An Application of TRANSIMS to the Analysis of Multimodal Corridors in the Greater Phoenix Metropolitan Region

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U.S. Department of Transportation
Federal Highway Administration

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In Partnership with
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Valley Metro Light Rail (METRO), Phoenix, AZ

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The proposed project involves the application of TRANSIMS (Transportation Analysis and Simulation System) to analyze multimodal corridors in the Greater Phoenix Metropolitan Region. The State of Arizona and the Greater Phoenix Metropolitan Region in particular are experiencing very rapid growth in population, employment, and travel demand. One of the most critical investments being made in the region to address growing travel demand is the construction of a new 20-mile light rail line scheduled to begin service in December 2008. Several additional corridors are being considered for light rail expansion in the future.

TRANSIMS is a comprehensive activity-based microsimulation model of travel demand and supply that offers the ability to forecast activity-travel patterns of individuals and vehicles along the continuous time axis. In the context of modeling and simulating a complex multimodal corridor, TRANSIMS may provide capabilities that existing four-step travel demand models and traffic simulation packages (that are not tightly integrated with demand models) are not able to provide. As many urban areas around the country are grappling with multimodal corridor simulation and modeling challenges, particularly in the context of FTA New Starts Analysis, a perfect opportunity exists to apply and test TRANSIMS in a large multimodal urban setting.

The research team comprises a university – industry – public agency partnership including the Arizona State University (ASU), HDR, Inc. (HDR), Resource Systems Group, Inc. (RSG), Maricopa Association of Governments (MAG), and Valley Metro (METRO). The research team will apply TRANSIMS to selected light rail corridors under consideration by the planning agencies. Using real-world before-and-after light rail data from the 20-mile starter line opening in December 2008, selected modules of TRANSIMS will be enhanced, calibrated, and validated. The validated model will be applied to corridors under consideration to forecast travel and network performance impacts of light rail for those selected corridors. Finally, the simulation will be interfaced with the high-power computational and visualization capabilities of the ASU Decision Theater to produce a realistic animation of TRANSIMS results that could serve as an aid in policy/investment evaluation.
PROBLEM STATEMENT

The Greater Phoenix Metropolitan Region is one of the fastest growing regions in the country and is fast becoming one of the largest metropolitan areas in the country. According to Census estimates, from 2000 to 2006, the region grew by 787,306 people, the fourth largest gain for a metropolitan area in the United States. During this six-year period, the population of the region grew by 24 percent and the region became the 13th largest metropolitan area in the country with a population of more than 4 million residents. In the one year from 2005 to 2006, the region ranked first in the country with respect to the number of people moving to the area from other regions of the country. Nearly 100,000 people moved to the Region within this one year time frame and accounted for more than one-half of the total population growth experienced by the region within the one year period. In combination with constraints imposed by the arid climate, desert landscape, and water availability, this rapid growth is threatening the quality of life in the region by resulting in choking levels of traffic congestion and vehicular emissions. Planning agencies in the region have been exploring numerous innovative transportation policies and solutions – such as multimodal investments in transit services, intelligent transportation systems (ITS), and managed lane options – to help manage and accommodate growing travel demand.

Although the Phoenix region is undoubtedly at the leading edge of travel demand growth, it is not alone when it comes to facing transportation challenges. Many urban areas around the country, particularly those in the South and West, are facing rapid increases in population and travel demand. Like the Phoenix region, they too are considering numerous innovative multimodal transport investments and policy solutions, and one of the most noteworthy among these is the implementation of light rail lines along congested corridors. In the Phoenix region, a 20-mile light rail line is scheduled to begin service in December 2008 and several additional corridors are under consideration for light rail expansion/extensions. The Regional Transportation Plan includes 37 miles of future high capacity/light rail transit extensions in Phoenix, Tempe, Mesa and Glendale. The initial 20-mile line will serve major traffic generators such as Downtown Phoenix and Arizona State University (ASU) (both Tempe and Downtown Campuses) and will include a series of park-n-ride lots at selected stations along the route (http://www.valleymetro.org/METRO_light_rail/).
On a similar note, numerous metropolitan areas around the country, including Salt Lake City, Charlotte, Denver, Portland, and Dallas, have projects underway for the implementation and/or expansion of light rail service. Virtually all of the light rail projects in the country are being undertaken with significant support (about 50-60 percent of total cost) from the Federal Transit Administration (FTA) through its New Starts program. The New Starts program is very competitive as the number of regions competing for funding far outstrips the available resources. The FTA can only provide resources for those projects where travel forecasts are robust and clearly show user benefits that exceed the cost of implementing the project. As a result, the FTA subjects travel models to intense scrutiny to ensure that the forecasts accurately reflect the travel behavior impacts of light rail service – and therein lies the problem.

