



INSTRUCTIONS FOR CONTRACTOR

DO NOT ATTACH TO CONTRACT

**Your contract *MUST* include the following information,
or it will not be signed by the City.**

- Check one box at top of Page 1 for the type of business entity.
- Sections 3 & 4 will be completed by the City and should be complete before you sign.
- Put a name in Sec. 7.A. – person responsible for administering the contract.
- Affirmative Action:** Check the appropriate box in Sec. 13.B., Article IV and complete the appropriate online form for the box you have checked:

All contractors:

Access the online forms for Affirmative Action compliance at this link: www.cityofmadison.com/civil-rights/contract-compliance/vendors-suppliers/forms. If you do not already have an approved, current Affirmative Action Plan on file with the City of Madison, read the “*Instructions for Completing City of Madison Affirmative Action Plan*” at the above link. This will direct you to register for an account. If you already have an account you may click on the link for “*Affirmative Action Plan for Vendors and Suppliers*” to proceed. If you have never filed a plan or request for exemption, you must create an account in our online system. If you are exempt under Article IV, Sections C or D you will still need to create an account and go through some steps to confirm your exemption. Register for an account here: <https://elam.cityofmadison.com/citizenaccess>.

Affirmative Action Questions? Contact Dept. of Civil Rights, Contract Compliance: (608) 266-4910.

- Complete Sec. 15 – Official Notices. This is the name/job title/address of the person at your organization to receive legal notices under the contract.
- Signature line. A person with authority to bind the organization should sign, date, and print name and job title where shown on the signature page. Contractor signs first, City signs last.
- Print, sign and return three (3) complete, signed hard copies to the address for the City in Sec. 15 (Notices) unless otherwise instructed. (Under some circumstances, the City will accept a signed, scanned PDF of the entire contract. Please ask if you want to use this method.)
 - Make sure all exhibits/attachments are labeled and attached after the signature page, unless otherwise instructed.
 - Double-sided is OK, but all attachments should begin on a new page.
 - City will sign last, and will send you one hard copy with original signatures unless otherwise agreed.
- Enclose CERTIFICATE OF INSURANCE (C.O.I.) showing proof of insurance required by Sec. 27.

Insurance Instructions:

Certificate Holder: City of Madison
Attn: Risk Manager
210 Martin Luther King Jr. Blvd. Room 406
Madison, WI 53703

Proof of all insurance required in the contract must be shown. Use City's certificate at this link: www.cityofmadison.com/finance/documents/CertInsurance.pdf

Insurance delivery options: (a) enclose hard copy of certificate with hard copies of contract mailed to the address in Section 15 of the contract, or (b) email certificate to City Risk Manager Eric Veum at: eveum@cityofmadison.com and cc: your City contact person on the email. Call Eric Veum at (608) 266-5965 with insurance questions.

Failure to complete these steps will result in contract not being signed.

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City of Madison
CONTRACT FOR PURCHASE OF SERVICES

1. **PARTIES.**

This is a Contract between the City of Madison, Wisconsin, hereafter referred to as the "City" and Cambridge Systematics, Inc. hereafter referred to as "Contractor."

The Contractor is a: Corporation Limited Liability Company General Partnership LLP
(to be completed by contractor) Sole Proprietor Unincorporated Association Other: _____.

2. **PURPOSE.**

The purpose of this Contract is as set forth in Section 3.

3. **SCOPE OF SERVICES AND SCHEDULE OF PAYMENTS.**

Contractor will perform the following services and be paid according to the following schedule(s) or attachment(s):

1. Attachment A - Scope of Services for Regional Travel Model Update
2. Attachment B - Cost Proposal

Order of Precedence: In the event of a conflict between the terms of this Contract for Purchase of Services and the terms of any document attached or incorporated herein, the terms of this Contract for Purchase of Services shall control and supersede any such conflicting term.

4. **TERM AND EFFECTIVE DATE.**

This Contract shall become effective upon execution by the Mayor, (or the Purchasing Agent, if authorized) on behalf of the City of Madison, unless another effective date is specified in the Attachment(s) incorporated in Section 3, however in no case shall work commence before execution by the City of Madison. The term of this Contract shall be through December 31, 2020.

5. **ENTIRE AGREEMENT.**

This Contract for Purchase of Services, including any and all attachments, exhibits and other documents referenced in Section 3 (hereafter, "Agreement" or "Contract") is the entire Agreement of the parties and supersedes any and all oral contracts and negotiations between the parties. If any document referenced in Section 3 includes a statement that expressly or implicitly disclaims the applicability of this Contract for Purchase of Services, or a statement that such other document is the "entire agreement," such statement shall be deemed rejected and shall not apply to this Contract.

6. **ASSIGNABILITY/SUBCONTRACTING.**

Contractor shall not assign or subcontract any interest or obligation under this Contract without the City's prior written approval. All of the services required hereunder will be performed by Contractor and employees of Contractor.

7. **DESIGNATED REPRESENTATIVE.**

- A. Contractor designates Daniel Tempesta as Contract Agent with primary responsibility for the performance of this Contract. In case this Contract Agent is replaced by another for any reason, the Contractor will designate another Contract Agent within seven (7) calendar days of the time the first terminates his or her employment or responsibility using the procedure set forth in Section 15, Notices.
- B. In the event of the death, disability, removal or resignation of the person designated above as the Contract agent, the City may accept another person as the Contract agent or may terminate this Agreement under Section 25, at its option.

8. **PROSECUTION AND PROGRESS.**

- A. Services under this Agreement shall commence upon written order from the City to the Contractor, which order will constitute authorization to proceed; unless another date for commencement is specified elsewhere in this Contract including documents incorporated in Section 3.
- B. The Contractor shall complete the services under this Agreement within the time for completion specified in Section 3, the Scope of Services, including any amendments. The Contractor's services are completed when the City notifies the Contractor in writing that the services are complete and are acceptable. The time for completion shall not be extended because of any delay attributable to the Contractor, but it may be extended by the City in the event of a delay attributable to the City, or in the event of unavoidable delay caused by war, insurrection, natural disaster, or other unexpected event beyond the control of the Contractor. If at any time the Contractor believes that the time for completion of the work should be extended because of unavoidable delay caused by an unexpected event, or because of a delay attributable to the City, the Contractor shall notify the City as soon as possible, but not later than seven (7) calendar days after such an event. Such notice shall include any justification for an extension of time and shall identify the amount of time claimed to be necessary to complete the work.
- C. Services by the Contractor shall proceed continuously and expeditiously through completion of each phase of the work.
- D. Progress reports documenting the extent of completed services shall be prepared by the Contractor and submitted to the City with each invoice under Section 24 of this Agreement, and at such other times as the City may specify, unless another procedure is specified in Section 3.
- E. The Contractor shall notify the City in writing when the Contractor has determined that the services under this Agreement have been completed. When the City determines that the services are complete and are acceptable, the City will provide written notification to the Contractor, acknowledging formal acceptance of the completed services.

9. **AMENDMENT.**

This Contract shall be binding on the parties hereto, their respective heirs, devisees, and successors, and cannot be varied or waived by any oral representations or promise of any agent or other person of the parties hereto. Any other change in any provision

of this Contract may only be made by a written amendment, signed by the duly authorized agent or agents who executed this Contract.

10. **EXTRA SERVICES.**

The City may require the Contractor to perform extra services or decreased services, according to the procedure set forth in Section 24. Extra services or decreased services means services which are not different in kind or nature from the services called for in the Scope of Services, Section 3, but which may increase or decrease the quantity and kind of labor or materials or expense of performing the services. Extra services may not increase the total Contract price, as set forth in Section 23, unless the Contract is amended as provided in Section 9 above.

11. **NO WAIVER.**

No failure to exercise, and no delay in exercising, any right, power or remedy hereunder on the part of the City or Contractor shall operate as a waiver thereof, nor shall any single or partial exercise of any right, power or remedy preclude any other or further exercise thereof or the exercise of any other right, power or remedy. No express waiver shall affect any event or default other than the event or default specified in such waiver, and any such waiver, to be effective, must be in writing and shall be operative only for the time and to the extent expressly provided by the City or Contractor therein. A waiver of any covenant, term or condition contained herein shall not be construed as a waiver of any subsequent breach of the same covenant, term or condition.

12. **NON-DISCRIMINATION.**

In the performance of work under this Contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, religion, marital status, age, color, sex, handicap, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs or student status. Contractor further agrees not to discriminate against any subcontractor or person who offers to subcontract on this Contract because of race, religion, color, age, disability, sex, sexual orientation, gender identity or national origin.

13. **AFFIRMATIVE ACTION.**

A. The following language applies to all contractors employing fifteen (15) or more employees (MGO 39.02(9)(c):

The Contractor agrees that, within thirty (30) days after the effective date of this Contract, Contractor will provide to the City of Madison Department of Civil Rights (the "Department"), certain workforce utilization statistics, using a form provided by the City.

If the Contract is still in effect, or if the City enters into a new Agreement with the Contractor, within one year after the date on which the form was required to be provided, the Contractor will provide updated workforce information using a second form, also to be furnished by the City. The second form will be submitted to the Department no later than one year after the date on which the first form was required to be provided.

The Contractor further agrees that, for at least twelve (12) months after the effective date of this Contract, it will notify the Department of each of its job openings at facilities in Dane County for which applicants not already employees of the Contractor are to be considered. The notice will include a job description, classification, qualifications, and application procedures and deadlines, shall be provided to the City by the opening date of advertisement and with sufficient time for the City to notify candidates and make a timely referral. The Contractor agrees to interview and consider candidates referred by the Department, or an organization designated by the Department, if the candidate meets the minimum qualification standards established by the Contractor, and if the referral is timely. A referral is timely if it is received by the Contractor on or before the date stated in the notice.

The Department will determine if a contractor is exempt from the above requirements (Sec. 13.A.) at the time the Request for Exemption in 13.B.(2) is made.

B. Articles of Agreement, Request for Exemption, and Release of Payment:

The "ARTICLES OF AGREEMENT" beginning on the following page, apply to all contractors, unless determined to be exempt under the following table and procedures:

NUMBER OF EMPLOYEES	LESS THAN \$50,000 Aggregate Annual Business with the City*	\$50,000 OR MORE Aggregate Annual Business with the City*
14 or less	Exempt**	Exempt**
15 or more	Exempt**	Not Exempt

*As determined by the Finance Director

**As determined by the Department of Civil Rights

(1) **Exempt Status:** In this section, "Exempt" means the Contractor is exempt from the Articles of Agreement in section 13.B.(5) of this Contract and from filing an Affirmative Action plan as required by Section IV of the Articles of Agreement. The Department of Civil Rights ("Department") makes the final determination as to whether a contractor is exempt. If the Contractor is not exempt, sec. 13.B.(5) shall apply and Contractor shall select option A. or B. under Article IV therein and file an Affirmative Action Plan.

