Model Structure



$$V_{DA} = C_{DA} + B_{Time} \cdot \text{Highway Skim}$$

$$V_{SR} = C_{SR} + B_{Time} \cdot \text{Highway HOV Skim}$$

$$V_{Bike} = C_{Bike} + B_{Time} \cdot \text{Bike Time} + B_{IntDensity} \cdot O_{IntersectionDensity}$$

$$V_{Walk} = C_{Walk} + B_{Time} \cdot \text{Walk Time} + B_{IntDensity} \cdot O_{IntersectionDensity}$$

Coefficient	Estimate	t-statistic
C_DA	1.8716	3.36
C_SR	1.1753	1.16
C_Walk	2.5009	2.32
C_Transit	1.4000	n/a*
B_Time	-0.0413	-2.46
B_IntDensity	0.0033	0.46
Rho_bar_squared	0.3386	

*The alternative specific constant for this mode was added to assist in asserting a desired transit mode share since the CHTS contained no records for transit trips for most of the trip purposes.

Re-calibration of constants

In this section, we present an analysis of the observed and modeled mode shares by trip purpose, after adjusting the mode specific constants to better replicate the shares indicated in the household survey.

Peak models

The following table shows the mode shares observed in the survey for peak-period trips:

Observed Peak Mode Shares by Trip Purpose

	Drive Alone	Shared Ride	Walk	Bicycle	Transit	School Bus	Other	TOTAL
HBW	76.4	16.7	3.6	3.3	0.0	0.0	0.0	100.0
HBSshop	45.0	44.7	8.7	1.3	0.3	0.0	0.0	100.0
HBSchool	2.6	65.6	19.9	2.5	0.0	9.3	0.0	100.0
HBUniv	58.1	31.2	6.9	3.8	0.0	0.0	0.0	100.0
HBOther	28.7	51.7	15.1	4.0	0.0	0.0	0.5	100.0
NHBW	72.4	14.8	9.4	1.6	0.0	0.0	1.8	100.0
NHBO	24.0	50.7	11.9	1.1	8.0	0.0	4.3	100.0

The corresponding shares from the AMBAG model are presented below, showing an accurate replication of the survey data:

Modeled Peak Mode Shares by Trip Purpose

	Drive Alone	Shared Ride	Walk	Bicycle	Transit	School Bus	Other	TOTAL
HBW	76.4	14.6	3.9	4.0	1.1	0.0	0.0	100.0
HBSshop	45.5	46.5	5.4	2.2	0.4	0.0	0.0	100.0
HBSchool	3.2	69.2	15.7	2.3	0.0	9.7	0.0	100.0
HBUniv	46.4	23.1	6.2	3.8	20.3	0.0	0.0	100.0
HBOther	27.8	54.0	13.2	4.3	0.0	0.0	0.7	100.0
NHBW	73.7	13.1	11.0	1.5	0.0	0.0	0.6	100.0
NHBO	25.1	52.3	12.0	0.8	6.9	0.0	2.9	100.0

Off-peak models

The following table shows the mode shares observed in the survey for off-peak-period trips:

Observed Off-peak Mode Shares by Trip Purpose

	Drive Alone	Shared Ride	Walk	Bicycle	Transit	School Bus	Other	TOTAL
HBW	75.4	17.3	4.4	3.0	0.0	0.0	0.0	100.0
HBShop	43.7	47.1	6.5	2.2	0.5	0.0	0.0	100.0
HBSchool	3.2	50.6	35.5	3.5	0.0	7.2	0.0	100.0
HBUniv	67.4	22.8	5.9	3.9	0.0	0.0	0.0	100.0
HBOther	31.9	48.9	15.6	3.0	0.0	0.0	0.5	100.0
NHBW	71.8	13.2	12.2	2.5	0.0	0.0	0.3	100.0
NHBO	25.5	53.4	13.0	1.2	4.7	0.0	2.2	100.0

The corresponding shares from the AMBAG model are presented below, showing an accurate replication of the survey data:

Modeled Off-peak Mode Shares by Trip Purpose

	Drive Alone	Shared Ride	Walk	Bicycle	Transit	School Bus	Other	TOTAL
HBW	77.0	14.2	3.8	4.2	0.9	0.0	0.0	100.0
HBShop	43.7	48.1	6.4	1.3	0.5	0.0	0.0	100.0
HBSchool	3.7	64.3	18.4	3.5	0.0	10.0	0.0	100.0
HBUniv	54.4	16.9	5.4	4.1	19.2	0.0	0.0	100.0
HBOther	31.3	50.7	14.6	2.7	0.0	0.0	0.8	100.0
NHBW	69.5	11.1	16.7	2.1	0.0	0.0	0.6	100.0
NHBO	24.1	55.4	12.3	1.0	4.8	0.0	2.5	100.0

*The mode choice model was adjusted to yield observed ridership shares not represented in the survey. For HBUniv trips, the output shares were adjusted using guidance from a 2012 Santa Cruz METRO on-board travel survey. For HBW trips, the regional target transit share was assumed to be in the vicinity of 1%.

