KNOXVILLE REGIONAL
400 Main Street, Suite 403
Knoxville, TN 37902

Knoxville Regional Transportation Planning Organization

Request for Qualifications

for

Travel Demand Forecasting Model Update Services

Applications must be received by 4 p.m. EDT
Friday, July 21, 2023

Issued on June 30, 2023

KNOXVILLE REGIONAL TRAVEL DEMAND FORECASTING MODEL UPDATE SERVICES

REQUEST FOR QUALIFICATIONS

NOTICE

Knoxville-Knox County Planning, in association with the Knoxville Regional Transportation Planning Organization (Knoxville TPO) is soliciting qualifications from transportation planning consultants to assist with services related to updating its regional travel demand forecasting model. Note, the Knoxville TPO is an independent agency engaged in the performance of meeting the required federal transportation planning regulations for urbanized areas greater than 50,000 population however it is housed within the agency known as Knoxville-Knox County Planning, which provides the professional transportation planning staff for the TPO and acts as the contracting agency for grant-funded projects such as this effort.

All application packages are due on July 21, 2023 by 4:00 p.m. EDT and submitted electronically at:

https://knoxplanning.org/rfq

See subsequent section of this RFQ for full electronic submittal instructions

Knoxville-Knox County Planning retains the right to reject any and all applications and may re-advertise, waive formalities in the request for qualifications, or abandon the project.

I. PROJECT BACKGROUND AND DESCRIPTION

Knoxville-Knox County Planning (Planning), in partnership with the Knoxville Regional TPO and its member jurisdictions, is seeking a professional firm, consultant, or team to perform various services related to updating the Knoxville Regional Travel Demand Forecasting Model. The selected entity must be experienced in travel demand modeling and have adequate qualifications and expertise to undertake required tasks in a timely and efficient manner in close coordination with the Planning staff.

PROJECT AREA

The Knoxville Regional TPO serves as the federally designated Metropolitan Planning Organization for the Knoxville Urbanized Area. The TPO's Metropolitan Planning Area (MPA) was established to include at minimum the 2010 Census-designated Knoxville urbanized area and expanded to include full municipalities and other area that was deemed likely to become urbanized within a 20-year forecast period. Voting membership on the TPO Executive Board is comprised of the county mayors for: Anderson, Blount, Knox, Loudon and Sevier counties and the mayors of municipal areas within those counties with population of 5,000 or greater.

The Knoxville TPO has an agreement with the Tennessee Department of Transportation (TDOT) and the Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO) based in Morristown, TN to develop and maintain a regional model that also includes the LAMTPO Planning Area in addition to Knoxville's. This was due to its close proximity and the previous need to conduct regional air quality conformity analysis for the 1997 Ozone Standard which affected a portion of nonattainment area that overlapped both MPOs.

The full geographic coverage of the current Knoxville Regional Travel Demand Forecasting Model is a 10-county area including: Anderson, Blount, Grainger, Hamblen, Jefferson, Knox, Loudon, Roane, Sevier and Union counties. Previous iterations of the model allowed for a standalone, sub-area model to be run for the LAMTPO region but the current version operates as a single overall model inclusive of both MPO planning areas. There are 1,173 internal plus 33 external Traffic Analysis Zones (TAZ) and approximately 2,880 centerline miles of roadway network in the model area.

Special note: Both MPOs are currently in the preliminary stages of determining possible changes to their Metropolitan Planning Area (MPA) boundaries based on the newly released 2020 Census Urban Area delineations. It is not expected that any MPA changes will result in the model coverage area being modified but this is subject to final determination expected later in 2023.

An overview map of the model coverage area is provided as **Attachment A**.