(2) **Request for Exemption – Fewer Than 15 Employees:** (MGO 39.02(9)(a)2.) Contractors who believe they are exempt based on number of employees shall submit a Request for Exemption on a form provided by the Department within thirty (30) days of the effective date of this Contract.

(3) **Exemption – Annual Aggregate Business:** (MGO 39.02(9)(a)c.): The Department will determine, at the time this Contract is presented for signature, if the Contractor is exempt because it will have less than \$50,000 in annual aggregate business with the City for the calendar year in which the contract is in effect. CONTRACTORS WITH 15 OR MORE

EMPLOYEES WILL LOSE THIS EXEMPTION AND BECOME SUBJECT TO SEC. 13.B.(5) UPON REACHING \$50,000 OR MORE ANNUAL AGGREGATE BUSINESS WITH THE CITY WITHIN THE CALENDAR YEAR, BEGINNING IN 2019.

(4) Release of Payment: (MGO 39.02(9)(e)1.b.) All non-exempt contractors must have an approved Affirmative Action plan meeting the requirements of Article IV below on file with the Department within thirty (30) days of the effective date of this Contract and prior to release of payment by the City. Contractors that are exempt based on number of employees agree to file a Request for Exemption with the Department within thirty (30) days of the effective date and prior to release of payment by the City.

(5) Articles of Agreement:

ARTICLE I

The Contractor shall take affirmative action in accordance with the provisions of this Contract to insure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin and that the employer shall provide harassment-free work environment for the realization of the potential of each employee. 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 insofar as it is within the control of the Contractor. The Contractor agrees to post in conspicuous places available to employees and applicants notices to be provided by the City setting out the provisions of the nondiscrimination clauses in this Contract.

ARTICLE II

The Contractor shall in all solicitations or advertisements for employees placed by or on behalf of the Contractors state that all qualified or qualifiable applicants will be employed without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin.

ARTICLE III

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining Agreement or other Contract or understanding a notice to be provided by the City advising the labor union or workers representative of the Contractor's equal employment opportunity and affirmative action commitments. Such notices shall be posted in conspicuous places available to employees and applicants for employment.

ARTICLE IV

(This Article applies to non-public works contracts.)

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison (MGO 39.02) including the Contract compliance requirements. The Contractor warrants and certifies that one of the following paragraphs is true (**check one**):

- A. Contractor has prepared and has on file an affirmative action plan that meets the format requirements of Federal Revised Order No. 4, 41 CFR part 60-2, as established by 43 FR 51400 November 3, 1978, including appendices required by City of Madison ordinances or it has prepared and has on file a model affirmative action plan approved by the Madison Common Council.
- B. Within thirty (30) days after the effective date of this Contract, Contractor will complete an affirmative action plan that meets the format requirements of Federal Revised Order No. 4, 41 CFR Part 60-2, as established by 43 FR 51400, November 3, 1978, including appendices required by City of Madison ordinance or within thirty (30) days after the effective date of this Contract, it will complete a model affirmative action plan approved by the Madison Common Council.
- C. Contractor believes it is exempt from filing an affirmative action plan because it has fewer than fifteen (15) employees and has filed, or will file within thirty (30) days after the effective date of this Contract, a form required by the City to confirm exempt status based on number of employees. If the City determines that Contractor is not exempt, the Articles of Agreement will apply.
- D. Contractor believes it is exempt from filing an affirmative action plan because its annual aggregate business with the City for the calendar year in which the contract is in effect is less than fifty thousand dollars (\$50,000), or for another reason listed in MGO 39.02(9)(a)2. If the City determines that Contractor is not exempt, the Articles of Agreement will apply.

ARTICLE V

(This Article applies only to public works contracts.)

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison, including the Contract compliance requirements. The Contractor agrees to submit the model affirmative action plan for public works Contractors in a form approved by the Director of Affirmative Action.

ARTICLE VI

The Contractor will maintain records as required by Section 39.02(9)(f) of the Madison General Ordinances and will provide the City's Department of Affirmative Action with access to such records and to persons who have relevant and necessary information, as provided in Section 39.02(9)(f). The City agrees to keep all such records confidential, except to the extent that public inspection is required by law.

ARTICLE VII

In the event of the Contractor's or subcontractor's failure to comply with the Equal Employment Opportunity and Affirmative Action provisions of this Contract or Sections 39.03 and 39.02 of the Madison General Ordinances, it is agreed that the City at its option may do any or all of the following:

- A. Cancel, terminate or suspend this Contract in whole or in part.
- B. Declare the Contractor ineligible for further City contracts until the Affirmative Action requirements are met.
- C. Recover on behalf of the City from the prime Contractor 0.5 percent of the Contract award price for each week that such party fails or refuses to comply, in the nature of liquidated damages, but not to exceed a total of five percent (5%) of the Contract price, or ten thousand dollars (\$10,000), whichever is less. Under public works contracts, if a subcontractor is in noncompliance, the City may recover liquidated damages from the prime Contractor in the manner described above. The preceding sentence shall not be construed to prohibit a prime Contractor from recovering the amount of such damage from the noncomplying subcontractor.

ARTICLE VIII

(This Article applies to public works contracts only.)

The Contractor shall include the above provisions of this Contract in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor shall take such action with respect to any subcontractor as necessary to enforce such provisions, including sanctions provided for noncompliance.

ARTICLE IX

The Contractor shall allow the maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this Contract. (In federally funded contracts the terms "DBE, MBE, and WBE" shall be substituted for the term "small business" in this Article.)

14. **SEVERABILITY.**

It is mutually agreed that in case any provision of this Contract is determined by any court of law to be unconstitutional, illegal or unenforceable, it is the intention of the parties that all other provisions of this Contract remain in full force and effect.

15. **NOTICES.**

All notices to be given under the terms of this Contract shall be in writing and signed by the person serving the notice and shall be sent registered or certified mail, return receipt requested, postage prepaid, or hand delivered to the addresses of the parties listed below:

FOR THE CITY:

William Schaefer, Transportation Planning Manager

(Department or Division Head)

Madison Area Transportation Planning Board - An MPO

121 S. Pinckney Street, #400, Madison, WI 53703

FOR THE CONTRACTOR:

Daniel Tempesta

Cambridge Systematics, Inc.

115 South LaSalle Street, Suite 2200

Chicago, IL 60603

16. **STATUS OF CONTRACTOR/INDEPENDENT/TAX FILING.**

It is agreed that Contractor is an independent Contractor and not an employee of the City, and that any persons who the Contractor utilizes and provides for services under this Contract are employees of the Contractor and are not employees of the City of Madison.

Contractor shall provide its taxpayer identification number (or social security number) to the Finance Director, 210 Martin Luther King Jr. Blvd, Room 406, Madison, WI 53703, prior to payment. The Contractor is informed that as an independent Contractor, s/he may have a responsibility to make estimated tax returns, file tax returns, and pay income taxes and make social security payments on the amounts received under this Contract and that no amounts will be withheld from payments made to this Contractor for these purposes and that payment of taxes and making social security payments are solely the responsibility and obligation of the Contractor. The Contractor is further informed that s/he may be subject to civil and/or criminal penalties if s/he fails to properly report income and pay taxes and social security taxes on the amount received under this Contract.

17. **GOODWILL.**

Any and all goodwill arising out of this Contract inures solely to the benefit of the City; Contractor waives all claims to benefit of such goodwill.

18. **THIRD PARTY RIGHTS.**

This Contract is intended to be solely between the parties hereto. No part of this Contract shall be construed to add, supplement, amend, abridge or repeal existing rights, benefits or privileges of any third party or parties, including but not limited to employees of either of the parties.

19. **AUDIT AND RETAINING OF DOCUMENTS.**

The Contractor agrees to provide all reports requested by the City including, but not limited to, financial statements and reports, reports and accounting of services rendered, and any other reports or documents requested. Financial and service reports shall be provided according to a schedule (when applicable) to be included in this Contract. Any other reports or documents shall be provided within five (5) working days after the Contractor receives the City's written requests, unless the parties agree in writing on a longer period. Payroll records and any other documents relating to the performance of services under the terms of this Contract shall be retained by the Contractor for a period of three (3) years after completion of all work under this Contract, in order to be available for audit by the City or its designee.

20. **CHOICE OF LAW AND FORUM SELECTION.**

This Contract shall be governed by and construed, interpreted and enforced in accordance with the laws of the State of Wisconsin. The parties agree, for any claim or suit or other dispute relating to this Contract that cannot be mutually resolved, the venue shall be a court of competent jurisdiction within the State of Wisconsin and the parties agree to submit themselves to the jurisdiction of said court, to the exclusion of any other judicial district that may have jurisdiction over such a dispute according to any law.

21. **COMPLIANCE WITH APPLICABLE LAWS.**

The Contractor shall become familiar with, and shall at all times comply with and observe all federal, state, and local laws, ordinances, and regulations which in any manner affect the services or conduct of the Contractor and its agents and employees.

22. **CONFLICT OF INTEREST.**

- A. The Contractor warrants that it and its agents and employees have no public or private interest, and will not acquire directly or indirectly any such interest, which would conflict in any manner with the performance of the services under this Agreement.
- B. The Contractor shall not employ or Contract with any person currently employed by the City for any services included under the provisions of this Agreement.

23. **COMPENSATION.**

It is expressly understood and agreed that in no event will the total compensation under this Contract exceed \$ 309,977 (or \$329,198 if the optional Task 14 of including income as a variable in the models is added).

24. **BASIS FOR PAYMENT.**

A. **GENERAL.**

- (1) The City will pay the Contractor for the completed and accepted services rendered under this Contract on the basis and at the Contract price set forth in Section 23 of this Contract. The City will pay the Contractor for completed and approved "extra services", if any, if such "extra services" are authorized according to the procedure established in this section. The rate of payment for "extra services" shall be the rate established in this Contract. Such payment shall be full compensation for services rendered and for all labor, material, supplies, equipment and incidentals necessary to complete the services.
- (2) The Contractor shall submit invoices, on the form or format approved by the City and as may be further specified in Section 3 of this Contract. The City will pay the Contractor in accordance with the schedule, if any, set forth in Section 3. The final invoice, if applicable, shall be submitted to the City within three months of completion of services under this Agreement.
- (3) Should this Agreement contain more than one service, a separate invoice and a separate final statement shall be submitted for each individual service.
- (4) Payment shall not be construed as City acceptance of unsatisfactory or defective services or improper materials.
- (5) Final payment of any balance due the Contractor will be made upon acceptance by the City of the services under the Agreement and upon receipt by the City of documents required to be returned or to be furnished by the Contractor under this Agreement.
- (6) The City has the equitable right to set off against any sum due and payable to the Contractor under this Agreement, any amount the City determines the Contractor owes the City, whether arising under this Agreement or under any other Agreement or otherwise.
- (7) Compensation in excess of the total Contract price will not be allowed unless authorized by an amendment under Section 9, AMENDMENT.
- (8) The City will not compensate for unsatisfactory performance by the Contractor.