Time of Day Analysis

The PA to OD and time-of-day steps convert the peak and off-peak production-attraction matrices from mode split into four time periods: AM, PM, Mid-day, and Evening/Night. Together, the four time periods make up the 24 hours of the day. The four periods are as follows:

Time Period	Hours
AM	6am-9am
Mid-Day	9am-4pm
PM	4pm-7pm
Evening/Night	7pm-6am

Departure and return percentages were estimated for each time period from the 2010 CHTS. The estimated percentages are shown below:

Time Period	AM	Mid-Day	PM	Evening/Night
Hours	6am-9am	9am-4pm	4pm-7pm	7pm-6am
HBW Depart%	46.9	31.9	3.1	18.1
HBW Return%	1.6	33.2	48.4	16.8
HBSshop Depart %	10.8	46.9	39.2	3.1
HBSshop Return %	2.6	36.4	47.4	13.6
HBSchool Depart %	49.4	50.0	0.6	0.0
HBSchool Return %	0.0	49.4	50.0	0.6
HBUniv Depart %	37.6	48.4	12.4	1.6
HBUniv Return %	0.0	31.7	50.0	18.3
HBOther Depart %	29.4	42.1	20.6	7.9
HBOther Return %	11.4	31.8	38.6	18.2
NHBW Depart %	5.5	46.4	44.5	3.6
NHBW Return %	42.3	48.3	7.7	1.7
NHBO Depart %	18.5	42.4	31.5	7.6
NHBO Return %	18.5	42.4	31.5	7.6
IXXI Depart %	24.4	45.7	15.2	14.7
IXXI Return %	13.4	48.9	21.4	16.3

Time Period	AM	Mid-Day	PM	Evening/Night
Visitor (both) Depart %*	29.8	43.3	20.2	6.7
Visitor (both) Return %*	11.2	31.3	38.8	18.7
Light Truck Depart %*	8.6	25.8	8.1	7.6
Light Truck Return %*	8.6	25.8	8.1	7.6
Medium Truck Depart %*	7.1	22.8	9.9	10.1
Medium Truck Return %*	7.1	22.8	9.9	10.1
Heavy Truck Depart %*	5.8	17.0	7.3	19.9
Heavy Truck Return %*	5.8	17.0	7.3	19.9

* Not estimated from the CHTS since no survey records exist for these trip types.

In addition to applying the percentages, the person trips are converted into vehicle trips. For the drive alone model, there is a one-to-one correspondence between person trips and vehicle trips. For the Shared Ride (SR) mode, average auto occupancy rates were estimated by trip purpose from the 2010 CHTS survey. These rates were applied to the SR trips to convert the person trip matrices into vehicle trip matrices. The occupancy rates are listed below:

Trip Purpose	Occupancy Factor
HBW	2.35
HBSshop	2.49
HBSchool	2.6
HBUniv	2.25
HBOther	2.6
NHBW	2.25
NHBO	2.73
Visitor	3.25

After the daily and hourly OD trips are estimated, external to external trips are estimated and added to each trip matrix to create the final matrix. The external trips from and to San Luis Obispo and Santa Clara counties were derived from the 2010 External Station Survey.

The following table lists the total vehicle OD trips estimated by the model by time period.

Time Period	DA Vehicle Trips	SR Vehicle Trips	Truck Trips	Total Vehicle Trips	% of Total
AM (6:00-9:00 AM)	170,669	80,519	9,411	260,599	16.8%
Mid-Day (9:00 -4:00 PM)	447,981	239,929	26,786	714,696	45.9%
PM (4:00-7:00 PM)	235,825	119,220	11,199	366,244	23.5%
Night (7:00 PM-6:00 AM)	130,042	69,453	14,347	213,842	13.7%
Total	984,518	509,120	61,743	1,555,380	100.0%

The estimated transit trips are shown below:

Period	Transit Trips
Peak	18,363
Off-peak	22,622
Total	40,985

The estimated all-day walk and bike OD trips are shown below:

Mode	Trips
Bike	58,462
Walk	267,991
Total	326,453

Truck Model

A simplified truck model was inserted into the model stream to estimate Internal-to-Internal truck trips. IX truck trips and XX truck trips are already factored into the model since the IX and XX trips are based on external station traffic counts that include truck trips. The truck model is based on The Southern California Association of Government's 2003 truck model, which estimates truck trip rates based upon employment variables. The original SCAG truck trip rates are shown below:

Category	Daily Truck Trip Rates		
	Light Trucks	Medium Trucks	Heavy Trucks
Households	0.0390	0.0087	0.0023
Ag/Min/Construction	0.0513	0.0836	0.0569
Retail	0.0605	0.0962	0.0359
Government	0.0080	0.0022	0.0430
Manufacturing	0.0353	0.0575	0.0391
Transportation/Utility	0.2043	0.0457	0.1578
Wholesale	0.0393	0.0650	0.0633
Other	0.0091	0.0141	0.0030

The employment categories were re-categorized into the AMBAG employment categories, and the trip rates were then re-estimated based upon the AMBAG employment categories:

Employment Type	Daily Truck Trip Rates		
	Light Trucks	Medium Trucks	Heavy Trucks
Households	0.0147	0.0046	0.0072
Agriculture	0.0804	0.0778	0.0715
Service	0.01662	0.019273	0.029718
Retail	0.073594	0.075022	0.087873
Public	0.0296	0.015	0.0148
Industrial	0.0613	0.0655	0.0924

Truck trip generation, distribution, and time-of-day models were added to the model stream. The truck distribution model utilized a Gravity Model with separate friction factor curve definitions for light, medium, and heavy trucks

The friction factors are calculated using a generalized cost formulation that considers operating cost per hour (dollars), fuel efficiency (miles per gallon), operating cost per distance (dollars), and fuel price (dollars per gallon) :

The following are the values used in the model:

Cost	Truck Classification		
	Light Trucks	Medium Trucks	Heavy Trucks
Variable			
Cost per hour (\$)	13.84	19.21	19.21
Fuel Efficiency (mpg)	8.5	7	6
Cost per mile (\$)	0.14	0.23	0.26
Fuel Price (\$/gallon)	3.13	3.15	3.15