PROJECT OBJECTIVE

The Planning staff desire to retain consulting services to perform a variety of tasks related to updating its current travel demand forecasting model and envision at least three major upcoming activities: (1) a minor model update, to coincide with the next Metropolitan Transportation Plan update that is due by mid-2025, (2) travel demand modeling support services in conjunction with the 2050 MTP update process and (3) scoping of a major model update including identification of the future model platform design such as a full activity-based model and associated data needs. The purpose of this RFQ is to select the most qualified consultant that can perform required model update services and also provide guidance to the Planning staff for future improvements and best practices related to travel demand modeling. It is desired for this RFQ to result in an "on-call services" type of arrangement with a consulting firm in order to be able to develop individual task order scopes for various travel demand forecasting services for a minimum three (3) year period following the initial award.

II. SCOPE OF WORK

Following the consultant selection process through this RFQ, an initial meeting will be held to determine and negotiate an overall on-call services contract agreement as well as an initial task order scope and fee for stages of the model update process that are to be determined at that time. The following scope description represents activities that are envisioned as likely tasks, but it is preliminary and as such Knoxville-Knox County Planning reserves the right to make revisions as deemed necessary. Once a consultant has been selected the specific refinement of the project scope will occur.

Task I: Review of Current Model and Determination of Interim Update Scope

The first task order is envisioned to be a review of the current model platform and feasibility of performing minor updates to develop a new 2022 base year validated model. The current model was updated as part of the previous MTP (Knoxville 2045 Mobility Plan) development process, but it was only a minor update to a base year of 2018 from 2014 and included a transition from TransCAD Version 6.4 to TransCAD Version 8.0. It is critically important to Planning/TPO staff that the model is continually improved and that subsequent updates are enhancing current capabilities/behavioral fidelity and not "back-sliding" towards less detailed and thorough approaches. Please refer to Attachment B for additional background and chronology of the modeling process for the Knoxville TPO.

The Planning staff desire to determine the feasibility of incorporating latest available data to calibrate and validate the current modeling platform to accurately reflect year 2022 conditions in preparation for its next major (2050) MTP update. As such the following items have initially been identified as key review and action items to be considered for this "minor" model update task:

- A first step will be to perform a full data inventory to determine what is already available and what may need to be additionally acquired to support the model update.
- Review current model TAZ boundaries and roadway network for potential changes/additions (Joint task of Consultant and Planning staff)
- Incorporate 2020 Census Population and Households to develop 2022 TAZ data (Planning staff to perform this task with guidance from consultant where necessary)
- Update 2022 base year employment based on sources already available to Planning including LEHD, QCEW and InfoUSA data. (Planning staff to perform this task with guidance from consultant where necessary)
- Determine feasibility of updating behavioral functions in the model to account for changing travel behaviors since the last major regional Household Travel Survey which was conducted in 2008 to include increased working from home, online shopping and micro-mobility options. A review of possible use of the latest National Household Travel Survey (NHTS) will be performed including the assessment of the add-on samples purchased by TDOT of which approximately 450 households were surveyed in the Knoxville Region and over 5,400 households statewide. The timing of the availability of this NHTS add-on data is unknown at the time of preparation of this RFQ.
- Update of the External Station origin-destination trip matrices based on available data sources such as roadway counts and use of INRIX Trip Analytics data which is available to Planning staff under an umbrella license through TDOT. Additional data needs/purchases can be considered as part of this task if determined to be necessary.
- Exploration of socio-economic control total allocation methods.
- Calibration/Validation of the updated travel demand model to 2022 conditions that meets the established "Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee" (link) and addresses the TDOT Model Approval Policy requirements (link). The model shall be compatible with the latest version of TransCAD software.
- Review and potential update of the post-processor that has been created to provide inputs for the EPA MOVES3 model to support air quality conformity analyses.
- Preparation of full model development documentation and a user's guide.
- Additional tasks as may be determined necessary as part of scope development.