B. **SERVICE ORDERS, EXTRA SERVICE, OR DECREASED SERVICE.**

- (1) Written orders regarding the services, including extra services or decreased services, will be given by the City, using the procedure set forth in Section 15, NOTICES.
- (2) The City may, by written order, request extra services or decreased services, as defined in Section 10 of this Contract. Unless the Contractor believes the extra services entitle it to extra compensation or additional time, the Contractor shall proceed to furnish the necessary labor, materials, and professional services to complete the services within the time limits specified in the Scope of Services, Section 3 of this Agreement, including any amendments under Section 9 of this Agreement.
- (3) If in the Contractor's opinion the order for extra service would entitle it to extra compensation or extra time, or both, the Contractor shall not proceed to carry out the extra service, but shall notify the City, pursuant to Section 15 of this Agreement. The notification shall include the justification for the claim for extra compensation or extra time, or both, and the amount of additional fee or time requested.
- (4) The City shall review the Contractor's submittal and respond in writing, either authorizing the Contractor to perform the extra service, or refusing to authorize it. The Contractor shall not receive additional compensation or time unless the extra compensation is authorized by the City in writing.

25. **DEFAULT/TERMINATION.**

- A. In the event Contractor shall default in any of the covenants, agreements, commitments, or conditions herein contained, and any such default shall continue unremedied for a period of ten (10) days after written notice thereof to Contractor, the City may, at its option and in addition to all other rights and remedies which it may have at law or in equity against Contractor, including expressly the specific enforcement hereof, forthwith have the cumulative right to immediately terminate this Contract and all rights of Contractor under this Contract.
- B. Notwithstanding paragraph A., above, the City may in its sole discretion and without any reason terminate this Agreement at any time by furnishing the Contractor with ten (10) days' written notice of termination. In the event of termination under this subsection, the City will pay for all work completed by the Contractor and accepted by the City.

26. **INDEMNIFICATION.**

The Contractor shall be liable to and hereby agrees to indemnify, defend and hold harmless the City of Madison, and its officers, officials, agents, and employees against all loss or expense (including liability costs and attorney's fees) by reason of any claim or suit, or of liability imposed by law upon the City or its officers, officials, agents or employees for damages because of bodily injury, including death at any time resulting therefrom, sustained by any person or persons or on account of damages to property, including loss of use thereof, arising from, in connection with, caused by or resulting from the Contractor's and/or Subcontractor's acts or omissions in the performance of this Agreement. An allegation of negligence on the part of the City or its officers, officials, agents or employees shall not affect the Contractor's obligations stated in the preceding sentence.

27. **INSURANCE.**

The Contractor will insure, and will require each subcontractor to insure, as indicated, against the following risks to the extent stated below. The Contractor shall not commence work under this Contract, nor shall the Contractor allow any Subcontractor to commence work on its Subcontract, until the insurance required below has been obtained and corresponding certificate(s) of insurance have been approved by the City Risk Manager.

Commercial General Liability

The Contractor shall procure and maintain during the life of this Contract, Commercial General Liability insurance including, but not limited to bodily injury, property damage, personal injury, and products and completed operations (unless determined to be inapplicable by the Risk Manager) in an amount not less than \$1,000,000 per occurrence. This policy shall also provide contractual liability in the same amount. Contractor's coverage shall be primary and list the City of Madison, its officers, officials, agents and employees as additional insureds. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain insurance meeting the above criteria, applying on a primary basis and listing the City of Madison, its officers, officials, agents and employees as additional insureds.

Automobile Liability

The Contractor shall procure and maintain during the life of this Contract Business Automobile Liability insurance covering owned, non-owned and hired automobiles with limits of not less than \$1,000,000 combined single limit per accident. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain insurance covering each subcontractor and meeting the above criteria.

Worker's Compensation

The Contractor shall procure and maintain during the life of this Contract statutory Workers' Compensation insurance as required by the State of Wisconsin. The Contractor shall also carry Employers Liability limits of at least \$100,000 Each Accident, \$100,000 Disease – Each Employee, and \$500,000 Disease – Policy Limit. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain such insurance, covering each subcontractor.

Professional Liability

The Contractor shall procure and maintain professional liability insurance with coverage of not less than \$1,000,000. If such policy is a "claims made" policy, all renewals thereof during the life of the Contract shall include "prior acts coverage" covering at all times all claims made with respect to Contractor's work performed under the Contract. This Professional Liability coverage must be kept in force for a period of six (6) years after the services have been accepted by the City.

Acceptability of Insurers. The above-required insurance is to be placed with insurers who have an A.M. Best rating of no less than A- (A minus) and a Financial Category rating of no less than VII.

Proof of Insurance, Approval. The Contractor shall provide the City with certificate(s) of insurance showing the type, amount, effective dates, and expiration dates of required policies prior to commencing work under this Contract. Contractor shall provide the certificate(s) to the City's representative upon execution of the Contract, or sooner, for approval by the City Risk Manager. If any of the policies required above expire while this Contract is still in effect, Contractor shall provide renewal certificate(s) to the City for approval. Certificate Holder language should be listed as follows:

City of Madison
ATTN: Risk Management, Room 406
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703

The Contractor shall provide copies of additional insured endorsements or insurance policies, if requested by the City Risk Manager. The Contractor and/or Insurer shall give the City thirty (30) days advance written notice of cancellation, non-renewal or material changes to any of the above-required policies during the term of this Contract.

28. **OWNERSHIP OF CONTRACT PRODUCT.**

All of the work product, including, but not limited to, documents, materials, files, reports, data, including magnetic tapes, disks of computer-aided designs or other electronically stored data or information (the "Documents"), which the Contractor prepares pursuant to the terms and conditions of this Contract are the sole property of the City. The Contractor will not publish any such materials or use them for any research or publication, other than as expressly required or permitted by this Contract, without the prior written permission of the City. The grant or denial of such permission shall be at the City's sole discretion.

The Contractor intends that the copyright to the Documents shall be owned by City, whether as author (as a Work Made For Hire), or by assignment from Contractor to City. The parties expressly agree that the Documents shall be considered a Work Made For Hire as defined by Title 17, United States Code, Section 101(2).

As further consideration for the City entering into this Contract, the Contractor hereby assigns to City all of the Contractor's rights, title, interest and ownership in the Documents, including the right to procure the copyright therein and the right to secure any renewals, reissues and extensions of any such copyright in any foreign country. The City shall be entitled to the sole and exclusive benefit of the Documents, including the copyright thereto, and whenever required by the City, the Contractor shall at no additional compensation, execute all documents of assignment of the full and exclusive benefit and copyright thereof to the City. Any subcontractors and other independent Contractors who prepare portions of the Documents shall be required by the Contractor to execute an assignment of ownership in favor of the City before commencing work.

Notwithstanding the foregoing, the term Documents as used herein shall not be deemed to include any data or other pre-existing materials and intellectual property ("Pre-Existing Data") of Contractor or obtained from third parties. Any such Pre-Existing Data will be subject to the applicable license terms of the party from which it is obtained. City acknowledges that such license terms may prohibit Contractor from sharing raw data with City or place restrictions on the sharing of such data, and may require City to sign documents governing use of the Pre-Existing Data. Any such license terms will take precedence over any conflicting or inconsistent terms of this Agreement.

29. **BAN THE BOX - ARREST AND CRIMINAL BACKGROUND CHECKS.** (Sec. 39.08, MGO. Applicable to contracts exceeding \$25,000.)

A. **DEFINITIONS.**

For purposes of this section, "Arrest and Conviction Record" includes, but is not limited to, information indicating that a person has been questioned, apprehended, taken into custody or detention, held for investigation, arrested, charged with, indicted or tried for any felony, misdemeanor or other offense pursuant to any law enforcement or military authority.

"Conviction record" includes, but is not limited to, information indicating that a person has been convicted of a felony, misdemeanor or other offense, placed on probation, fined, imprisoned or paroled pursuant to any law enforcement or military authority.

"Background Check" means the process of checking an applicant's arrest and conviction record, through any means.

B. **REQUIREMENTS.** For the duration of this Contract, the Contractor shall:

- (1) Remove from all job application forms any questions, check boxes, or other inquiries regarding an applicant's arrest and conviction record, as defined herein.
- (2) Refrain from asking an applicant in any manner about their arrest or conviction record until after conditional offer of employment is made to the applicant in question.
- (3) Refrain from conducting a formal or informal background check or making any other inquiry using any privately or publicly available means of obtaining the arrest or conviction record of an applicant until after a conditional offer of employment is made to the applicant in question.
- (4) Make information about this ordinance available to applicants and existing employees, and post notices in prominent locations at the workplace with information about the ordinance and complaint procedure using language provided by the City.
- (5) Comply with all other provisions of Sec. 39.08, MGO.

C. **EXEMPTIONS:** This section does not apply when:

- (1) Hiring for a position where certain convictions or violations are a bar to employment in that position under applicable law, or
- (2) Hiring a position for which information about criminal or arrest record, or a background check is required by law to be performed at a time or in a manner that would otherwise be prohibited by this ordinance, including a licensed trade or profession where the licensing authority explicitly authorizes or requires the inquiry in question.

To be exempt under sec. C.(1) or (2) above, Contractor must demonstrate to the City that there is a law or regulation that requires the hiring practice in question. If so, the contractor is exempt from this section for the position(s) in question.

30. **WEAPONS PROHIBITION.**

Contractor shall prohibit, and shall require its subcontractors to prohibit, its employees from carrying weapons, including concealed weapons, in the course of performance of work under this Contract, other than while at the Contractor's or subcontractor's own business premises. This requirement shall apply to vehicles used at any City work site and vehicles used to perform any work under this Contract, except vehicles that are an employee's "own motor vehicle" pursuant to Wis. Stat. sec. 175.60(15m).

31. **IT NETWORK CONNECTION POLICY.**

If this Contract includes services such as software support, software maintenance, network services, and/or system development services and will require a Network Connection the City Network (as defined in the following link), the City's Network Connection Policy found at this link: <http://www.cityofmadison.com/attorney/documents/posNetworkConnection.doc> is hereby incorporated and made a part of this Contract and Contractor agrees to comply with all of its requirements.

32. **AUTHORITY.**

Contractor represents that it has the authority to enter into this Contract. If the Contractor is not an individual, the person signing on behalf of the Contractor represents and warrants that he or she has been duly authorized to bind the Contractor and sign this Contract on the Contractor's behalf.