To calculate the generalized cost, a zone to zone travel time matrix and distance skim are applied in the following equation:

$$\text{generalized cost}_{ij} = \text{Cost per Hour (\$/hour)} * \text{Time}_{ij} \text{ (min)} / 60 + \text{Fuel Price (\$/gallon)} / \text{Fuel Efficiency (miles/gallon)} + \text{Cost Per Mile (\$/mi)} + \text{Distance}_{ij} \text{ (miles)}$$

Once the generalized costs is calculated, the friction factors are derived using an exponential function. The function applied is:

$$\text{friction factor} = e^{(a-c*\text{generalized cost}_{ij})}$$

The values of c vary by truck type and are as follows:

Truck Type	a	c
Light Truck	2.0	0.095
Medium Truck	4.0	0.055
Heavy Truck	5.0	0.045

The truck time-of-day diurnal factors are shown below:

Time Period	AM	Mid-day	PM	Evening
Hours	6am-9am	9am-4pm	4pm-7pm	7pm-6am
Light Truck Depart %	8.6	25.8	8.1	7.6
Light Truck Return %	8.6	25.8	8.1	7.6
Medium Truck Depart %	7.1	22.8	9.9	10.1
Medium Truck Return %	7.1	22.8	9.9	10.1
Heavy Truck Depart %	5.8	17.0	7.3	19.9
Heavy Truck Return %	5.8	17.0	7.3	19.9

The estimated truck trips by time period is listed in the table below:

Time Period	Truck Vehicle Trips
AM (3 hr)	9,411
Mid-Day (7 hr)	26,786
PM (3 hr)	11,199
Night/Evening (11 hr)	14,347
Total	61,743

Trip Assignment

Highway Assignment

In the highway assignment step, trips from the OD matrix are assigned to the network to determine flows on links and route choices between any origin and destination. In the AMBAG RTDM, four assignments are performed: AM peak (6:00-9:00 AM), PM Peak (4:00-7:00PM), Mid-day (9:00AM-4:00PM), and Evening/Night (4:00PM - 6:00AM). The Bi-Conjugate User Equilibrium (BFW) method is used for each of these assignments. The objective of any User Equilibrium-based model is to attempt to assign the flow in such a manner to find a solution where no user can improve his or her travel time from their origin to destination by choosing a different path. We also experimented with other assignment algorithms, including Origin User Equilibrium, which yielded similar results as BFW. BFW was ultimately chosen over OUE to harness the benefits of multi-threading since the desired convergence was attained using either algorithm.

The User Equilibrium method begins by assigning all trips to the shortest routes based upon free flow travel time. Based on the volume assigned to each link, a congested travel time is estimated based on the follow delay function:

$$TIME = FFTIME * \left[1 + \alpha \left(\frac{Volume}{Capacity} \right)^\beta \right]$$

Where:

<i>TIME</i>	= Estimated congested time
<i>FFTIME</i>	= Free-flow travel time
<i>α</i>	= Parameter, usually between 0.1 and 2
<i>β</i>	= Parameter, usually between 3 and 10
<i>Volume</i>	= Assigned volume on link
<i>Capacity</i>	= Estimated capacity of link

Using the congested time, alternate paths are sought and flow is moved from one path to another until the User Equilibrium solution is approximated as measured by the relative gap. The model is run to either a maximum of 250 iterations per assignment period or a relative gap of 1e-4, whichever is achieved first. Most assignments for AMBAG converge in about 60-100 iterations in the most congested time periods (AM and PM Peak periods).

Model Performance

The following model performance criteria were used to calibrate the model:

- Graphically display a scatter-gram of model daily volumes versus average annual daily traffic (AADT). The volumes should be in line with the AADT, with few outliers.

- Match Vehicle Miles Travelled (VMT) with Highway Performance Monitoring Study (HPMS) VMT estimates.
- Calculate the correlation and R^2 between model volumes and counts. R^2 values should be greater than 0.88.
- Compare model flows versus counts by functional class and volume group type. Model volumes should be within certain standard percentage ranges of counts within the groupings.
- Compute Root Mean Square Error (RMSE) between volumes and counts. Volumes should be within certain stand RMSE values within the groupings.

The results presented below are based on daily flows which are calculated by summing the results of the period assignments and then compared against ADT or AADT, whichever is available for the count location.

Model VMT and VHT by Functional Class: Base Year

Link Type	Segments	VMT	VHT	%VMT	%VHT
Freeways	243	3,346,901	65,451	21.6%	16.7%
Major Arterials	1,350	7,333,351	163,682	47.4%	41.8%
Minor Arterials	1,983	2,019,639	60,399	13.1%	15.4%
Major Collectors	2,846	763,873	25,913	4.9%	6.6%
Minor Collectors	345	169,158	5,393	1.1%	1.4%
Local Roads	16,697	655,442	25,570	4.2%	6.5%
Ramps	406	309,908	10,333	2.0%	2.6%
Centroid Connectors	3,240	872,523	34,902	5.6%	8.9%
TOTAL (ALL LINKS)	27,149	15,470,794	391,643	100.0%	100.0%

Three other aggregate statistics were also calculated when comparing the daily counts versus flows: correlation, coefficient of determination, or R^2 , and the calculation of Percent Root Mean Square Error.

The correlation between daily counts and flows was 0.95. A value of 1 represents a perfect fit.

The r^2 value between daily counts and flows was 0.95. A good rule of thumb is that this value should be greater than 0.88 when conducting a region-wide comparison.