Task II: Travel Demand Model Services to Support 2050 MTP Development

The 2050 Metropolitan Transportation Plan update is expected to begin development under a separate, parallel effort utilizing consulting services by mid-August 2023. The initial update of the

travel demand forecasting model described in Task I will need to be developed in concert with the MTP process and be finalized in time to be utilized when necessary to determine roadway network needs and deficiencies and to test potential scenarios. The intent will be for most Plan-update modeling-related tasks to be performed by Planning staff however there may be need of on-call support for special scenario testing and especially investigation of potential "Choice Lanes" as discussed in TDOT's Transportation Modernization Act and/or regional bypass options as a potential method of addressing the heavy congestion on sections of I-40/75 in west Knoxville. Additionally, other performance-based planning aspects related to the MTP update where the model may be of use will be explored to include potential tie-in with the FHWA Performance Measures related to travel time reliability and congestion (PM3).

Task III: Visioning and Scoping Exercise for next Major Travel Demand Model Update

The third task entails a significant effort to determine the future direction of the travel demand modeling process for the Knoxville Region to include possible migration to more advanced modeling practices such as a full activity-based model (ABM) and dynamic traffic assignment (DTA) approaches. A consultant that is well-versed and experienced in the full spectrum of modeling platforms and approaches will be of critical importance to achieving a successful outcome for this task. A full exploration of the data needs and tradeoffs such as model fidelity versus run-time and staff effort to maintain it will be performed and presented to Planning staff and interested stakeholders such as the Knoxville Air Quality Interagency Consultation group and member jurisdictions of the Knoxville TPO and LAMTPO. Other aspects related to the next model update that are of interest are new approaches to model network coding/micro TAZs, scenario version control, integrated socio-economic and land-use forecasting models, improved multimodal (transit/non-motorized) modeling capabilities, testing of scenarios involving large-scale implementation of new technologies such as autonomous vehicles and other innovative practices.

A workshop/symposium is envisioned to occur along with this task where information is provided to invited stakeholders for review and comment regarding various model update/platform approaches including associated costs. Data needs including a potential new regional household travel survey will be presented. The final deliverable will be a report on the outcomes from the workshop and a "menu" of possible approaches and costs for the next major model update along with initial recommendations.

III. QUALIFICATIONS SUBMISSION REQUIREMENTS

To be eligible for consideration, an electronic (pdf) version of the overall qualifications package and proposed approach to the initial proposed tasks, i.e., "Application", shall be received by Knoxville-Knox County Planning no later than **by 4:00 p.m. EDT on July 21, 2023**. Late submittals will not be considered.

Electronic Submission Procedures :

Each Application must be submitted electronically as a PDF document as follows:

1. Go to the direct internet link of: https://knoxplanning.org/rfq
2. Click "RFQ – Travel Demand Model Update Services"
3. Click "Submit Application"
4. Follow the prompts to upload and submit the full PDF version of your Application to the Dropbox account provided.
5. Files MUST use the following naming convention of first including the firm's name followed by the title of the project, followed by the word "Qualifications".

   a. Example: ABC Company-Knoxville Model Update-Qualifications.pdf.

Applications should be fully self-contained and display clearly and accurately the capabilities, knowledge, experience, and capacity of the Respondent to meet the requirements of the project tasks as described. Respondents are encouraged to utilize methods they consider appropriate in communicating the required information. The Application shall be organized in the following format and shall include the information in the below outline:

A. Cover Letter

The cover letter must be signed by an officer of the firm authorized to execute a contract with Knoxville-Knox County Planning. The primary contact should be identified with name, telephone number, email and mailing address.

B. General Qualifications

Provide a summary of the Consultant's/Team's qualifications, general information about the firm(s), location of office(s), years in business and areas of expertise.

C. Key Staff & Sub-consultants

Identify key staff and include a description of their abilities, qualifications and experience. Attach resumes of key staff that will be assigned to this project. Include a proposed project management structure, organizational chart and availability to work on this project.