33. **COUNTERPARTS, ELECTRONIC DELIVERY.**

This Contract may be signed in counterparts, each of which shall be taken together as a whole to comprise a single document. Signatures on this Contract may be exchanged between the parties by facsimile, electronic scanned copy (.pdf) or similar technology and shall be as valid as original. Executed copies or counterparts of this Contract may be delivered by facsimile or email and upon receipt will be deemed original and binding upon the parties hereto, whether or not a hard copy is also delivered. Copies of this Contract, fully executed, shall be as valid as an original.

IN WITNESS WHEREOF, the parties hereto have set their hands at Madison, Wisconsin.

CONTRACTOR

Cambridge Systematics, Inc.

(Type or Print Name of Contracting Entity)

By: _____
(Signature)

(Print Name and Title of Person Signing)

Date: _____

**CITY OF MADISON, WISCONSIN
a municipal corporation**

By: _____
Paul R. Soglin, Mayor

Date: _____

Approved:

David P. Schmiedicke, Finance Director

Date: _____

By: _____
Maribeth Witzel-Behl, City Clerk

Date: _____

Approved as to Form:

Eric T. Veum, Risk Manager

Date: _____

Michael P. May, City Attorney

Date: _____

NOTE: Certain service contracts may be executed by the designee of the Finance Director on behalf of the City of Madison:

By: _____
Mary Richards
Procurement Supervisor

_____ Date

MGO 4.26(3) and (5) authorize the Finance Director or designee to sign purchase of service contracts when all of the following apply:

- (a) The funds are included in the approved City budget.
- (b) An RFP or competitive process was used, or the Contract is exempt from competitive bidding under 4.26(4)(a).
- (c) The City Attorney has approved the form of the Contract.
- (d) The Contract complies with other laws, resolutions and ordinances.
- (e) The Contract is for a period of 1 year or less, OR not more than 5 years AND the average cost is not more than \$100,000 per year, AND was subject to competitive bidding. (If over \$50,000 and exempt from bidding under 4.26(4)(a), regardless of duration of the Contract, the Common Council must authorize the Contract by resolution and the Mayor and City Clerk must sign, per 4.26(5)(b).)

Emergency Service contracts may also be signed by the designee of the Finance Director if the requirements of MGO 4.26(3)(c) are met.

ATTACHMENT A. Scope of Work of Services for Regional Travel Model Update

Cambridge Systematics proposes an update approach that benefits from the lessons learned from the various model update and estimation projects that our team has recently developed. Among the common themes of these projects are the multimodal nature of the models; the need to jointly assess passenger, transit, and non-motorized flows; the option to model diversions between competing modes and facilities; and the use of a variety of data sources to estimate, validate, and apply the models in a forecasting context. Our approach, outlined in this workplan, is an initial guide for how the MATPB model will be updated. The overall goal is to enhance and update the MATPB model to better meet MATPB's current and future needs. As such, some of the outlined tasks may be given a higher priority than others, with other tasks moved to later phases to facilitate the model update within available resources.

As part of this Scope of Work, each Task will be considered completed upon the completion of the technical memo associated with that Task and acceptance of the deliverable by MATPB. The tech memos will be submitted by CS in draft final format for review and comment by MATPB staff. After addressing the comments, CS will resubmit the memos as the final deliverable for this task.

Task 1—Develop Overall Workplan, Milestones, Project Schedule, and Coordination

The model workplan development will be an interactive effort in which we will work closely with MATPB staff to define different options, and to make tradeoffs to arrive at a final decision. MATPB has already laid out its desired updates to the current travel demand model. In this proposal, the CS team uses the requested task list as a starting point to identify updates needed for the model system to address MATPB's policy objectives. These updates are discussed in detail under Tasks 2 through 13. This proposal serves as a draft model development workplan that will form the basis of our discussions.

A modular approach to model design, data collection, model estimation, and model application is proposed to conduct tasks in parallel to meet the schedule requirements for the project. A modular approach will help identify tasks for which existing models or data can be readily used for “test runs” of the model. These data and application modules can be updated continuously and will be included as part of a later version of the MATPB model. In developing our approach, we will work with MATPB staff to address the following questions:

- The importance and hierarchy of different data compilation and analysis tasks, model estimation tasks, and application routines that need to be developed as part of the model update.
- Analysis tasks that need to be completed early in the process, since they provide inputs and are on the critical path of other key model development tasks.
- Types of data that can be used “as is,” data that may need to be collected early in the process, and data that can be used as placeholders but need to be updated at a later date.
- Tasks that can be undertaken in parallel compared to tasks that require the completion of data collection or analysis activities and need to be conducted sequentially.
- The most efficient sequencing of tasks and data collection efforts to optimize the allocation of resources over the course of the project.

- Potential enhancements of individual model components that will have to be deferred for future upgrades of the model system, and enhancements that can be implemented efficiently within the timeline and budget of the current project.

During the kickoff meeting we will discuss and lay out an outline for an updated workplan. Our revisions will reflect input from the MATPB project manager and staff on the proposal, our preliminary assessment of data, and questions and recommendations submitted by MATPB staff. The building blocks of the final workplan and management plan will include the work scope from this proposal, along with the proposed schedule, organizational chart, allocation of staff and budget by task, and QA/QC approach used by CS.

The roles of our proposed management team will be further refined as part of the workplan task. Our team consists of **Dan Tempesta** as our **Project Manager**, **Kimon Proussaloglou** as our **Principal-in-Charge**, and **Jeff Newman** as our **Deputy Project Manager**. The project manager is responsible for the overall project management and is tasked with keeping the overall schedule and making sure the deliverables are on time. The principal-in-charge is responsible for the overall satisfaction of the MATPB. The deputy project manager is responsible for the day-to-day activities of the project. Both the project manager and the deputy project manager will be in regular contact with MATPB during the course of the project. As part of the workplan development task, these roles will be further refined to best meet MATPB's needs and goals.

Regularly scheduled recurring project calls are important to monitor the progress of the project, resolve questions quickly and effectively, and make any necessary adjustments during the course of the project. We believe that brief biweekly calls are important especially at the start of the project. During periods of intense model estimation or model application, we propose to move to a weekly schedule to allow for measurable progress to be reviewed by MATPB and project team staff. CS staff have used a variety of software such as GoToMeeting, Skype, or join.me to conduct the teleconference meetings.

In addition to our regularly scheduled check in calls, the workplan will include two presentations to the Technical Coordinating Committee and one to the Policy Board.

Deliverables:

- Final detailed workplan with milestones, tasks, schedule, and coordination details
- Summaries of check in/coordination conference calls/meetings
- Monthly invoicing and progress reports
- PowerPoint presentations to MATPB Technical Committee (minimum of 2) and Policy Board (minimum of 1) explaining the project and status. The CS team will be available to meet with the Technical Committee and/or Board as needed throughout the project.

Task 2—Process Household Travel Survey Data and AirSage O-D Data for Model Calibration

CS has a long history of working with data from the National Household Travel Survey (NHTS) throughout the country and especially in Wisconsin. In 2004, we presented findings from the work done using 2001 NHTS Add-on data at the Annual TRB Meeting¹. To date, this report remains a gold standard on the appropriate use of NHTS data to enhance modeling. More recently, we have participated in several projects that have pushed the boundaries of using survey data to develop enhanced models. A few key examples are listed below:

¹ <http://onlinepubs.trb.org/onlinepubs/archive/conferences/nhts/aunet.pdf>.

- We have processed survey data to develop models for regions large and small alike. These include mega-regions like the NYMTC region in New York, and the States of California, Colorado, Florida, and Maryland; large urban areas such as the Houston-Galveston area (H-GAC), the Met Council region in the Twin Cities, the SEMCOG region in Detroit, and the BMC region in Baltimore; and mid-to-small cities such as Wichita, Kansas, Teton County, Wyoming, and Ann Arbor, Michigan.
- We have developed advanced survey expansion procedures that not only reflect residential and demographic characteristics, but also capture employment and worker-level characteristics. These enhancements allow a better representation of commute travel and commute vehicle miles traveled (VMT) both for activity-based models as well as traditional trip-based models².
- We are currently using the latest NHTS to support modeling and off-model efforts throughout the country and specifically in the State of California. Through our work, we are aware of some of the weighting issues that remain in the NHTS, and we will work with MATPB and UW staff to ensure that the expansion being conducted utilizes best practices.
- We also have been avid proponents and advanced users of fused data for model development and validation.
 - We implemented a unique mixed frame survey data collection effort for the Maricopa Association of Governments (MAG), which combined the use of a probabilistic sample (similar to the NHTS) with an add-on sample for special market segments such as large households. This experience is very similar to the effort that MATPB has described in the RFP, and we believe we are uniquely qualified to support the use of disparate datasets in the use of modeling.
 - Currently, for the development of the California Statewide Model, we are fusing NHTS data with location-based services (LBS) data from StreetLight to support both passenger and freight modeling. As part of this effort, we have streamlined the number of survey purposes, and developed weighting adjustments for the data to improve data usage in the model.
 - For the California High-Speed Rail Authority (CAHSR), we have fused long-distance data from AirSage with other survey data to develop an effective rail forecasting model. The forecasts of these models have been scrutinized by a panel of academic experts across the U.S. and around the world and have passed their rigorous evaluation.
 - For LA Metro, we have fused LBS data with fare card usage datasets to generate an in-depth understanding of transit ridership. This analysis is being used to drive LA Metro's bus restructuring efforts.
 - We wrote NCHRP Report 868, which discusses the best practices for using cell phone data in travel demand modeling^{3,4}.

We will apply all of the knowledge we have gained from these projects to support the enhancement of the MATPB model.

We will use the weighted survey data generated by UW to develop data that can be used in the estimation of trip generation rates, trip distribution, mode choice, and auto access. Even though it is not described in the RFP, we are also aware that MATPB has a transit onboard survey dataset from 2015 that can be used in the model development effort. As administrators of this onboard survey effort, we are experts at the use of these data, and know these data are weighted and organized. As needed, we will

² <https://journals.sagepub.com/doi/abs/10.3141/2669-06>.

³ <http://www.trb.org/Publications/Blurbs/177847.aspx>.

⁴ <http://camsys.com/nchrp>.

fuse this data with the household travel survey dataset—especially to aid the development and validation of the mode choice model.

Deliverables:

- Final processed household travel survey data files
- Final processed O-D data files
- Tech Memo describing data processing and review and any issues discovered and how addressed

Task 3—Purchase and Process as Necessary Travel Speed and Additional O-D Data for Model Calibration

In the RFP, MATPB has laid out an excellent vision of working with multiple datasets to generate inputs that will greatly enhance the value of the travel demand model. In our response below, we lay out our proposed approach to meet MATPB's goals. We provide a few alternative approaches that, if implemented at the right time, can further enhance MATPB's vision for the model.