Most, if not all, travel forecasts are based on four-step travel demand modeling systems that are not particularly well-equipped to handle the range of behavioral changes brought about by a light rail investment. Changes in mode choice (i.e., light rail use) are linked to time of day choice, destination choice, trip chaining behavior, and access- and egress- considerations, all of which are highly interwoven with one another. In addition to the demand side of travel forecasts, one needs to also give careful consideration to the supply side and traffic network performance aspects related to light rail implementation. In situations where light rail lines operate in mixed traffic, various traffic flow optimization techniques (including, for example, signal priority for light rail) may be implemented to favor light rail operations while simultaneously optimizing vehicular traffic flow. The supply side dynamics are likely to impact demand side behavioral choices as well. Thus, there is a clear need to account for feedback between supply and demand in a tightly integrated fashion, something that is not particularly well done in existing four-step travel demand models.

It is in this context that the profession has been showing increasing interest in the activity-based microsimulation modeling paradigm for travel demand forecasting. While there are a handful of activity-based and tour-based microsimulation models developed by researchers and/or consultants in place around the country (and the world), the Federal Highway Administration (FHWA) has spearheaded the development and deployment of TRANSIMS. TRANSIMS, originally developed by scientists at Los Alamos National Laboratory (LANL), is a comprehensive Transportation Analysis and Simulation System capable of modeling activity-travel patterns of individual travelers and vehicles in detailed multimodal
transportation networks along the continuous time axis. More importantly, it is virtually the only activity microsimulation model that has integrated the demand and supply sides of the modeling process in a tightly interwoven framework that allows consistent feedback between the demand and supply sides of the model. TRANSIMS therefore offers much promise for metropolitan areas that are thirsting for robust models capable of simulating activity-travel demand and network performance in a multimodal context. This research project is aimed at applying TRANSIMS in a multimodal analysis context where its need is felt most with a view to accelerate its deployment in practice. If this project demonstrates how, when, where, and why TRANSIMS is a useful planning tool for the analysis of multimodal corridors (where, for example, urban areas are considering light rail service), then it will provide a significant breakthrough in the acceleration of TRANSIMS deployment in practice.

One of the key strengths of TRANSIMS (similar to other microsimulation models) is its ability to trace activity-travel paths of individual travelers and vehicles along the continuous time axis. This strength can be best utilized in transport policy decision-making if one is able to visualize dynamic microsimulation outputs using high-fidelity and computationally efficient graphics and animation displays. The ASU Decision Theater (http://dt.asu.edu) serves as a unique computational and dynamic visualization facility for graphically displaying TRANSIMS results/outputs along the continuous time axis. Individual travelers and vehicles can be viewed and the impacts of alternative multimodal scenarios can be evaluated. In this project, the ASU Decision Theater will play a key role in providing the computational and visualization capabilities needed to run and graphically display TRANSIMS results.