Identify any portion of the scope of work that would be subcontracted. Include firm qualifications (brief) and key personnel and contact information for all subcontractors. It shall be the responsibility of the prime consultant to include a signed statement from each sub-consultant on their own letterhead confirming that they have the staff available and agree to provide the necessary services for the specific item/project listed in the application. Failure to meet these requirements will void the submittal. Knoxville-Knox County Planning reserves the right to approve or reject all consultants, internal staff performing consulting services, or subconsultants proposed by the Consultant.

D. Previous Experience

Provide documentation of relevant experience with up to four (4) examples of similar projects identifying which team members worked on the project and their roles. An emphasis and priority in evaluation will be placed on firms with qualifications and experience that have resulted in successful implementation of comparable projects.

Provide the names, addresses, email addresses and telephone numbers of the clients for the projects included in this section. Projects and references for both the prime consultant as well as any proposed sub-consultants should be provided. Each project example shall include information on the dates that work was performed and the contract amount.

E. Proposed Project Approach and Workplan

Provide documentation of the proposed approach to the project that includes the proposer's understanding of the project's objectives and local context, a description of your approach/methodology to each of the tasks listed in Section II, a general estimated schedule for duration of each task (detailed schedules to be determined after consultant selection) and any proposed stakeholder engagement processes. Consultant/Team shall expand on the scope of work if appropriate to accomplish the overall objectives of the project and provide suggestions which might enhance the results or usefulness of the overall project.

IV. CONSULTANT SELECTION PROCESS

Knoxville-Knox County Planning shall designate a Consultant Evaluation Committee (CEC) comprised of certain staff members and other key project stakeholders. The basic elements of the selection process are as follows:

EVALUATION OF SUBMITTALS

The applications submitted by each Consultant/Team will be evaluated by the CEC and scored according to the following criteria (relative weight):

a. **Qualifications (35 points)** Staff qualifications, credentials, overall firm experience and time availability of the staff assigned to manage and conduct the study tasks.

b. **Experience (30 points)** Demonstration of the Offeror's past experience in providing the proposed services. Examples of similar work and satisfaction of other clients with the Offeror's services.

c. **Project Understanding and Approach (30 points)** Does the proposal reflect a thorough, thoughtful, and accurate portrayal of the requested services? Is there evidence of a clear understanding of the MPO program and related planning requirements? Evaluation of the application's overall completeness, organization, innovation and strength of the technical

approach to the study tasks.

d. **Local Knowledge (5 points)** Demonstrated understanding of the area and awareness of opportunities and constraints of the project. Evaluations on prior projects with Knoxville-Knox County Planning, TDOT or TPO jurisdictions if applicable.

Following the evaluation process, the CEC will make a final ranking of the Consultant(s)/Team(s) in order of preference. Based on the outcome of the initial application evaluation, the CEC reserves the right to request interviews from shortlisted firms. Knoxville-Knox County Planning will negotiate with the most highly qualified firms in rank order until successful execution of a contract for on-call services is completed.

SELECTION SCHEDULE

The process for selecting a consultant team, including the commencement of contract and notice to proceed, are tentatively scheduled as follows:

RFQ Issued	**June 30, 2023**
Written Questions Deadline	**July 14, 2023**
Application Submittal Deadline	**July 21, 2023**
Qualifications Evaluation	**July 24 – August 4, 2023**
Consultant Selection Notification	**August 4, 2023**
Contract Commencement	**August 21, 2023**

NOTICE: This schedule is provided for information only and is tentative and subject to change. Planning/TPO reserves the right, at its sole discretion, to adjust this schedule as it deems necessary.

REJECTION RIGHTS AND COST OF APPLICATION PREPARATION

A selected consulting firm shall provide professional services in full accordance with federal, state and local regulations, policies and/or standards specific to the project's funding source, where applicable. Knoxville-Knox County Planning reserves the right to reject any or all applications submitted, to advertise for new applications, or to accept any submitted application deemed to be in the best interest of Knoxville-Knox County Planning. Further, all costs incurred by consulting teams in the preparation and submittal of applications, including interview travel if held, are not reimbursable by Knoxville-Knox County Planning. Additionally, any costs incurred by a selected consultant prior to a notice to proceed are not reimbursable by Knoxville-Knox County Planning.