- **Travel Speeds.** The Federal Government has procured and made available to State and MPO agencies, the use of the National Performance Management Research Dataset (NPMRDS) that captures truck and vehicular speed by time-of-day and percentile scores. We understand MATPB's concerns about the limitation of these data and recommend additional data to augment them. We recommend using INRIX as a first option because the current iteration of the NPMRDS is maintained by INRIX. CS, and teaming partner F&P, will reach out to INRIX for additional licensing, we should be able to utilize the same roadway system and mile-markers as the rest of the NPMRDS data.
- **Traffic Counts.** CS will also sort traffic count data collected by different agencies and match them to the appropriate location on the network. We will also scan these counts and drop stations which appear to have unreliable data.
- **O-D Data.** Passively collected data are becoming increasingly useful to aid the development and validation of travel demand models—particularly the trip length distribution and time-of-day components. To support trip distribution effectively, it is vital that the data are obtained at very fine-grained levels. Typically this results in increased costs for the agency. Therefore, prior to making any additional data purchases, we will look closely at the available AirSage data and then make recommendations for the need for additional data. At this stage, we also note that CS has a passive trip table product that is comparable in scope to other commercially available products, with three additional advantages:
 - We are transparent in our data processing techniques and are willing to build the analytics in a collaborative and customized fashion. This means that geographies and times of day can be defined in a manner that is most beneficial to MATPB without incurring additional costs.
 - We expand the resulting data to match both population and employment metrics so they better reflect regional activity generators.
 - Our licensing structure allows agencies to use the data for multiple projects and studies without incurring additional costs.

CS presented findings from our LBS analyses at the 2019 TRB Annual Meeting, and we are currently using this product to help Caltrans build the framework for their next generation travel demand model (residents and visitors). However, we remain committed to licensing a data product that is most beneficial and suitable for MATPB.

Deliverables:

- Final processed travel speed data files, including maps of speeds by roadway segment by time period.
- Final processed O-D data files.
- Technical memo describing data processing and review, and any issues discovered and how addressed.

Task 4—Create 2016 Base Year and 2050 Future Year Highway, Transit, and Active Transportation Networks in the Model

Model networks, along with the Traffic Analysis Zone data, are among the most important inputs to any travel demand modeling system. The data incorporated into the networks directly inform three of the four main modeling steps: trip distribution, mode choice, and trip assignment. Any errors or miscoded information in the model networks get passed on to these modeling steps. It is imperative that the information included in the networks be as accurate as possible. Additionally, the networks need to be fully connected and interconnected.

Fully connected means that each network is built in such a manner that all desired travel movements that are allowed in the actual transportation system are reflected in the demand model networks. Fully connected networks have to be substantially debugged and are flowable without any artificial breaks in the links. Since demand model highway networks are typically developed from GIS based inventory files, ensuring the proper connectivity of the network is a time-consuming task. The processing time for creating a new network from an inventory file can be greatly reduced using automated procedures that locate and flag breaks within the network, inconsistent coding in the network, and other indicators of error, but each of these still needs to be reviewed individually.

Interconnected networks means that the highway, transit, and active transportation networks need to be able to communicate with each other. The highway and active transportation networks consist of links and nodes that spatially define each of the networks, with the active transportation network typically built upon the highway network. The transit networks overlay the highway network, and the “.LIN” files used within the Cube modeling software are simply route identification and operating information and a listing of a sequence of nodes that defines the route of the transit vehicle.

CS built the existing **highway network** using the Wisconsin Local Roads (WisLR) and State Trunk Highway (STN) GIS inventory files, back in 2012. At the end of this process the highway network was converted to a geodatabase containing all model network links as well as all local roads that are included in the WisLR. The network development process entailed conflating data from the STN to the WISLR representation of these links. The connectivity of the network was tested over the course of the development of the network. Since the highway network contains numerous links and intersection configurations, the network could not reliably be considered to be fully connected until it had been used for numerous projects. Since the time that CS initially developed this network, it has continued to evolve and to be vetted, resulting in a network that should now be considered as fully connected.

To create a new 2016 base network, there are two primary options:

- Update the existing 2010 base network to reflect 2016 conditions, or
- Build a new network from the latest Dane County Street Centerline file.

Updating the existing 2010 highway network to 2016 would require building into the network all changes to the highway system that have occurred from 2010 to 2016. This would include projects such as Verona Road, as well as minor construction projects that added capacity or changed the configuration of the

system. The major advantage of this approach is that it will require fewer resources, as the 2010 network is a functional network that is only in need of updating. The disadvantage of this approach is that data from the model will not be able to be transferred directly to other MATPB roadway data. In the update approach, we will create an equivalency between the model highway network and the Dane County Street Centerline file to allow for data to be transferred between the two systems. The effort to conflate the two lineworks will be less than creating a new network.

The second approach is to build a new model network using the **Dane County Street Centerline**. This would allow for direct linkage with other MATPB roadway data. However, creating a new network from the Dane County Street Centerline file would require significant resources, making it prohibitive for the CS team to process the data and still update the other components of the model. To successfully implement this approach, we would create the first draft highway network and work with and direct MATPB staff on how to troubleshoot a newly developed network. We would provide MATPB with a checklist of tests to perform on the network to identify potential problems, and a short list of techniques to use to correct these problems.

Both highway network approaches would require approximately the same consultant team effort, with the Dane County Street Centerline approach also requiring MATPB staff time. A decision on the network update approach will be made in the earliest phase of the project in consultation with MATPB.

Intersection delay will be added to the highway network. Intersections will be classified based on their traffic control devices; at a minimum intersections will be identified as:

- Signalized Intersection.
- Roundabout.
- Four-way Traffic Stop.
- Two-way Traffic Stop.

Each of the classified intersections will have a major and minor approach designation. Using the approach and intersection type, we will implement a system of delay rules for each movement type. The delay will be incurred at the highway network node, with maximum/minimum delays and delay override procedures to allow for fuller control of the delay in the system. The speeds and capacities included in the model will likewise be updated to properly reflect the delay that will accrue at the intersection. The current speeds and capacities account for intersection delay in very broad terms based on area type and link type. The relationship between link travel times and intersection delays will be revisited to ensure consistency of the methods, and to avoid over and under estimation of combined link and intersection delay. Additionally posted speeds may be used as a starting point for a new free flow speed process that incorporates the intersection delay.

Regardless of whether the highway network is updated or is developed from scratch, the resulting network will be **compatible with the Wisconsin Statewide Model**. CS, as the developer of both the existing MATPB and statewide model networks, is intimately familiar with each of these networks and the procedures for linking them together. The existing network is linked to the statewide network using "joinnodes." Each of the roadways that exit the county is coded with a joinnode value at the last node of the network; this code is also included in the adjacent statewide modeling districts. The statewide model uses these nodes to build the MATPB network directly into the statewide model network. If MATPB decides to use the existing network, it will already be compatible with the statewide network. If a new network is developed from the Dane County Street Centerline, then the joinnode values will need to be built into the new network.

The existing **transit network** in the MATPB model was built using the Metro Transit GTFS files. CS has converted numerous GTFS files into transit networks, including the first version of the MATPB transit

network. We will apply a set of GIS tools and programs to convert the Metro and Monona GTFS files to functioning Cube transit networks that will reside in the Cube geodatabase file. In addition to developing a new.LIN file representing the transit routes, we will review and update the procedures to represent the non-transit leg components of the transit system. The non-transit legs consist of the walk, drive, and transfer access links that connect the TAZ to the transit system at the transit stops.

The transit route system is combined with the roadway layer, walk access links, and drive access settings to create a consolidated transit network. The transit network includes aspects of both the roadway and route system layers. Transit travel times and route attributes such as headways are obtained from the route system. Drive access links originate in the roadway layer, while walk access links are a combination of roadway network links and additional walk access connectors.

The Cube transit procedures allow direct use of the roadway network to model drive access to transit park-and-ride lots. We propose to implement penalties for driving to park-and-ride lots near one's destination. In some cases where the auto travel times are comparable to transit times, the transit path builder may create counterintuitive results. Specifically, it is possible to generate a transit path that uses a free or discounted park-and-ride lot near one's destination, effectively treating the premium service as an "egress mode" to travel a very short distance to one's final destination. As a QA/QC check, we will also write out the utilities generated by the transit path builder and evaluate the reasonableness of the implied competitiveness among the modes. This will allow us to make necessary changes to path building algorithms to reflect a realistic assessment of transit paths.

Active transportation networks representing the walk and bike modes of transportation are of keen interest to the City of Madison. Madison has a robust biking and walking community, and it is essential that these modes are accurately included in the MATPB model networks. The **walk network** will consist of all walkable roadways from the source file for the highway network. The WisLR based network already has all of the local roads included, and these can be activated to allow for walk paths using roads that are not included in the highway network. A similar process can be used if the Dane County Centerline file is the basis for the highway network.

The **bicycle network** GIS layer provided by MATPB will be integrated with the highway network. This process will bring the bicycle network traffic stress into the highway network for routing purposes. Dedicated bike paths in the bike GIS layer will be merged to the highway network, and access and egress points will be added to allow for the transition from one system to another during the bicycle path building process.

Both pedestrian and bicycle accessibility will be incorporated into the trip distribution and mode choice modeling steps. The weighted impedance of each of these modes will be built into the new destination choice model such that changes to the active transportation networks will have an impact on the trip distribution. Both "pedestrian" and bicycle will be treated as separate modes within the mode choice model if the estimation datasets allow us to account for these modes in each trip purpose.

All of the 2016 base year networks will be edited to account for future year projects, through to the forecast year of 2050. The highway, transit, and active transportation networks will all be coded such that the future year projects are implemented by making adjustments to the base networks. Using the base networks as the starting point for the **future networks** is critical to have a consistent network system. When changes/corrections are made to the base networks, they will automatically be incorporated into the future networks.

Deliverables:

- Updated 2016 base year and 2050 future year model transportation networks with all needed attributes in a Cube geodatabase format that is compatible with WisDOT's statewide travel model.
- Updated speed and capacity methodology as needed, in particular to account for intersection delay.

- Technical memo describing the assumptions, network updates and additions and attributes, updates to the speed and capacity methodology, and recommendations for network file management.

Task 5—Refine the Model Transportation Analysis Zone Structure and Incorporate Associated Socioeconomic, Land Use/Area, and Parking Cost Data

The current model has over 1,100 traffic analysis zones (TAZ) that were developed using Census block data. Per MATPB's request, these TAZ will be revisited and edited to maintain block group geography. This will allow for a more direct comparison to the ACS data. No other major changes to the zone system are anticipated, but there may be some select zone splitting based on new roadways and future planned roadways. Specifically, it may be desirable to split some of the zones in Middleton west of the Beltline and other zones north of Verona to accommodate future planned highway projects.