The equation of Percent Root Mean Square Error (%RMSE) is as follows:

$$\%RMSE = \frac{\sqrt{\sum_j (Model_j - Count_j)^2 / \text{Numberofcounts}}}{(\sum_j Count_j / \text{Numberofcounts})} * 100$$

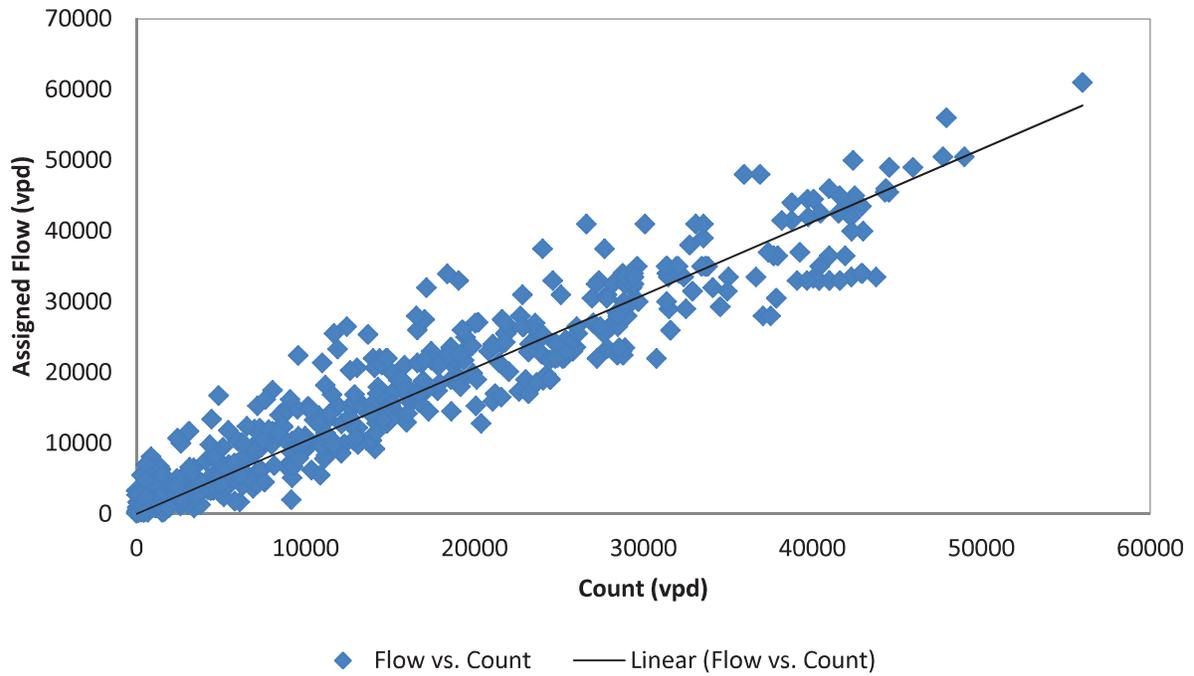
Daily Model Volumes vs. Counts, %RMSE by Functional Class

Link Type	Segments	Total Count	Total Flow	Percent Difference	%RMSE
Freeways	96	3,139,600	3,292,936	4.88	17.92
Major Arterials	341	4,602,649	4,461,467	-3.07	20.96
Minor Arterials	261	1,207,346	1,003,195	-16.91	43.85
Major Collectors	146	394,321	239,764	-39.20	63.41
Minor Collectors	46	60,580	37,098	-38.76	72.56
Local Roads	104	130,338	85,053	-34.74	66.48
Ramps	20	84,688	98,735	16.59	44.66
All Counts	1,026	9,728,319	9,322,334	-4.17	28.95

Daily Model Volumes vs. Counts, %RMSE by Volume Group:

Volume Group	Segments	Total Count	Total Flow	Percent Difference	%RMSE
ALL	1,026	9,728,319	9,322,334	-4.17	28.95
[0, 500)	80	22,749	20,933	-7.98	87.26
[500, 1500)	160	174,356	138,848	-20.37	89.21
[1500, 2500)	100	188,445	113,200	-39.93	59.06
[2500, 3500)	81	239,267	196,087	-18.05	52.73
[3500, 4500)	45	179,746	169,134	-5.90	45.18
[4500, 5500)	50	251,233	208,127	-17.16	36.70
[5500, 7000)	65	401,750	351,671	-12.47	32.75
[7000, 8500)	74	569,960	480,912	-15.62	31.81
[8500, 10000)	59	555,357	562,651	1.31	24.16
[10000, 12500)	99	1,108,239	1,028,284	-7.21	25.69
[12500, 15000)	49	658,404	600,155	-8.85	23.71
[15000, 17500)	36	575,080	532,267	-7.44	24.10
[17500, 20000)	22	399,500	426,327	6.72	16.80
[20000, 25000)	35	782,700	780,100	-0.33	20.43
[25000, 35000)	72	2,156,500	2,232,506	3.52	19.00

Relationship of count to assigned flow for the daily flows, illustrating a correlation coefficient of 0.95



Transit Assignment

For transit assignment, the model uses TransCAD's Pathfinder method, the same method used for transit skimming. In the Pathfinder method, generalized cost is minimized. Generalized cost is computed using weighted values of in-vehicle, access, egress, transfer, dwelling, and waiting times and other costs such as transfer penalty costs and fares. Pathfinder also performs route combinations, which reduces effective initial waiting times and assigns trips based upon the relative frequencies of the routes combined. Routes are combined if they serve the same origin-destination pair and if their travel times are relatively close to each other. The transit assignment utilizes existing park and ride facilities, and includes the capability to add additional sites for any scenario.

Peak and off-peak transit trips are assigned separately. A post-process routine aggregates these four assignments into a total transit flow table.