COMPLIANCE WITH LAWS

The consulting firm(s) shall conduct all operations under this contract in compliance with all applicable laws. The consulting firm(s) shall comply with all state and federal regulations pertaining to minimum wage and fair labor standards. The consulting firm(s) shall not discriminate in hiring or any other practice with respect to gender, race, age, creed, religion, or nationality. Knoxville-Knox

County Planning and its officers, officials, agents, and employees shall be indemnified and held harmless for any failure by the consulting firm(s) to comply with any applicable laws, rules and/or regulations.

ADDENDA AND SUPPLEMENTS TO RFQ

In the event that it becomes necessary to revise any part of this RFQ or if additional information is necessary to enable the proposer to make adequate interpretation of the provisions of this Request for Qualifications, a supplement to the RFQ will be posted on the Knoxville-Knox County Planning website.

PROPOSALS TO BE IN EFFECT

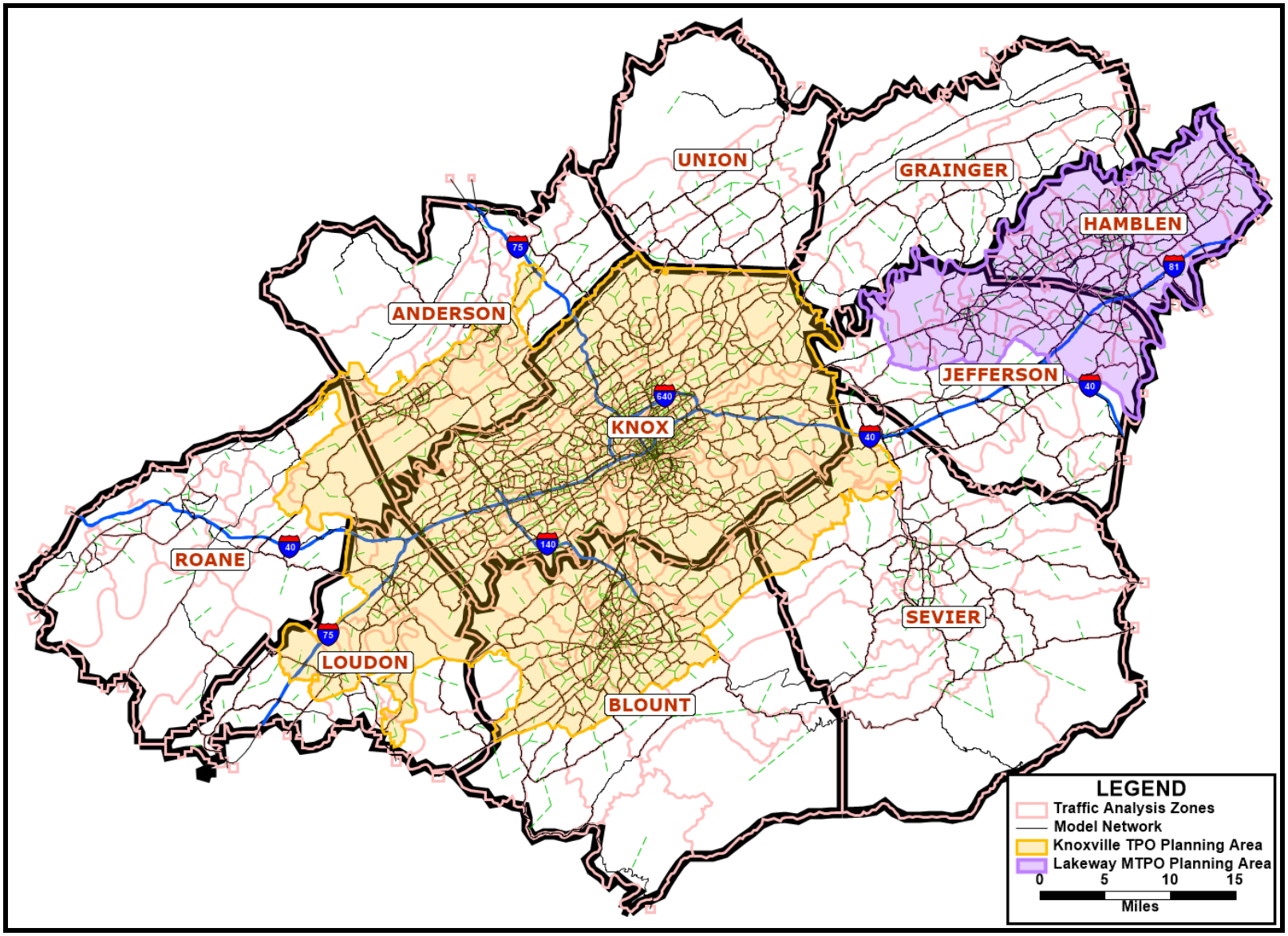
Each proposal/application package shall state it is valid for a period of not less than ninety (90) days from the date of receipt. All proposals shall become the property of Knoxville-Knox County Planning and will not be returned.