Household data from the Census and InfoUSA data will be used in consultation with MATPB to populate the zonal socioeconomic data. These same sources and MATPB guidance will be used to project the zonal data out to the forecast year of 2050. This is an area of the update project where MPO staff can provide valuable insights and efforts. Enlisting MATPB staff to help in the zonal development will reduce the burden on modeling resources and allow them to be used in other aspects of the model.

TAZs located in the isthmus have parking garages, and drivers also pay for on-street parking. As part of the zonal update, we will inventory the existing parking and the **cost associated with parking**. These data will be included in the destination and mode choice models to capture travelers' sensitivity to cost.

Understanding vehicle access is important for the model to be able to be sensitive to Transportation Network Companies (TNC) and Autonomous Vehicles (AV). Accessibility to the various travel modes are the critical inputs to mode choice models. We will test these accessibility measures in trip generation and destination choice to develop parameters for these models that will allow them to react to changes in mode accessibility.

A vehicle availability (auto ownership) model will be introduced in the model update. ***While the RFP calls for the auto ownership model to be implemented in later stages, we feel that it should be in place sooner, so as not to necessitate the re-estimation of models after its implementation.*** This model will relate the number of vehicles owned by households (or available to households) to household characteristics (number of persons, income level, etc.), land use characteristics, and modal accessibility measures. Using the NHTS and local survey data, a vehicle availability model can be estimated. The model will consider ped/bike accessibility, land use, and auto costs. Once this model is in place, we will use the resulting data in the estimation of the parameters of the trip generation, destination choice, and mode choice models to fully incorporate vehicle availability in the model.

CS has worked with UrbanFootprint in other regions. CS and F&P will implement a process by which the land use information generated by UrbanFootprint will be brought into the MATPB Cube model for testing. UrbanFootprint allows planners to easily change and update land use scenarios. F&P will focus on the UrbanFootprint outputs while CS will process them in Cube. The great benefit of this is that many alternate scenarios may be tested in a relatively short timeframe. The VMT estimates and transit accessibilities from the UrbanFootprint scenarios can be used to inform the demand model for alternative testing. Automating the process by which the UrbanFootprint data are brought into Cube and that Cube data are sent back to UrbanFootprint will allow MATPB planners to explore various future alternatives in a timely manner.

Deliverables:

- Revised model TAZ structure and centroid connectors and walk-to-transit connectors.
- Socioeconomic and land use/place type data associated with the TAZs.

- Technical memo describing the TAZ structure and associated data updates.

Task 6—Separate Regional and Local Retail for Trip Generation and Distribution

To account for the differences in **regional and local retail trips**, we propose to split the home-based shopping category into regional and local shopping trips. To estimate the trip generation rates for the local shopping trips, the household survey combined with the O-D data should provide enough information, as there are many more “local” retail stores than the relatively few regional shopping centers. The trip generation estimation process will follow the guidelines set forth in Task 7.

Regional retail trip generation will also be estimated using the household survey data if the dataset contains enough observations to produce robust trip rates. Using the household survey for trip generation rates would allow the model to capture the potentially higher regional retail trip rates of larger households. If the household survey does not provide enough observations, the regional retail trip rates may be created from a combination of the household survey and O-D data or based on the ITE trip generation rates. This is an aspect of the model development that will require close coordination between MATPB and the CS team.

Potential regional retail trip attractors include:

- East Towne and West Towne Malls, and Greenway Station.
- Menards, Home Depot, Sam’s Club and Costco locations.
- Three Walmart stores located in the City of Madison as well as the Walmart Super Center stores located in Sun Prairie and Stoughton.

The distribution of the local and regional trips will be handled in the destination choice models as described in Task 8. Both of these trip purposes will have differing average travel times and as a result different trip frequency distributions. The household survey will have enough observations to estimate destination choice models for the local retail trips. The regional retail trip purpose will have fewer observations, and it may be difficult to isolate regional trip destinations from the survey or from O-D data. Working with MATPB, we will implement a reasonable distribution model for the regional retail trips.

Due to the precise location of some of the regional retail trip attractors, it may be advantageous to treat them either as special generators or as sub-TAZ loading points to accurately reflect the traffic movements in and out of these locations.

Deliverables:

- Methodology for separating regional and local retail for trip generation and distribution.
- TAZ level regional and local retail employment data file.
- Technical memo describing the methodology and the calibration/validation.

Task 7—Develop and Calibrate Cross Classification Model for Trip Generation

The development of **trip production** rates from survey data is generally straightforward. CS proposes to use the combined 2016-17 household survey data to develop initial cross-classified rates of trips by trip purpose and time period, based on high priority explanatory variables such as household size, number of workers, and auto ownership, as well as lower priority variables such as land use and demographic characteristics (e.g., housing density, income distributions, etc.). By creating trip rates based on a variety of different classification schemes, it will be possible to identify the most appropriate variables to use in

the updated model. This will be achieved by conducting a series of analysis of variance tests to quantify the degree of separation for each classification scheme. In addition, progression of trip rates across the scheme will also be evaluated and incorporated in deciding the best possible classification scheme.

Cross-classified trip rates consist of two key components. Trip rate “marginals” are the aggregate rates across different values of a single attribute. The joint distribution of trip rates results in rates that vary based on simultaneous values in multiple attributes, e.g., when both household size and auto ownership are high. Household survey datasets typically include enough data to produce rates with narrow confidence intervals (i.e., low expected errors) at the marginal level. For joint distributions of trip rates, it may be necessary to group or smooth cells so that the resulting trip rates are defined with adequate confidence for lower frequency cells and to follow commonly documented patterns. CS will review trip rates resulting from data analysis and perform limited smoothing or grouping if needed.

The household surveys also provide a good data source for the development of **trip attraction** rates for given employment levels by industry category. While attraction models or rates are not necessarily critical if the trip distribution step is implemented by destination choice models, they still provide useful information to assess the reasonableness of destination choice model application, and can be used directly as measures of attractiveness (“size variables”) for each possible destination zone. CS proposes to develop and implement a trip attraction model using data from the combined 2016-17 household survey, as well as employment and other land use data generated in Task 5. The attractions model will generate forecasts for the quantity of opportunities for each activity purpose in each zone. These quantities will serve as a “size” component in the destination choice models estimated in Task 8.

CS will explore including an income variable in the trip generation process. If this is found to be useful to the process, CS will undertake the optional task of including income in the trip generation process.

The CS team will **validate** the trip generation models in a manner consistent with the Travel Model Validation and Reasonability Checking Manual, second edition, which CS wrote for the Federal Highway Administration. One important component of this task is comparing the updated MATPB trip generation model parameters and results to other models, national datasets, and generally accepted ranges of reasonable values. In particular, a key validation for the trip generation model results will be a comparison to the previous MATPB model’s results for similar purposes. Because the trip purpose structure will be substantially retained from the prior model, we expect overall to see relatively stable trip generation results by purpose, as the CS team has observed in other recent trip generation model updates. The possible exception to this stable trend is a small decrease in the share of home-based work trips relative to other purposes, in part due to an increased focus by the NHTS to more accurately and completely capture non-motorized and non-work trips.

Deliverables:

- Calibrated trip generation component of the model.
- Technical memo describing the work, including assumptions, methodology, findings, and the calibration/validation.
- Data files.

Task 8—Develop and Calibrate Trip Distribution Model, Converting Gravity Model to Destination Choice Model

For this task, the CS team will estimate, calibrate, and validate an updated discrete choice destination choice model for trip distribution, to replace the current gravity model. A destination choice model, which usually uses a multinomial logit formulation, provides several benefits with respect to a more basic gravity model, including sensitivity to changes in transit and non-motorized accessibility, the potential for additional market segmentation, and singly constrained application.

The most prominent of these benefits is the **sensitivity to changes in transit and non-motorized accessibility**, which is achieved by using the logsums generated by the mode choice model (see Task 9). These logsums incorporate the features of all travel modes in a behaviorally consistent manner. This contrasts with the current gravity model, which considers only auto travel time and does not account for transit or non-motorized modes in computing the impedance measure used in trip distribution. While there have been models that use multimodal impedances for the gravity model, there have often been issues with consistency when combined with mode choice models. Adoption of destination choice is generally more consistent with mode choice models and can reflect the propensity of trip makers to make trips within transit corridors and near locations with enhanced bicycle infrastructure, which is especially important for the evaluation of the benefits associated with investing in these facilities. The destination choice model that CS will develop for MATPB will incorporate level of service information from non-motorized and transit networks, developed in Task 4, into the trip distribution models.

Destination choice also can more fully consider additional **market segments** such as zero-auto households and households with fewer autos than workers. When combined with the improved transit sensitivity, this allows the model to better reflect trip distribution patterns for a variety of household types. The CS team will evaluate a variety of automobile ownership factors in the destination choice model, to identify the most important features observed in the MATPB survey data for inclusion in the destination choice models. Moreover, although the incorporation of additional socioeconomic data is identified as beyond the scope of this proposal, the CS team will work with MATPB staff to evaluate the most salient other factors that should be considered for inclusion in the model, either in this task (if the level of effort is within the available budget), or as part of future work outside the scope of this project.

In addition to the enhanced sensitivities discussed above, the implementation of a destination choice model also encourages the use of a **singly constrained application**, which does not rigidly enforce a requirement about the exact number of trips attracted to each zone. Instead, the trip attraction model results are used as “size variables,” meaning that the accessibility of a zone is allowed to impact effective attraction rates. Zones that are more accessible to households will receive more trip-ends per unit of attractiveness, while more remote zones may receive fewer trip-ends per unit of attractiveness. For example, under a gravity model adding households to Middleton would result in new trip attractions throughout the region, while the same change under a destination choice model would create most of the additional attractions near Middleton, with fewer attractions east of Lakes Monona and Mendota. This type of relationship ensures that the trip distribution component can impact the actual trip destinations, while still remaining behaviorally consistent with the trip mode choice and trip generation model components.

CS will explore including an income variable in the trip distribution process. If this is found to be useful to the process, CS will undertake the optional task of including income in the trip distribution process.

Proper model **calibration and validation** will remain important, even when a singly constrained application is implemented, as this type of constraint is not to be used in lieu of proper calibration and validation, but instead as a complement for those processes. With this in mind, CS will present MATPB with recommended trip distribution calibration targets. Targets are expected to include trip length frequency distributions by purpose and time period (peak and off peak). Targets will also include the comparison of modeled and observed trip tables at a super-district and district level. Regional-district analysis will likely consider about 5 large areas that reflect travel within and between major portions of the Madison area. A more detailed analysis could include a larger number of smaller districts, but is more difficult to evaluate as a whole. Methods of evaluating the district trip table may include the share of trips internal to a district, and between adjacent districts. Plots of internal versus adjacent capture can help identify trip generation and trip distribution problems.