A unique research team consisting of an academic institution and two leading transportation planning/modeling consulting firms, in partnership with two key planning agencies in the Phoenix Region, has been assembled for undertaking this project. This project is of great relevance, both nationally and locally. As mentioned earlier, numerous urban areas around the country, and the Phoenix Region in particular, are considering light rail investments and are struggling to modify existing four-step models for analyzing alternative light rail scenarios. The research team has the expertise, experience, data resources, and computational power needed to successfully undertake this test application of TRANSIMS. The planning agencies are committed to participating in all phases of the project and reviewing the model results for potential use in light rail planning and evaluation.
This section of the proposal presents the work plan that will be followed by the research team for the successful accomplishment of the project objectives. The research team will adopt a phased approach to the work plan to ensure adequate opportunity for feedback and peer review throughout the course of the project. The phased approach will also help define deliverables and allow adjustments in the work plan based on results of a preceding project phase.

The research team will largely obtain the data needed for this project from the partner agencies, MAG and METRO. In addition, the research team will engage in considerable data preparation and set up tasks at various stages of this project so that the databases are TRANSIMS compatible. Thus, the research team envisions that there will be no issues related to acquiring the data necessary to run and deploy TRANSIMS for purposes of this project. With respect to running TRANSIMS from a computational standpoint, the expertise of Resource Systems Group, Inc. (RSG), will prove very useful. RSG is currently undertaking an effort that involves the deployment and application of TRANSIMS in the Burlington, VT area. As part of that effort, RSG (in collaboration with the University of Vermont) has deployed TRANSIMS in a high-power computing environment. A similar process will be followed in the context of this project. The ASU Ira A. Fulton School of Engineering High Performance Computing Initiative (HPCI) provides the ideal environment and computational system (hardware and software) for running TRANSIMS (the computational capabilities are described in greater detail in Part II of the proposal). The HPCI has a computing cluster that is specially dedicated to the ASU Decision Theater, a unique facility for visualizing dynamic simulations in a panoramic display. The HPCI-Decision Theater computing systems will be used to run TRANSIMS and simultaneously display the results in a dynamic 3-D visualization environment.

**PROJECT OBJECTIVES**

The overall goal of the project is to apply TRANSIMS for the analysis of multimodal corridors in the Greater Phoenix Metropolitan Region, thereby demonstrating how, when, where, and why TRANSIMS
can serve as a useful planning tool for evaluating multimodal transportation investments. In particular, the specific objectives of the project are to:

- apply TRANSIMS for analyzing multimodal network performance under mixed traffic conditions using alternative traffic control strategies
- enhance, calibrate, and validate demand models in TRANSIMS using household travel survey data and before-and-after light rail data collected in the Greater Phoenix Metropolitan Region
- analyze alternative multimodal (light rail) corridor scenarios using TRANSIMS
- identify how, when, where, and why TRANSIMS would serve as a useful multimodal planning tool
- demonstrate the strengths of TRANSIMS microsimulation through graphic animation and visualization in the ASU Decision Theater
- develop a series of “how-to” guides so that practitioners will be able to implement TRANSIMS technologies and modules in their specific planning context.

PLANNED PHASES AND TASKS

The research team envisions undertaking several tasks within planned project phases to accomplish the objectives outlined above.

Phase 1: Project Set Up

This phase involves the installation and set up of TRANSIMS along with the set up of input databases and networks needed to run TRANSIMS.

Task 1-1: Set up and Installation of TRANSIMS

TRANSIMS software and source code is available under the NASA Open Source Agreement v1.3 at [http://sourceforge.net/projects/transims](http://sourceforge.net/projects/transims). FHWA has prepared a user-friendly installation package, along with sample data sets, for setting up and testing the installation of the TRANSIMS software. The research team will work closely with FHWA to set up, install, and test the TRANSIMS software package. Resource Systems Group, Inc. (RSG) has already successfully navigated the learning curve and it is envisioned that their experience will help the research team accomplish this initial installation and setup very quickly. In addition to the core TRANSIMS software, the research team will obtain copies of all utilities and programs that help convert existing data and trip tables into TRANSIMS-useable format.
**Task 1-2: Identify Multimodal Corridors and Model Subareas**

Within the scope of this project, the focus is on the simulation of demand and network performance for multimodal corridors with particular emphasis on those corridors where light rail lines are under consideration. It would be prohibitive to implement TRANSIMS for the entire Greater Phoenix Metropolitan Region. The size of the region and the data needs would be too large to accommodate within the available project resources. The research team will work closely with MAG and METRO to identify a selected set of multimodal corridors where light rail lines are under consideration (in addition to the 20-mile line that is scheduled to open in December 2008). For each identified corridor, the research team will work in partnership with MAG and METRO to define a model subarea that may be considered the influence area of the selected multimodal corridor (light rail line).