INQUIRIES

Questions or inquiries about the RFQ are to be made in writing (email) prior to 4:30 PM EDT on July 14, 2023 and answers will be posted to the RFQ webpage if determined to be necessary to clarify aspects of the solicitation. Origin of the questions will not be identified.

Please direct questions via email to: contact@knoxtpo.org

ATTACHMENT A: TRAVEL DEMAND MODEL COVERAGE AREA MAP



ATTACHMENT B: BACKGROUND AND CHRONOLOGY OF KNOXVILLE TRAVEL DEMAND MODEL UPDATES

Brief History of Knoxville Model Updates:

The Knoxville Regional TPO maintains a 10-county travel demand forecasting model to support transportation planning activities including air quality conformity analyses. The current model is based on a special hybrid platform that blends elements of traditional trip-based (4-step) models with newer tour-based (activity) models. This hybrid model was first delivered to the TPO by the consulting firm Bernardin, Lochmueller and Associates (BLA) in 2009 and has undergone a few minor updates since that time. The first update was completed in 2012 again by BLA and consisted primarily of validating to a 2010 base year and expanding the model geography to include all of the Lakeway Area MTPO planning area. The second update was completed by TPO staff in 2016 and consisted of updating to a base year of 2014 and other minor modifications to support development of the 2040 Mobility Plan that was adopted in April 2017. The most recent update was performed to update the model to be validated to a base year of 2018 and a migration from TransCAD 6.4 to TransCAD 8.0. Additional features of the latest update included development of an embedded post-processing step that generates several inputs needed for the EPA MOVES3 model to support the regional emissions analysis process required for both pollutants of Ozone and PM2.5 that the Knoxville Region is considered an Air Quality Maintenance Area for.

Current Model Platform and Applications:

The full model takes approximately 4 hours to run a complete analysis year scenario, which is an acceptable length of time for most applications. There was previously a separate sub-area model for just the LAMTPO region however that was abandoned due to the difficulty in maintaining separate roadway network and TAZ layers and since the full model run does not take a significant amount of time. The primary purpose of the model is to support development of the long-range transportation plan by running future-year land use scenarios on the existing roadway network to determine deficiencies. Another major model application in terms of satisfying regulatory requirements is in providing output information that goes into the air quality conformity analysis process as part of major plan updates and amendments requiring a regional emissions analysis. The model is also utilized in developing project-level traffic forecasts for roadway projects undergoing the NEPA process as well as for various other small area planning studies as needed. The TPO staff has been capable of maintaining basic elements of the model and coding network changes to run scenarios as needed in-house without relying on outside consultant assistance.

The following two pages provide a short overview of the unique “Hybrid” platform of the Knoxville Model that was produced in 2011. Additional previous model documentation may be downloaded from the webpage where this RFQ was posted.