Using finalized calibration targets, the CS team will develop procedures to implement and evaluate the performance of the models with respect to the targets, and ensure that the destination choice model provides results that are well calibrated and validated for the base year. We expect that some limited use of location-specific constants (i.e., origin-and-destination specific adjustments) will be necessary to ensure that the model performs within accepted margins of variation for base year forecasts.

Deliverables:

- Calibrated trip distribution component of the model that uses destination choice rather than gravity model.
- Technical memo describing the assumptions, methodology, findings, and the calibration/validation.
- Data files.

Task 9—Develop and Calibrate Mode Choice Model

In this task, CS will produce an updated mode choice model that is well-calibrated and continues to abide by FTA guidance. The mode choice models will be structured as a nested multinomial logit model, including single and multiple occupancy automobile, regular and premium transit with walk access (and for home-based trips, drive access), and non-motorized modes. The nesting structure used in the prior MATPB model is generally reasonable and will be employed as the default nesting structure. As part of the model estimation process, CS will evaluate whether the recently collected survey data provides enough statistical evidence to justify any changes or simplifications in the nesting structure.

CS will work in conjunction with MATPB staff to determine whether and how any **new travel modes** should be included in the model design, either to accommodate planned system investments or technological change in the transportation environment. To inform this decision, in particular with regard to “ride share” (i.e., Uber and Lyft) services, CS will evaluate the observed trips in available household survey data sources, and make a recommendation for whether there is enough data to reliably estimate meaningful and statistically significant parameters for a “ride share” mode in any of the purpose-specific mode choice models. This type of transportation service did not exist in Madison during the previous model design. Since Uber and Lyft were introduced in Madison in 2014 and enjoyed rapid adoption, it is possible that the 2016-17 household surveys in the region may have enough observations to include these modes in the model estimation in a statistically reasonable manner. Moreover, it may be deemed appropriate to explicitly include ride sharing or other potential modes (e.g., electric scooters) in the model structure at the design stage. This could allow such modes to not appear in base year forecasts (i.e., by making the alternatives universally unavailable), but be potentially be evaluated in future year forecast scenarios using reasonable assumptions about market penetration and traveler behaviors, without requiring any significant changes to the rest of the travel model.

Working from the set of modeled modes, CS will undertake a **model estimation** process to provide an initial set of parameters for alternative specific constants, level of service, and socioeconomic variables. The estimation process will leverage data both from the combined household surveys, as well as the 2015 Metro Transit onboard survey, which will provide nearly 6,000 additional survey records to supplement the household survey results. The inclusion of the onboard survey data will provide enhanced detail about mode choice sensitivity for transit riders. CS proposes a mode choice model that includes level of service variables that are commonly found in both small and large MPO mode choice models, including in-vehicle travel time, out of vehicle travel time (e.g., wait times, transfer times), additional penalties for transfers, and cost of travel. In addition to these factors, CS will examine a broad cross section of possible land use and accessibility factors to include in the mode choice models, including employment and population density, zonal area types, and general accessibility by various transportation modes at both the trip origin and destination.

Starting from the estimated models, CS will conduct an extensive **calibration and validation** of the mode choice models to guarantee a high-quality fit for the base year and reasonable sensitivities for future year forecasts. Alternative specific constants and level of service parameters and penalties will be adjusted in the calibration process to match the observed targets obtained from the household survey and the transit onboard survey. We expect to use finalized and expanded datasets from both surveys during this task.

CS will explore including an income variable in the mode choice process. If this is found to be useful to the process, CS will undertake the optional task of including income in the mode choice process.

The calibration process will be especially cognizant of FTA guidelines that could be necessary for subsequent use of the model for New Starts or Small Starts purposes. The fully calibrated parameters will be used to compute logsums that will be used in the estimation of destination choice models, described in Task 8. Mode choice calibration involves the adjustment of constants applied to each mode of travel. The CS team will calibrate mode choice constants using an iterative process, and then assign the calibrated auto and transit trips to the roadway and transit networks. Mode choice model validation is intertwined with traffic and transit assignment validation, requiring some iterations between these steps.

Deliverables:

- Calibrated mode choice component of the model with enhancements described.
- Technical memo describing the assumptions, methodology, findings, and the calibration/validation of the model.
- Data files.

Task 10—Develop and Calibrate Trip Assignment Model, Incorporating Intersection Delay

The CS team will review the existing the **traffic assignment** procedures and compare them to best practices in other models. It is envisioned that the multimodal, multi-class, capacity-restrained assignment procedures will continue to be utilized for the highway assignment. The trip assignment review will include review of the generalized cost functions, passenger car equivalencies, time periods, volume delay functions and implementation of the assignment.

The **intersection delay** introduced in the network update will be vigorously tested and can be calibrated during the highway assignment. Summaries of volume to count ratios will be produced for intersections with count data. These summaries will inform the intersection delay process and allow for changes to the routines to better match ground observations. Turn penalties used in the path building will be further revised during the highway assignment calibration. The CS team will work closely with MATPB to ensure that the intersection delay and turn penalties are applied in a manner that is consistent with the per lane capacities and related link delays, so as to not over or understate the node based delay.

The current model uses a tiered time period system that begins with general peak and off peak, moves to peak periods, and finally disaggregates time periods to individual peak hours and shoulder hours. As implemented, the peaking factors were obtained from the most current household survey; however, these need to be updated to also take recent traffic count data into consideration. The share of traffic occurring in the peak hour as represented by the household survey is not always consistent with the share of peak-hour traffic as represented by traffic counts. The CS team will re-evaluate both survey and traffic count data to improve the peaking characteristics in the updated model.

Because I-39/90 and I-94 experience different peaking patterns than arterial streets within the region, we will also evaluate traffic count data, StreetLight data, and the household survey to develop separate time-of-day factors for external stations. Based on the results, we will implement an updated time-of-day model that allows alternate time-of-day patterns to be specified at selected external stations. To address potential capacity issues at external stations, we will also consider the use of a peak spreading model to ensure that daily external station volumes as represented by regional and statewide growth forecasts can be reasonably accommodated.

The CS team will present MATPB with recommended traffic assignment calibration targets for review and discussion. These targets will include the current volume targets such as volume/count ratio, root mean

square error, screenline analysis, and R-squared. In addition, targets will include travel time calibration measures. Example travel time validation measures include:

- Comparison of corridor travel times to observed sources such as Google Maps and INRIX data that may be purchased by MATPB.
- Comparison of skimmed travel times to travel times reported in the household survey.
- Comparison of skimmed travel times to origin-destination travel times from StreetLight data.

The assignment process will also examine validation by time of day, with the understanding that the validation criteria will not be as rigorous as the daily criteria.

The **transit assignment** routines will utilize the same path building procedures used in the transit network skimming. Boardings by route will be recorded and compared to observed data for both the Metro and Monona transit systems. Transit boardings will be calibrated to a grouped route level, based on key travel corridors as identified by MATPB. Boardings, and corresponding transfers at the transit transfer centers, will be recorded and compared to observed data. Maximum and minimum wait time at the transfer centers will be adjusted as needed during the calibration process.

At this time, it is not envisioned that the pedestrian/bike trips from the mode choice model will be assigned to the active transportation network, but this is a task that may be explored at a later time.

Deliverables:

- Calibrated trip assignment component of the model with intersection delay added.
- Technical memo describing the assumptions, methodology, findings, and the calibration/validation of the model.
- Data files.

Task 11—Enhance and Calibrate the External Travel Model

The current external trip model structure is defined so that internal/external and external/internal (IE/EI) trips are specified by purpose at external stations. Conversely, “through” or external/external (EE) trips are specified as a vehicle trip table and are not modeled separately by trip purpose. Because IE/EI trips are specified as person trips, an adjustment must be implemented to convert traffic counts from vehicle trip to person trip units.

The external trip models in the current model are implemented through a separate spreadsheet process, which creates input values that are fed into the MATPB demand model.

As part of this task, the CS team will review the external station model specifications and provide recommendations on updated procedures. The Wisconsin Statewide Travel Model provides valuable estimates of the IE, EI, and EE trips with respect to Dane County. Since the statewide model uses the same zone system as the MATPB model, capturing the EI and IE trip movements by purpose will be done directly and the EE movements will be recorded by performing a subarea analysis of the statewide model. These statewide data will be combined with the household survey data and the O-D data to develop new procedures to implement the IE, EI, and EE modeling procedures.

The Wisconsin Statewide Model has a robust freight model that includes all intrastate, inbound, outbound, and through freight flows relative to the State of Wisconsin. The truck trip tables generated by the statewide model will be reviewed with regard to Dane County and potentially used either directly or indirectly in the estimation of the “through” truck movements for the MATPB model.

Forecast year data for the IE, EI, and EE trips will be developed using the growth rates from the statewide model. The growth rates will be taken directly from the statewide model and reviewed against local and TAFIS forecasts. Together with MATPB, CS will determine which growth rates are most appropriate for use in the external trips.

The external to internal and internal to external trip procedures will be updated and enhanced to incorporate the regional retail trip purpose. The size function (or the direct use of trip attractions) will be used to determine the attractiveness of each regional retail trip attractor, which will draw a disproportionate amount of the external trips entering the region.

As described in Task 10, the external station time of day factors will be estimated based on a variety of data sources, including traffic counts, StreetLight, and household survey data. The time of day factors for the external zone will be at a minimum segmented by interstate and non-interstate roadway facilities.

Deliverables:

- Calibrated external travel component of the model with enhancements described.
- Technical memo describing the assumptions, methodology, findings, and the calibration/validation of external travel.
- Data files.

Task 12—Prepare Model User Guide and Provide Training

In our experience, training in the development, properties, and the application of passenger travel demand models is a **two-way street**. The training process can benefit greatly by active engagement by MATPB staff, who will help identify the questions of greatest interest that training will address. Developing a model that is used on a daily basis is the litmus test of the success of the project, and training is a necessary part of this process.

We also believe that training is most successful when it is approached as an **ongoing process** of learning and training. Although we will schedule a hands-on training session during and at the end of the project, ongoing participation by MATPB and CS project team staff allows an in-depth understanding of the individual elements of each model component as they are developed, validated, and implemented.

The CS team has extensive experience working cooperatively with our modeler colleagues in state and regional planning agencies. We also have a tradition of **model development training** in support of Federal and NCHRP model projects to support the U.S. DOT Travel Model Improvement Program (TMIP). These include courses in survey design and application, model validation and calibration, advanced and innovative modeling techniques, time of day modeling, and integration of land use and travel demand modeling.

CS team staff have led the development of many standard travel demand modeling reference documents and seminars. Examples that are relevant to this project include the *FHWA Model Validation and Reasonableness Checking Manual*; the *FHWA Travel Survey Manual*; the *FHWA Workshop over the Web* for travel model estimation, calibration, and validation; and a series of DOT courses on statewide freight planning and modeling.