**Task 1-3: Prepare and Set Up Input Databases and Multimodal Networks**

The research team will prepare and set up input databases and multimodal networks for the model subareas identified and defined in the previous task. For each model subarea, the research team will set up socio-economic databases including base year and forecast year information, multimodal networks with and without the proposed light rail lines, and other input data needed to run TRANSIMS. The research team will work very closely with the partner agencies, MAG and METRO, to obtain the data needed for this project. The research team will also obtain detailed demand data that is currently available from the existing four-step travel demand model. These include demand/ridership estimates, traffic volumes, and origin-destination trip tables that are provided by the four-step travel demand model for the variety of light rail scenarios defined in the previous task.

**Task 1-4: Estimation of TRANSIMS Models/Parameters Using Local Survey Data**

There may be modules within TRANSIMS that merit re-estimation using locally available travel survey data. MAG and METRO have been collecting a wealth of survey data for the region and several additional surveys are planned in the near future. Valley Metro has conducted comprehensive on-board transit surveys for the Valley’s bus system in 2007. The most recent household travel survey in the region was conducted in 2001 and the next one is scheduled for Fall 2008. A survey of ASU faculty, staff, and students was conducted in 2007 to measure the potential impact of ASU on light rail patronage. As part of the initial 20-mile light rail line evaluation process, Valley Metro is conducting a before-and-after
survey of transit patronage; the “before” survey has been completed and the “after” survey will be conducted in early 2009 to gauge changes in behavior brought about by the light rail line. The mode and destination choice models embedded in TRANSIMS may be substituted with existing model components from the MAG Regional Travel Demand Model or new models estimated on local survey datasets collected in the Greater Phoenix Metropolitan Region.

**Task 1-5: Prepare Phase 1 Report**

The research team will prepare a report summarizing the work accomplished in and results of various tasks undertaken in the first phase of the project. The report will focus on the software installation and set up process, the preparation of input databases, and the substitution of default TRANSIMS parameters and models with those obtained using local travel survey data.

**Task 1-6: Incorporate Peer Review and Feedback**

The research team will provide the Phase I report to FHWA and a specially constituted peer review panel for this project. The peer review panel will consist of both national and local experts and stakeholders. Review comments and feedback from the peer panel will be incorporated into a final and revised Phase 1 report and Phase 2 work plan.

**Phase 2: TRANSIMS Multimodal Mixed-Traffic Network Microsimulation**

This phase involves running the TRANSIMS traffic microsimulator using demand estimates and origin-destination trip tables from the existing four-step travel demand model. This phase is similar to Track 1 of the Portland, Oregon implementation of TRANSIMS where existing trip tables, combined with the TRANSIMS Router and Microsimulator, were used to develop regional simulations of travel.

**Task 2-1: Format and Set Up Four-Step Model Trip Tables and Demand Estimates**

The research team will format and set up the origin-destination trip tables and demand data from the existing four-step travel demand model. In this task, light rail ridership estimates and origin-destination trip tables for base-year conditions and for a series of light rail corridor scenarios will be compiled for use in this project. The data will be formatted and restructured using utilities that have been developed and made available to the user community at the TRANSIMS website through the TRANSIMS open source agreement.
Task 2-2: Calibration of TRANSIMS Router and Microsimulator Using Existing Multimodal System

The TRANSIMS Router and Microsimulator will be calibrated to local conditions using demand data for existing multimodal transportation systems in the Greater Phoenix Metropolitan Region. All of the light rail corridors under consideration already have bus service (and possibly Express Bus Service), thereby constituting a multimodal network. The research team will take the demand data compiled in Task 2-1 and apply the TRANSIMS Router and Microsimulator with a view to replicate base year traffic conditions. The TRANSIMS Router and Microsimulator would then be ready to be applied for analyzing alternative scenarios in the region.