Total Base Year Estimated Model Ridership

Transit Agency	Peak Boardings	Off-Peak Boardings	Total Boardings
Monterey-Salinas Transit (MST)	6,529	7,801	14,330
San Benito Express	555	642	1,198
Santa Cruz Metro	9,843	12,030	21,873
Total	16,928	20,474	37,402

Feedback

After the end of the highway assignment step, the congested travel times are used to update the input travel times into the both the highway and transit networks. Both the highway and transit skimming routines then use these congested times to produce congested highway and transit skim matrices. The logic of feedback is that the congested times are a more accurate measure of travel time than the initial free flow times, and can have a profound effect on the trip distribution and mode choice stages steps. During the feedback process, all models following the skimming stage are run again until an updated set of congested times is found following the highway assignment. This loop continues until a set number of feedback iterations are completed. The Multiple Successive Averages (MSA) method is used to calculate the congested time resulting from each feedback iteration. A total of 5 feedback loops are performed in the AMBAG RTDM. Five loops were found to be sufficient to ensure stability in the final solution. Due to the peak period definitions and the high variance in flow at the start of the peak and the remaining hours, skims for the peak period utilized AM skims derived from the hours 7-9AM. The assignment results are reported for all three hours of this period, however. Mid-day skims are used for the off-peak periods, utilizing a four hour capacity.

AMBAG Model Sensitivity Tests

To evaluate the sensitivity of the AMBAG mode, the following tests were performed:

- Add capacity to a roadway facility
- Modify land use
- Add BRT and LRT service

Summary of Tests

Based on the tests conducted, the model is sensitive to some changes while not sensitive to others. For those where the model is not sensitive, a discussion of potential enhancements or post-processing methods is included in the appropriate section below. TDM, Transportation Systems Management (TSM), and active transportation were not evaluated in the travel model since there are no variables or sub-models for their implementation. Recommendations for off-model adjustments are described rather than results of testing. Details on each of the tests are contained in the following sections.

Added Roadway Capacity

The model is appropriately sensitive during traffic assignment for roadway widening projects in terms of route selection. The influence of roadway capacity on trip generation, distribution, mode choice, and GHG were not evaluated.

Modified Land Use

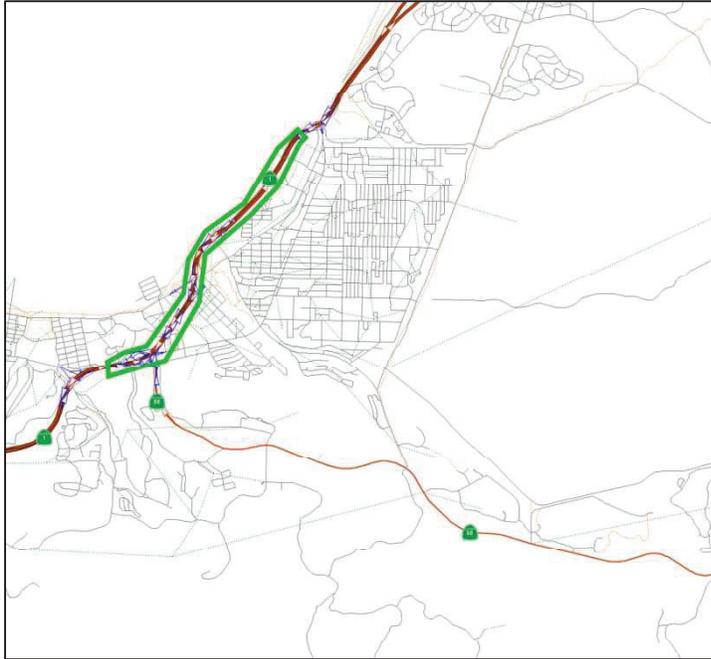
The changes in land use and the formulation of the mode choice model were not significant enough to cause a change in mode. As a result, the implication of the land use change on VMT is determined by the location and magnitude of the land use rather than the density, diversity, and other D factors. Post-processing for active transportation (bike facilities, walking paths, etc), Travel Demand Management (TDM,) and density are recommended.

Added New Transit Service

The model is not sensitive to changes in transit. The mode choice model estimation based on survey data resulted in a fairly static mode split model. As such, the change to transit shifted trips from local bus to BRT or LRT, but overall mode shares remained constant. Although these tests were conducted in isolation to determine model sensitivity, it is recommended that scenarios be developed to maximize the sensitivity by incorporating multiple strategies cohesively. For example, additional infill or density should be accompanied with enhanced transit service along the route, and stops should be placed within walking distance.

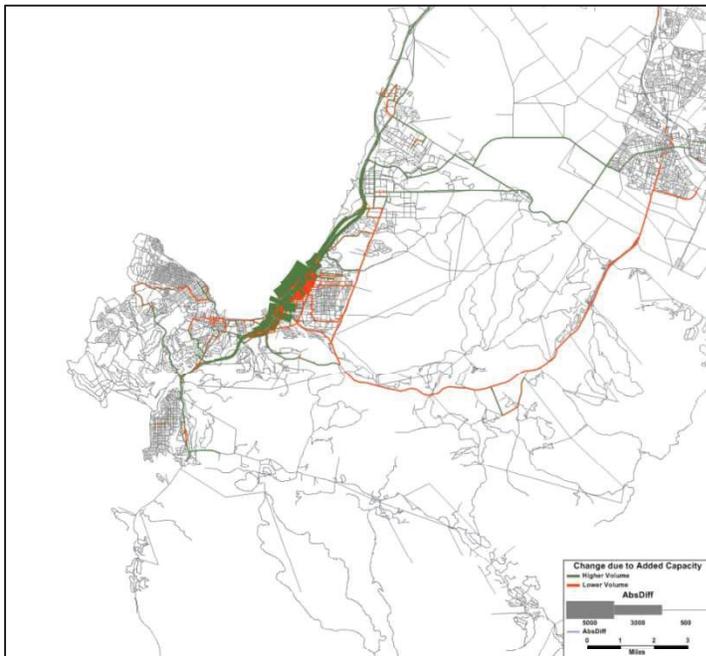
Added Roadway Capacity

CA 1 Widening: 4 to 6 lanes



CA 1 was widened within the area highlighted in green. The associated capacity per lane, speed, etc were automatically updated based on the lookup table by facility type and number of lanes.