Over the last few years, we have also developed **customized training sessions** for staff at the Metropolitan Council, the Houston-Galveston Area Council, and the Baltimore Metropolitan Council to present the models developed in Minneapolis-St. Paul, Houston, and Baltimore respectively. Our experience from these training sessions will guide the training for the MATPB model. From our experience, there are **multiple audiences**, such as the policy board, within each organization who are

interested in different aspects of the model, and our formal training will be geared towards addressing these diverse requirements.

We will develop with MATPB staff the outline of a **customized training** program. Our objective is to initiate a productive interactive session during the discussion and presentation of material on topics such as trip generation, mode choice, trip distribution, and highway/transit assignment. This two-way exchange between MATPB and project team staff will have a true and lasting impact on our mutual understanding of the nuances of the model, and will ensure the day-to-day use of the model for years to come.

The **User's Guide**, potentially in the form of an online document that can be easily search and updated, will be developed as a concise "**how to**" document for daily reference. The documentation in Task 13 will focus on the "why" of the model, while the User's Guide will provide the "how." We propose developing a user's guide that walks users through the key steps of running, testing, and operating the full model and individual model components. The User's Guide will be split into two main elements: model operation and model mechanics. The model operation portion of the guide will provide the information required for a modeler to operate the model, while the mechanics portion will outline the working relationships between model components and how they fit within the model structure. For completeness, we will also provide detailed analysis validation results in technical appendices for future reference.

Deliverables:

- Model User Guide.
- Staff training sessions, mostly on-site, throughout the course of the project.
- Model introduction presentation for non-technical staff and policy board covering the basic process and the model's capabilities and limitations.

Task 13—Create Model Validation and Scenario Comparison Reports and Prepare Comprehensive Model Development Report

CS has long been a leader in quality model calibration and validation. CS authored both the original *FHWA Travel Model Validation and Reasonableness Checking Manual* (known as the "*Validation Manual*") and the Second Edition of that manual, which serves as the current primary reference for travel model validation in the U.S. We have used these concepts to validate dozens of statewide and urban area models throughout the U.S.

The *Validation Manual* recommends that a validation plan be prepared prior to beginning the validation effort. The development of a **validation plan** will provide an opportunity to coordinate the approach with MATPB and to discuss validation guidelines and targets in advance of model development. The plan will be prepared near the beginning of the project, as soon as we have reviewed the existing model and available data, and will be submitted to MATPB for approval. The validation plan will include the following elements:

- Description of the overall process.
- Validation guidelines and targets.
- Description of available data for validation.
- Checks of model input data (including socioeconomic data and networks).
- Validation of individual demand model components, including trip generation, trip distribution, and mode choice models, as well as external and truck/freight model components.

- Highway assignment validation.
- Temporal validation and sensitivity testing.

Following the model development, we will perform a comprehensive model validation effort that follows the approved validation plan and incorporates all of the validation tests outlined in the RFP. The main components of the process will be a set of model validation tests. We will devise and execute tests for all model components, evaluating their results based on reasonableness, comparisons to independent and other observed data sources (traffic counts, American Community Survey data, National Household Travel Survey, etc.), and results we have seen in other areas. In our evaluation, we will be using the targets and guidelines agreed on with MATPB.

Temporal validation and sensitivity testing are needed to ensure that the model not only accurately reflects existing travel conditions, but also will accurately reflect the impact of changes in land use, demographics, and transportation supply and can be used to analyze the planning scenarios that MATPB will need to examine. The specifics of temporal validation and sensitivity testing will be determined in consultation with MATPB and will be defined in the validation plan; the testing will consider other periods besides the base year and the scenarios that MATPB expects to use the model to analyze.

The **validation reports** and data generated by the model will be thoroughly explained in the User's Guide. Currently these reports are generated as text and comma separated value (CSV) files that are automatically read into a spreadsheet program for viewing. If resources allow, this reporting feature can be expanded to be more integrated in the model system and dynamic.

The CS team will review the existing **model summary report**, provide sample reports that we have developed elsewhere, and guide MATPB in identifying improvements and enhancements to this tool.

A typical summary report contains information about each model run, including a complete inventory of inputs, settings, and output files. These reports include technical details, such as data from each model step, and a consolidated summary containing key performance measures, such as VMT and congestion delay. Specific summary report sections could include:

- VMT and vehicle hours traveled (VHT), stratified by trip purpose.
- Summaries of congested lane-miles.
- Trip totals by mode.
- Validation statistics including root mean square error, volume/count ratio, and screenline analysis.

The summary report can classify most values by facility type and area type, and will include totals alongside the detailed breakdowns. The trip production summary, the trip distribution summary that includes average trip lengths, detailed mode choice and destination choice results by trip purpose and mode, and several other statistics can be incorporated. The CS team will adapt such a tool to include measures that are important to MATPB.

In addition to typical components, possible improvements include an option to generate the report directly in Excel, show direct **comparisons between different scenarios**, and implement formatting updates to improve readability. Information in the report can also be updated to any model summary information or validation statistics that are commonly referenced but are not currently available. The CS team will update the summary report based on review and discussions with MATPB.

We will provide MATPB with more detailed documentation on the contents of the summary report. This documentation will describe what each component of the report means, how this information can be useful, and how this information is calculated.

CS understands the need to **thoroughly document** all model updates and development tasks, the validation summaries, and application activities, along with the need to maintain a record for users of the model and model specifications.

The documentation of the MATPB model update will reflect MATPB's needs and will be developed to reflect the requirements of MATPB staff, both as in-depth technical documentation and as a reference guide that supports their daily work. Early in the process, the CS team will work together with the MATPB project manager and staff to create an outline of the Final Report and the User's Guide and develop their contents. This will be the first step in making **model documentation** a resource of living documents, rather than a bulky and seldom-used reference. The model user's guide developed in Task 12 is also an important part of the model documentation and will be part of the overall model documentation.

As noted individually for each task, a technical report will be produced outlining the work in every proposed task. These reports will serve as the basis for the chapters of the model documentation. The technical reports will state the reasoning for why a particular update method was used, and list the advantages and any limitations of the process. In addition to the reasoning behind the update process, the process itself will be documented, including the data that were used and the source of these data.

The final report will serve as a **repository of key information** related to the project. It will preserve the history of the project, the databases and analytical methods that were developed, the base year application of the model, and the comparisons with different sources of observed travel and traffic data.

Deliverables:

- Model Validation and Scenario Comparison Reports set up to automatically generate in the model.
- Model Development Report.

Task 14 Income Variable (optional)

Household variables impact the trip generation, trip distribution, and mode choice steps in the modeling process. Trip generation typically uses a combination of household size and auto availability to determine the rate of trip making activity of the household. Both of these variables are closely related to household income and are sometimes used as a surrogate for household income. Within trip distribution, income can be used to better match workers and jobs. In the mode choice model, income is a key variable that is used to reflect different values of time and sensitivity to travel cost by income.

The testing of income as a variable will be performed in Tasks 7-9 for trip generation, trip distribution and mode choice respectively. The results of these tests will be presented in each of the tasks technical memoranda along with our recommendations for implementation.

If the income variable implementation is recommended the model structure will require additional market segments. These additional market segments will need to be built into the current model structure and maintained separately throughout the process.

In addition, the greater segmentation of the model will require additional validation work, as each new market segment will have validation targets through the generation, distribution and mode choice steps.

Deliverables:

- Implementation and validation of the income market segments.

ATTACHMENT B. Cost Proposal

Tasks and Subtasks	Kimon Proussaloglou	Dan Tempesta	Anurag Komaduri	Jason Lemp	Jeff Newman	Sean McAtee	Brent Selby	Haiyun Lin	Tom Notbohm	Emily Silverson	Matt Roland	Matt Sudac	Mike Wallace	Kevin Johnson	Jennifer Ziebarth	Total Hours by Task	Total Cost by Task
	CS	CS	CS	CS	CS	CS	CS	CS	TranSmart	TranSmart	TranSmart	TranSmart	Feer&Peers	Feer&Peers	Feer&Peers		
Hourly Rates	\$417.79	\$267.54	\$263.19	\$195.27	\$187.20	\$226.70	\$163.02	\$142.77	\$170.15	\$126.94	\$94.53	\$70.22	\$272.54	\$180.80	\$144.30		
Task 1 - Workplan	8	50	8	0	24	0	0	0	0	0	0	0	4	1	1	96	\$24,732.90
Task 2 - Existing Data	2	2	24	0	0	0	24	0	0	0	0	0	2	1	1	56	\$12,469.88
Task 3 - New Data	2	2	24	0	0	0	40	0	8	8	0	24	26	1	1	136	\$25,681.16
Task 4 - Networks	0	16	0	0	0	0	0	24	2	4	16	40	2	1	1	106	\$13,746.64
Task 5 - Zones	0	4	0	0	0	0	32	0	2	4	32	40	6	25	25	170	\$22,731.36
Task 6 - Region/Local TG	0	8	0	0	16	0	0	16	0	0	0	0	2	1	1	44	\$8,290.02
Task 7 - Trip Gen	0	4	0	0	40	8	0	40	0	0	0	0	2	1	1	96	\$16,952.74
Task 8 - Trip Dist	0	4	0	40	0	8	0	40	0	0	0	0	2	1	1	96	\$17,275.54
Task 9 - Mode Choice	2	4	0	40	0	8	0	40	0	0	0	0	2	0	1	97	\$17,930.32
Task 10 - Assignment	2	16	0	0	0	16	0	32	4	6	24	40	2	0	0	142	\$20,376.90
Task 11 - External	0	4	4	0	0	8	40	0	0	0	0	0	2	0	0	58	\$11,002.40
Task 12 - Users Guide / Training	2	16	0	0	0	0	0	0	0	0	0	0	0	0	0	18	\$5,116.22
Task 13 - Validation/Development Report	2	16	8	0	0	16	0	0	0	0	0	0	0	0	0	42	\$10,848.94
Task 14 - Income Variable (optional)	2	16	0	0	40	4	0	40	0	0	0	0	0	0	0	102	\$19,221.82
Total Hours by Staff	22	162	68	80	120	68	136	232	16	22	72	144	52	32	33		
Total Cost by Staff	\$9,191.38	\$43,341.48	\$17,896.92	\$15,621.60	\$22,464.00	\$15,415.60	\$22,170.72	\$33,122.64	\$2,722.40	\$2,792.68	\$6,806.16	\$10,111.68	\$14,172.08	\$5,785.60	\$4,761.90		
Total for Project																	\$226,376.84
Other Expenses:																	
1 person trip Boston to Madison (2 Days)																	\$931
2 person trip Boston to Madison (2 Days)																	\$1,891
Not to Exceed Total:																	\$229,198.84

Our total budget for the Regional Travel Model Update is \$329,199 (\$19,222 optional). This includes \$229,199 for consulting services and \$100,000 for data purchases.