Task 2-3: Develop/Define Mixed Light Rail – Highway Traffic Control Scenarios

The research team will develop a series of mixed multimodal traffic network scenarios for which TRANSIMS Router and Microsimulator performance can be tested. The scenarios will be characterized by service frequency (of light rail), nature of mixed traffic conditions, signal pre-emption and priority schemes, and other mixed traffic protocols and traffic control strategies that may be considered. The research team will work closely with partnering agencies (MAG and METRO) to define the mixed traffic scenarios that would be of interest to the agencies.

Task 2-4: Apply TRANSIMS to Mixed Multimodal Traffic Network Scenarios

In this task, the research team will apply TRANSIMS to the mixed multimodal traffic network scenarios to simulate network performance under a variety of traffic control protocols and systems. Again, within this phase, the demand data will be treated as given by the existing four-step travel demand model. Only the TRANSIMS Router and Microsimulator will be applied and tested in this phase of the project.

Task 2-5: Visualize and Evaluate TRANSIMS Microsimulation Results in ASU Decision Theater

The TRANSIMS output from the previous task will be visualized in the ASU Decision Theater. The ASU Decision Theater is a unique facility that combines the computational power and visualization capabilities necessary for graphically displaying the output of dynamic microsimulation models such as TRANSIMS. In this task, the research team will work closely with staff members of the ASU Decision Theater to interface the TRANSIMS output with the computational and visualization software of the ASU Decision Theater. The TRANSIMS output for the various scenarios considered in this phase of the project will be
visually displayed in the Decision Theater to assess and evaluate the TRANSIMS Router and Microsimulator as a traffic network microsimulation tool in the context of multimodal corridor analysis.

**Task 2-6: Prepare Phase 2 Report**

The entire effort, data, experimental design, and results will be documented by the research team in a Phase 2 report. The report will focus on the conversion of trip tables and demand data to a TRANSIMS-compatible format, the experimental design (definition of scenarios), and results obtained from the Router and Microsimulator. The report will include a discussion on how best the Router and Microsimulator can be used for multimodal corridor simulation in conjunction with demand estimates derived from an existing four-step demand model.

**Task 2-7: Incorporate Peer Review and Feedback**

The Phase 2 report will be provided to a peer review panel for feedback and comments. The research team will present the report and key findings to the peer review panel during a face-to-face meeting. The Phase 2 report will be revised to incorporate the feedback and suggestions received from panel members.

**Phase 3: Full TRANSIMS Microsimulation of Multimodal Corridors**

This phase of the project constitutes a full-fledged implementation and application of TRANSIMS.

**Task 3-1: Assemble Before-and-After Light Rail Data**

The 20-mile light rail starter line is scheduled to begin operation in December 2008. MAG and METRO have already collected travel survey data for the “before” condition and will be collecting survey data soon “after” the opening of the light rail line in Spring 2009. The research team will obtain the before-and-after travel survey data and assemble it in a form that would allow the validation and refinement of the demand modules in TRANSIMS. TRANSIMS data conversion utilities will be used extensively in this task.

**Task 3-2: Refine and Validate TRANSIMS Demand Modules**

TRANSIMS includes an activity-based travel demand model (Activity Generator) and trip planner for simulating travel behavior on the demand side. The research team will use the before-and-after data to refine and validate the activity-based model component of TRANSIMS. The local travel survey data can be used to customize TRANSIMS models, parameters, and coefficients to local conditions. In addition, TRANSIMS can be validated using ground counts of traffic volumes. However, the model should be able
to capture the range of behavioral changes or impacts due to light rail. With before-and-after data, the research team will be able to refine the mode choice, destination choice, and other modules of the activity generator and validate the trip planner. The refined and validated TRANSIMS now not only replicates base year ground counts, but also accurately reflects the impacts of multimodal corridor investments on travel behavior.