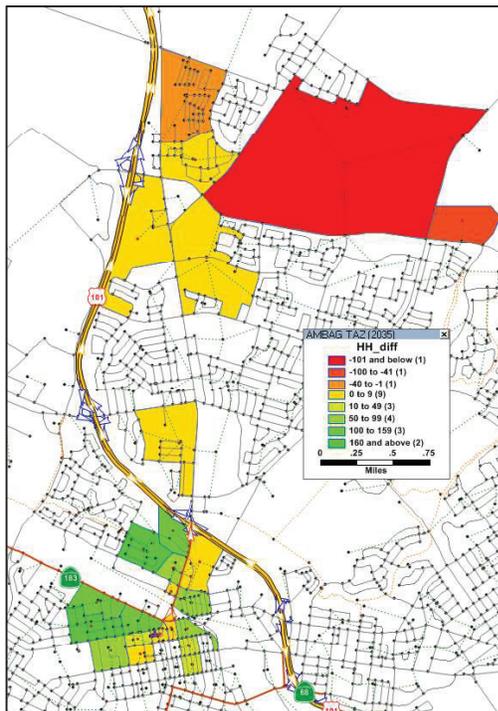
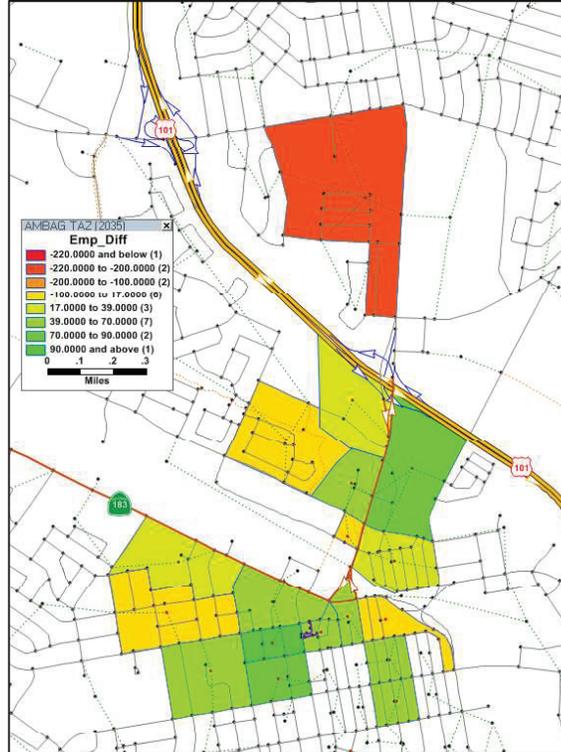
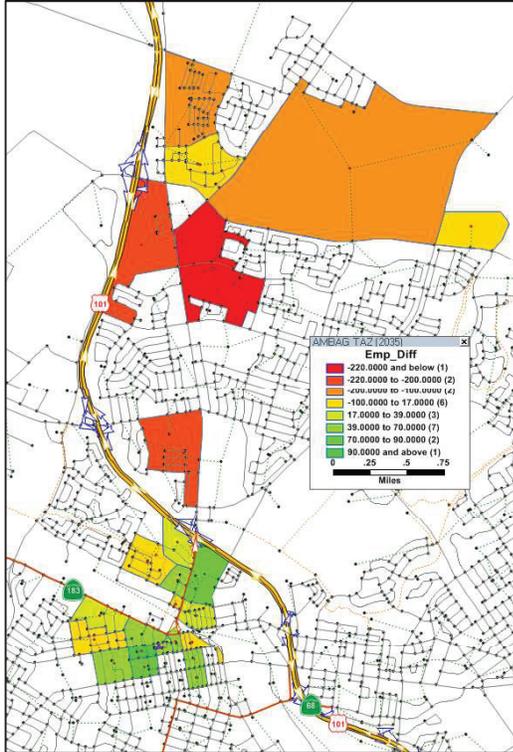
Area of Influence



The magnitude, direction, and area of influence for the widening is appropriately sensitive for traffic assignment. Distribution and mode choice were not investigated since the widening was limited and few alternatives are available in the corridor.

Modified Land Use

Land Use Change 1: Salinas Infill



Employment changes by TAZ in the Salinas area are shown above.

Residential changes are shown to the left.