Hybrid Model Platform Summary Document
Prepared in 2011 by Vince Bernardin, Jr

Knoxville's Hybrid Model

The Knoxville Regional Transportation Planning Organization hired Bernardin, Lochmueller & Associates, Inc. (BLA) to develop a new, advanced travel demand model. Model parameters were estimated from a combined dataset including household travel surveys from 2000 and 2008 as well as an on-board transit survey.

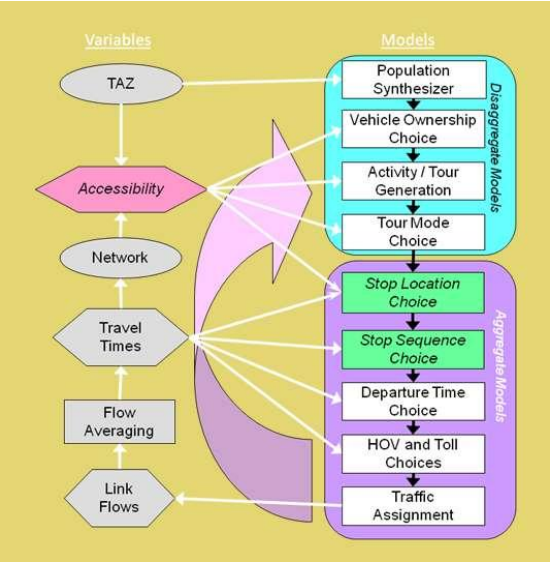
Timeline	
2000	Household Travel Survey
2002	New Trip-based Model
2005	Model Peer-Review
2007	External Cordon Line Survey
2008	Land Use Model (ULAM)
2008	Household Travel Survey
2008	Transit On-board Survey
2009	Hybrid Tour-based Model
2011	Hybrid Model with Expanded Geography

Goals

- Improve model accuracy & address issues with old model (gravity models, k factors, etc.)
- Reflect transportation – land use interactions
- Develop some capability to look at overall levels of walking, biking and transit use
- Ability to evaluate tolling
- Keep model run times and development costs reasonable

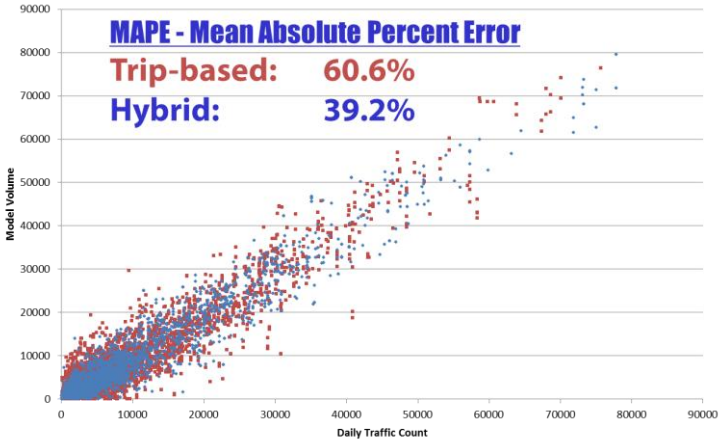
Method

- Starts with a synthetic population and disaggregate logit models like a full activity-based model, only a little simpler
- Then uses an advanced system of inter-related destination choice models to produce aggregate trip tables, like a four-step model produces, only consistent with trip-chaining and tours



Accuracy

- Better able to reproduce traffic counts especially for lower volume roadways than previous model
- Better able to reproduce workers commuting flows from surveys & from CTPP than old model



Costs

Knoxville Hybrid	Typical Activity-Based*
9 months to develop	2-3 years to develop
under $300k (+ data) consultant fees	$600-800k (+ data) consultant fees
Runs in under 4 hours	Runs in 1-2 days
On dual core machines	On computers with 10+ processors

Rossi, T. F., B. Winkler, T. Ryan, K. Faussett, Y. Li, D. Wittl, and M. A. Zeid. Deciding on Moving to Activity-Based Models (or Not). Presented at 88th Annual Mtg of the TRB, Washington,D.C., 2009.