**Task 3-3: Run All TRANSIMS Components for Multimodal Corridors**

In this task, the research team will run all TRANSIMS components for the selected multimodal corridors identified in Phase 1. While Phase 2 focused on the application of the Router and Microsimulator, this phase will involve all components and modules of TRANSIMS. TRANSIMS activity generator and trip planner modules will be applied to various scenarios along selected multimodal corridors to simulate activity-travel patterns of individual travelers and vehicles. In this context, it should be noted that TRANSIMS operates on individual travelers and vehicles – not on traffic analysis zones. As such, it is likely that the population synthesizer will have to be run to generate a synthetic population of households and travelers. However, within the scope of this project, the population synthesizer will not be critically examined and evaluated. Instead, it will be used to generate a synthetic population and then the primary focus of the research effort will be on the activity generator, trip planner, and traffic microsimulator modules of TRANSIMS for multimodal corridor analysis.

**Task 3-4. Visualize and Evaluate TRANSIMS Microsimulation Results**

In this task, the TRANSIMS microsimulation results will be visualized within the ASU Decision Theater. All TRANSIMS modules will be interfaced with the computational and visualization hardware of the ASU Decision Theater so that the output can be graphically displayed and animated in real time. Based on the graphical display, the research team hopes to evaluate the results provided by TRANSIMS with respect to traditional measures of effectiveness such as intuitive reasonableness and nature and magnitude of response to changes in input conditions.

**Task 3-5. Prepare Phase 3 Report**

The research team will prepare and deliver a Phase 3 report that describes the results of the full-fledged TRANSIMS application effort. The report will provide detailed information on the model validation,
experimental design, and application results. The report will include an assessment of how TRANSIMS modules can be used in the context of multimodal corridor assessment.

**Task 3-6. Incorporate Peer Review and Feedback**

The research team will incorporate all peer review feedback into the Phase 3 report. The research team will meet personally with the peer review panel to discuss findings and obtain comments.

**PROJECT SCHEDULE**

An 18-month project duration is envisioned for this effort. Table 1 shows the proposed project schedule.

**Table 1. Proposed Schedule for Project**

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*Note: X denotes a major milestone deliverable; X* denotes the same deliverable submitted in a revised format following incorporation of feedback and comments received from the peer review panel.*

**PROJECT DELIVERABLES**

The research team plans to produce a series of deliverables during the course of the project. The specific deliverables, the contents and objectives of the deliverables, and the time point at which each deliverable will be produced and submitted are provided in Table 2.
Table 2. Description of Proposed Project Deliverables

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Description of Contents</th>
<th>Time Point of Submission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td>Comprehensive project website with all project resources</td>
<td>Continuous</td>
</tr>
<tr>
<td>Phase I Report</td>
<td>Complete description of Phase 1 effort, tasks, and results</td>
<td>Month 4-5</td>
</tr>
<tr>
<td>Phase 1 Databases/Programs</td>
<td>All Phase 1 databases and computer programs</td>
<td>Month 4-5</td>
</tr>
<tr>
<td>Phase 2 Report</td>
<td>Complete description of Phase 2 effort, tasks, and results</td>
<td>Month 11-12</td>
</tr>
<tr>
<td>Phase 2 Databases/Programs</td>
<td>All Phase 2 databases and computer programs</td>
<td>Month 11-12</td>
</tr>
<tr>
<td>Phase 3 Report</td>
<td>Complete description of Phase 3 effort, tasks, and results</td>
<td>Month 17-18</td>
</tr>
<tr>
<td>Phase 3 Databases/Programs</td>
<td>All Phase 3 databases and computer programs</td>
<td>Month 17-18</td>
</tr>
<tr>
<td>How To Documents</td>
<td>3 How-To documents describing procedures for applying TRANSIMS to multimodal corridor analysis</td>
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<tr>
<td></td>
<td>- Database preparation</td>
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<td>- Procedures for running TRANSIMS</td>
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<td>- Interpreting the TRANSIMS output</td>
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<td>Month 18</td>
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<tr>
<td>Final Summary</td>
<td>Executive Summary of entire project</td>
<td>Month 18</td>
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</tbody>
</table>
**PEER REVIEW**