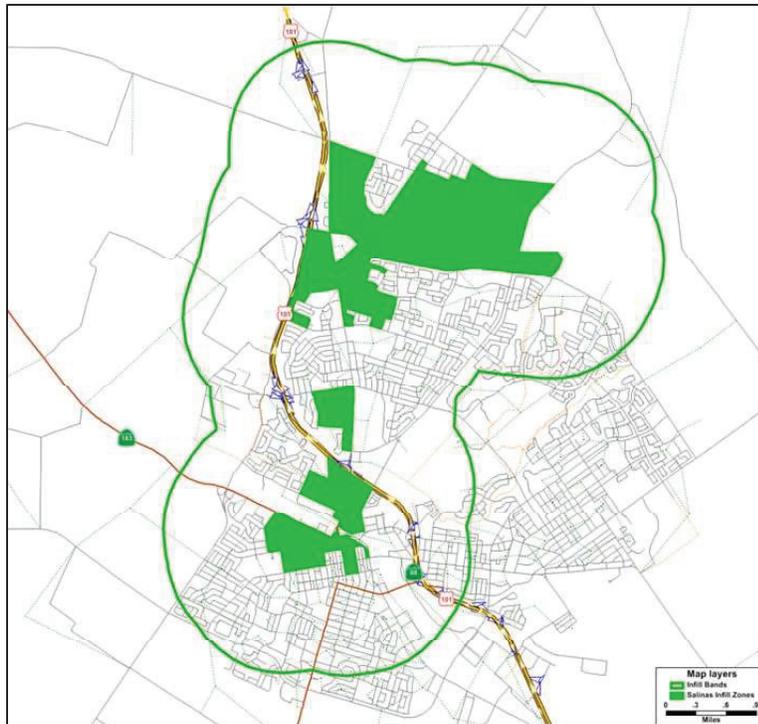
For the Salinas Infill scenario, land use in the northern areas (orange and red) was moved to the downtown area (yellow and green), west of 101. The land use changes kept the same regional control total roughly identical.

The intent was to allow more interaction with existing land use and transit, with a final outcome of reducing VMT.

Resulting VMT for Salinas Infill and AMBAG Region

When planning for an SCS, the VMT associated with development opportunity areas and the areas without much change are both important for regional VMT. The table below shows the VMT for the Salinas Infill influence area and the entire AMBAG region, with and without the land use changes. With the Salinas Infill changes, the VMT in the influence area is reduced by 1.19%, and the regional VMT increases by 0.04%. Within the influence area the trips are shorter and have other options than driving, but the interaction with land uses outside of Salinas and congestion in the downtown area caused an overall increase in VMT for the region.

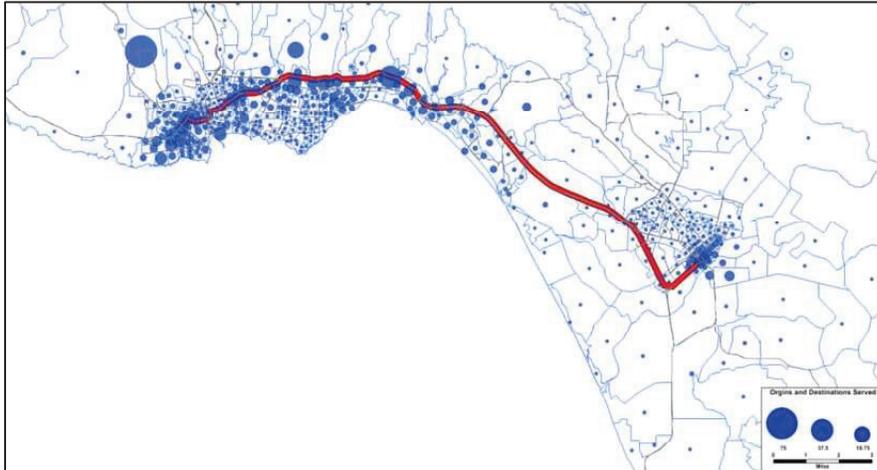
Region	VMT within Salinas Infill	VMT with Salinas Infill	Percent Difference
Salinas Infill Influence Area	203,640	201,220	-1.19%
Entire AMBAG Area	4,703,250	4,705,170	+0.04%



Salinas Infill zones and influence area are shown in green to the left.

Added New Transit Service

BRT: Add BRT in a congested corridor



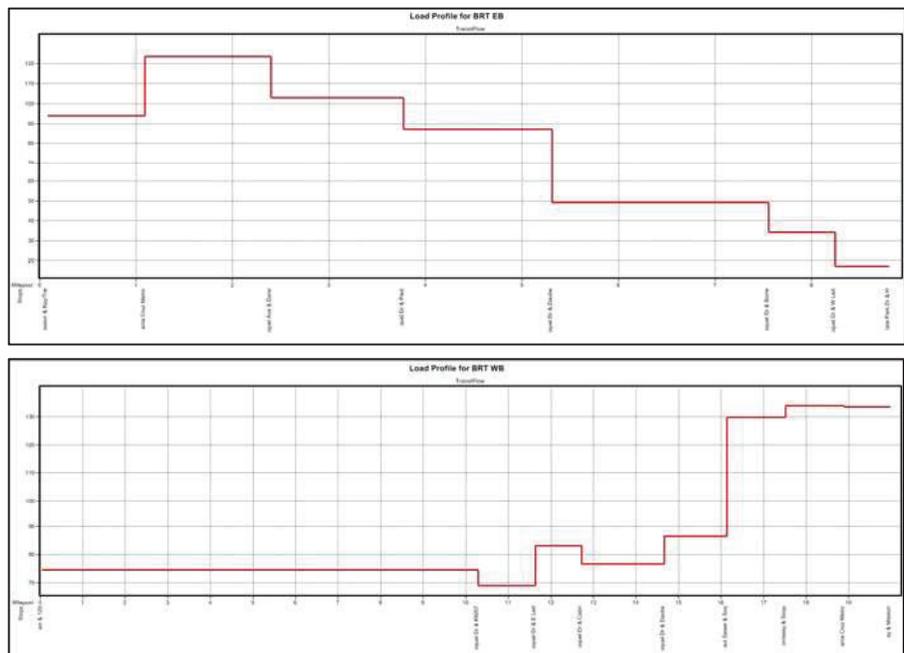
The red line shown in the graphic to the left represents the new BRT, and the blue circles represent the location and magnitude of origins and destinations accessible to the BRT route.