Sensitivity

- Incorporates the effects of the built environment and urban design on travel patterns – shows lower car ownership and more walking with dense, connected streets, good sidewalks & mixed land use
- Shows decreasing VMT with rising gas prices, particularly for low income travelers, from more walking, more transit use, more carpooling, even from less eating out, shopping stops, etc.
- Reflects different travel behavior by seniors, e.g., more driving midday, less at night, etc.

What is a Hybrid Travel Model?

The new Knoxville regional travel model is the first of a new family of hybrid travel models. It is neither a traditional trip-based model, nor a standard activity-based microsimulation model. The new model design was first introduced in concept only three years ago. Since then various components of the new model design have been the subject of academic research. A second model of similar design is now under development for the Evansville (IN) MPO.

The adjective "*hybrid*" refers to two ways in which the new model design blends aspects of four-step and activity-based models and defies traditional categorization. First, hybrid models can be described as trip-based in so far as they essentially produces aggregate trip table matrices of trips between origins and destinations rather than disaggregate records detailing individual travelers' activities. However, hybrid models can also be described as tour-based since the travel patterns they predict can be mathematically proven to be consistent with tours and all travel is segmented within the model by types of tours rather than trip purposes; this has the effect of eliminating non-home-based trips problematic in traditional models. Hence, models of this design are *hybrid trip-based/tour-based* models.

Second, perhaps even more meaningfully, models like Knoxville's are *hybrid aggregate/disaggregate* models. Unlike four-step models which were (traditionally) entirely aggregate and activity-based models which are entirely disaggregate, hybrid models include both aggregate and disaggregate component models. Yet despite its inclusion of disaggregate choice models, there are no random number draws or Monte Carlo simulation. As a result, a hybrid model can produce a forecast of average or expected values from a single run, unlike activity-based or other simulation models which require multiple runs to produce an average forecast. Any difference between two hybrid model runs is directly attributable to differences in their inputs as with traditional trip-based models. Whereas, in simulation models, the multiple model runs are necessary when comparing alternatives to ensure that the difference between model runs results from differences in the alternative inputs rather than from differences in the random numbers drawn for each run.

Limitations

The hybrid approach adopted by Knoxville does have limitations. In many cases, it presents some information, such as on how much people are walking and from which neighborhoods, where a trip-based model typically presents none, but not as much information as an activity-based model can provide, such as how many people are walking on a particular street. As it does not produce disaggregate final outputs, it has limited capacity for the detailed data mining that activity-based simulations can support, such as for some EJ investigations. It also lacks the explicit representation offered by activity-based models of the interactions among household members and of constraints in the timing of travel and activities (although these phenomena are still implicit in this framework). For this reason, it may not be as well suited to studying complex temporal effects, such as may occur from time variable tolling schemes, but it can capture basic temporal effects such as peak-spreading from congestion.

Applications

Knoxville's 2013 long range transportation plan update will be the first major use its hybrid model. In addition to traditional roadway forecasting and level-of-service analysis, etc., the hybrid model will be used to compare status quo vs. sustainable growth land use scenarios and provide information on mode shifts to transit in response to transit-oriented-design (TOD) and shifts to walking/bike with denser, mixed use development patterns. The table above offers a high level comparison of the sorts of scenario evaluation that fout-step, hybrid and activity-based models can support.

Scenarios\Models	Four-Step	Hybrid	Activity-Based
Roadway Improvements	✓	✓+	✓+
Density/Mixed Use/TOD	✘	✓	✓+
Higher Gas Prices	✘	✓	✓
Aging Population	✘	✓	✓
Detailed EJ Analysis	✘	✓-	✓+
Time Variable Tolling	✘	?	✓