The research team is committed to developing a rigorous peer review process in the context of the proposed project. A peer review panel of experts will be assembled in close cooperation with FHWA staff. The panel will include practitioners, TRANSIMS users/experts, academics and researchers, and planning agency staff. All deliverables will be sent ahead of time through electronic means to all peer review panel members. Four face-to-face meetings (at least two of which will happen during the Annual TRB Meetings to cut down on travel expenses) will take place with the peer review panel. The research team will present research results, discuss the work plan, and solicit feedback and comments. In addition, the research team will conduct teleconferences and web-conferences with the peer review panel as needed to brainstorm ideas, obtain advice, or discuss interim results.

**USER COMMUNITY PARTICIPATION**

The research team will actively engage with the TRANSIMS user community at [http://transims-opensource.org/](http://transims-opensource.org/). The research team will participate in the discussion forums and e-mail groups of the community and post information on experiences gained in the context of the application of TRANSIMS in this project. The research team will extensively utilize and add to the source code, programs, utilities, and procedures available at the TRANSIMS open source website. The research team will maintain a project website with all datasets, procedures and programs, and deliverables throughout the duration of the project and beyond. This project website will be linked to the TRANSIMS open source website so that users will have full access to the materials generated by the project. In addition, all materials will be deposited in the TRANSIMS open source website so that there is some redundancy built into the availability of resources to the community. The research team will conduct periodic webinars on the project and share project related information and findings. The research team will post information on the project to the TMIP listserv to share ideas and findings with a wider audience. It is to be noted that all procedures, programs, and source code generated in this project will remain open source and be available to the community for use and further enhancement in the future.
The research team will work closely with MAG and METRO to acquire the databases necessary to successfully deploy TRANSIMS in the analysis of multimodal corridors. MAG and METRO have undertaken or are planning a series of survey data collection efforts that provide data useful for this study:

- 2001 Household Travel Survey data and planned Fall 2008 Household Travel Survey Data
- Surveys of Special Generators including Arizona State University and Phoenix Sky Harbor Airport

In addition to these data sets, the research team will acquire socio-economic databases, detailed model highway and transit networks, transit schedules, and other input databases that currently drive the four-step travel demand model in the region. Various model components including the mode choice model, speed-flow curves, gravity model, and trip production/attraction models will also be acquired as part of this study. The idea is that various TRANSIMS modules can either be replaced with local model components or calibrated to local travel survey data. Traffic counts, transit ridership, and other data useful for model validation will also be obtained from these agencies and used to validate TRANSIMS.

The research team will work closely with MAG and METRO to enhance the model highway network using Census Tiger files so that the sophisticated microsimulation capabilities of TRANSIMS can be exploited in the context of this project. The specific multimodal corridors and model subareas will be identified in consultation with MAG and METRO so that the analysis conducted in this project would be of potential use to the agencies. METRO has coordinated the collection of before-and-after survey data to assess the impact of the initial 20-mile light rail line on travel behavior. The “before” portion of the survey will be available to the research team as soon as the project is awarded. The first “after” portion of the survey will be available to the research team by April 2009, just in time for model calibration and validation in Phase 1 of the project. Additional “after” survey data will become available throughout 2009 and the research team envisages re-calibrating and re-validating the model in Tasks 2-2 and 3-2 to ensure that it accurately reflects changes in travel patterns brought about by the introduction of a light rail line. As the research team has ample multiple opportunities to validate the model using before-and-after survey data, there is no concern regarding the timing of data availability in the context of this project.
A strong research team has been assembled to undertake this project. The research team represents the ideal university – industry – public agency partnership that is critical to the success of an endeavor of this nature. Professor Ram M. Pendyala of the Arizona State University will serve as the principal investigator for the project. He is an internationally renowned authority in travel demand modeling and activity-based microsimulation of activity-travel patterns. He will be assisted by his post-doctoral research associate, Dr. Xin Ye, who is an expert in high-end computer modeling and travel microsimulation. Dr. Perry Miller, who worked for several years in the ASU Decision Theater and is now with the ASU High Performance Computing Initiative, is an expert in computer visualization, animation, and high-power computing.