Ridership and Load Profile

The table below shows the ridership for transit within the entire model area and within a 5 mile buffer of the expanded service. Due to the mode choice model estimation, the ridership on transit in the corridor is roughly constant, and shifts from local bus to the more attractive BRT line.

Region	Riders without BRT	Riders with BRT	Percent Difference
BRT 5 mile buffer	9,469	9,465	-0.05%
Entire AMBAG Area	40,669	40,764	0.23%

The BRT load profile for eastbound and westbound to the right show where load changes due to riders boarding/alighting. As expected, the load is highest in the urban area and is lower in the rural area.



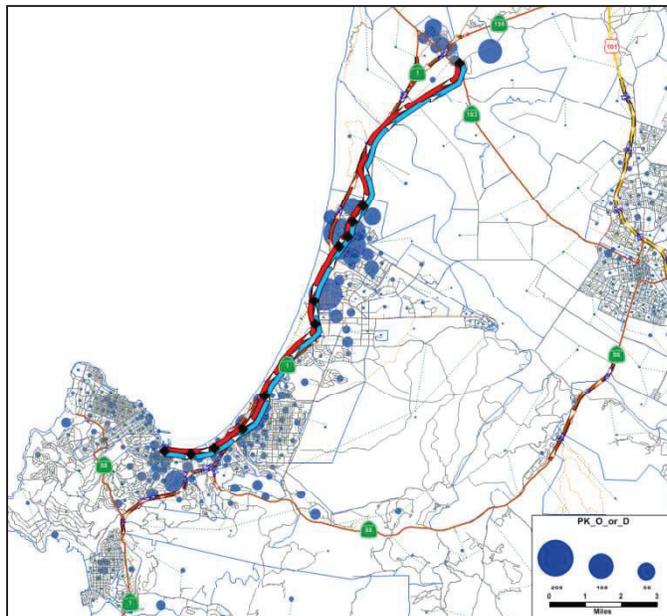
Mode Share

The ridership and load profile shown above results in mode shares for the entire AMBAG region and within the area of influence as shown in the tables below.

Mode Shares for Entire AMBAG Region

Mode	Mode Share without BRT	Mode Share with BRT	Percent Difference
Transit	1.53%	1.56%	2.95%
Drive Alone	43.25%	42.89%	-0.03%
Shared Ride	41.76%	41.40%	-0.05%
Walk	10.56%	11.26%	7.49%
Bike	2.89%	2.90%	0.98%

LRT: Add LRT in a congested corridor



The alignment for the LRT is shown in the image to the left, with blue line for northbound and red for southbound, and the blue circles represent the location and magnitude of origins and destinations accessible to the LRT line.

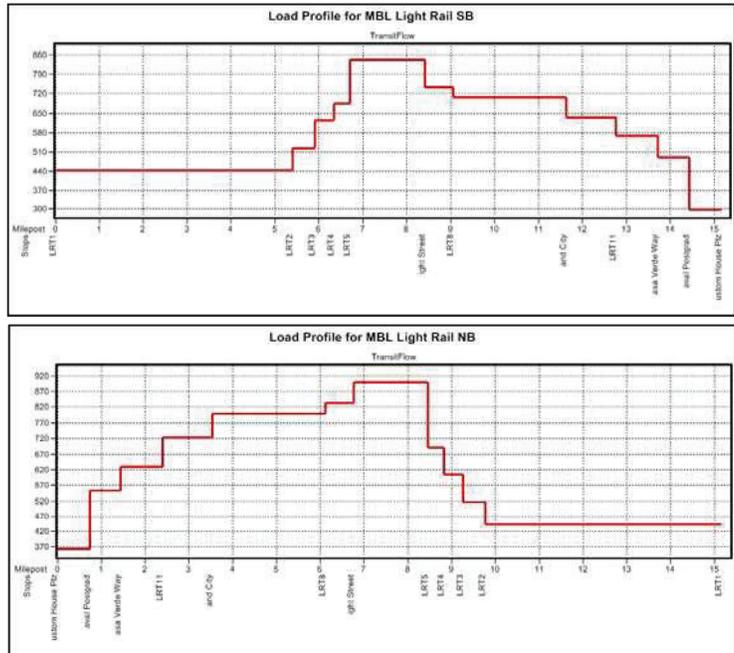
The table below shows the ridership for transit within the entire model area and within a 5 mile buffer of the expanded service. Due to the exclusive right of way, short headway, and overall attractiveness, the LRT ridership is high and pulls from competing bus routes but also adds roughly 800 passengers within the corridor, about 20% increase in transit riders in the corridor after the

addition of LRT.

Ridership and Load Profile

Region	Riders without LRT	Riders with LRT	Percent Difference
LRT 5 mile buffer	4,126	4,916	19.15%
Entire AMBAG Area	40,669	41,680	2.49%

The LRT load profile for northbound and southbound are to the right. The load quickly builds, remains at a high level for a majority of the route, and then quickly drops off. This suggests that land use at each stop has an opportunity for more mix of uses rather than the primarily housing focus on the south and jobs focus on the north.



Mode Share

The ridership and load profile shown above results in mode shares for the entire AMBAG region and within the area of influence as shown in the tables below.

Mode Shares for Entire AMBAG Region

Mode	Mode Share without LRT	Mode Share with LRT	Percent Difference
Transit	1.53%	1.57%	2.96%
Drive Alone	43.25%	43.20%	-0.03%
Shared Ride	41.76%	41.00%	-1.72%
Walk	10.56%	11.34%	7.49%
Bike	2.89%	2.89%	-0.09%