The Ira A. Fulton School of Engineering High Performance Computing Initiative (HPCI; http://hpc.asu.edu/index.php) at Arizona State University offers world-class high performance computing to the engineering school's researchers and their industrial partners. The HPCI main facility supports more computing power per square foot than virtually any other university facility; 750,000 watts in only 1,200 sq. feet. It totals approximately 1,000 processors, each as fast as or faster than a single top-of-the-line desktop computer. The facility's central computing cluster, Saguaro, is capable of sustained performance of more than four trillion computations per second (two teraflops) on 400 processors. Within the next year, the Fulton HPCI will provide 30 Teraflops of computing power, more than any academic computing center can currently provide. Most academic computing centers are limited in growth by their cooling capacity. The Fulton HPCI has constructed machine room facilities with innovative new cooling technologies, which will provide available thermal capacity far beyond what is available at any other university today. The HPCI has created an advanced campus-area grid infrastructure for the School, providing both large central computing facilities and leveraging distributed satellite computer clusters assigned to particular laboratories. One of the key satellite clusters is dedicated to the ASU Decision Theater, a state-of-the-art facility for visualizing dynamic 3-D urban simulations (http://dt.asu.edu).

Two nationally recognized consulting firms are on the team. First, the Phoenix-based office of HDR, Inc. is on the team. HDR, Inc. is the consulting firm that is assisting MAG and METRO in defining and analyzing alternative light rail corridors. HDR, Inc. is applying the MAG Regional Travel Demand
model for forecasting ridership and assessing user benefits as per the FTA New Starts analysis methodologies. Staff from HDR, Inc., led by Mr. Marc Soronson who brings more than 20 years of experience and expertise in large scale transit analysis, will play a critical role in defining the light rail corridors, generating input databases, and evaluating the reasonableness and performance of TRANSIMS model runs. Second, Resource Systems Group, Inc. (RSG) is on the team. RSG has a proven track record of implementing innovative and cutting-edge travel model solutions for agencies around the country. RSG is currently working on an implementation of TRANSIMS for the Burlington, VT area and has gained valuable expertise and experience in setting up, installing, debugging, and running TRANSIMS. Their inclusion on the team essentially means that the learning curve on the proposed project will be minimal to none. This will help conserve project resources, minimize the potential for a project delay, and help maximize the effectiveness of the project for deploying TRANSIMS. Staff from RSG, Inc., led by Dr. Thomas Adler who brings more than 20 years of experience and expertise in innovative travel data collection and travel demand modeling, will play a critical role in helping execute TRANSIMS runs and interpreting the output for the variety of multimodal corridor scenarios considered in this project. Resume’s of key staff personnel are included in this proposal following this page; however, it should be noted that not all staff resume’s have been included in the proposal in the interest of brevity.

PLANNING AGENCY SUPPORT

The research team enjoys strong support from two planning agencies in the region that are critical to the success of the project. The Maricopa Association of Governments (MAG) is the Metropolitan Planning Organization (MPO) for the region. MAG has been at the cutting edge of travel demand modeling and is implementing a series of model improvement initiatives to transition to new activity-based microsimulation models of travel demand. Valley Metro (METRO) is the regional transit agency for the Greater Phoenix Metropolitan Region. METRO is committed to the development of a multimodal transportation system in the region and is working closely with MAG to develop and apply state-of-the-art tools for modeling light rail corridors. Both MAG and METRO are committed to this project and have provided letters of support and cooperation (attached at the end of this section).