INTRODUCTION

Purpose

The Rhode Island Statewide Travel Demand Forecasting Model (henceforth referred to as the RI State Model) was prepared by Louis Berger & Associates (LBA) under contract to the Rhode Island Department of Transportation. The RI State Model facilitates the State of Rhode Island's compliance with air quality and congestion management requirements set forth by the 1990 Clean Air Act Amendments (CAAA) and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The initial use of the RI State Model was to evaluate Rhode Island's Transportation Improvement Program (TIP) to determine project conformity to requirements of the CAAA. Later the model was used in different studies such as corridor planning, traffic management, strategic planning, high occupancy vehicle (HOV) studies, testing of travel demand management (TDM)/transportation system management (TSM) strategies, project level modeling, testing landuse scenarios and other congestion management system (CMS) strategies.

Features

The RI State Model was developed using TransCAD, a Geographic Information System (GIS) software package for planning, management, operation, and analysis of transportation systems and facilities. TransCAD is capable of directly reading many data files (e.g., STF 3A, PL94-171, and TIGER/Line files), thus allowing the street database, area database, and much of the 1990 socioeconomic data to be imported directly from these sources.

The RI State Model is a multi-modal model with highway, transit, and high-occupancy vehicle (HOV) components. It consists of nearly 1000 traffic analysis zones, thus allowing statewide as well as subarea transportation projects to be modeled. To facilitate long-range transportation planning, the RI State Model contains data for five years: 1990, 1996, 1999/2000, 2010, and 2020. Information for all five years is contained in one database allowing for powerful and convenient data analysis and management. Socioeconomic data, roadway attributes, and the network itself can be modified to evaluate land use and roadway alternatives. Peak hours and off-peak hours can be modeled.

In addition to projecting travel demand, the RI State Model produces projections, stratified by functional classification, of vehicle-miles traveled (VMT), and vehicle-hours traveled (VHT). This data can be used with Mobile 5.0A, a mobile source inventory model for emissions analysis.

Software for the Model--TransCAD

Preceding development of the RI State Model, several software packages were assessed as possible platforms for development of the RI State Model. Each of these software was examined relative to a common set of evaluation criteria. The evaluation process led to selection of TransCAD as the software
for developing the RISM. TransCAD also provides ready compatibility with the Rhode Island Department of Administration, Division of Planning (RIDOA/P) data sources and analyses because of their use and application of TransCAD’s geographic informational system (GIS) functions.

TransCAD’s Geographic Information System (GIS) capabilities were more attractive and suitable to the needs of this project than many other complex transportation modeling capabilities. TransCAD helps transportation professionals store, display, manage, and analyze transportation data. Information on transportation networks, freight flows, routes, schedules, traffic analysis zones, and transportation system performance can be stored, displayed, and analyzed at any spatial scale with ease.

**Trip Generation**

Four trip generation models were tested for the RI State Model. Three basic criteria were used to evaluate the alternative trip generation models:

1. accuracy in representing existing activity,
2. predictive power, and
3. relative ease in forecasting the required input variables.
4. The final trip generation model used the following socioeconomic variables in the enactions: population, employment and auto registration.

**Calibration**

Calibration was performed in two stages: in the first stage, cordon line and cut line calibration was performed in accordance with *Calibration and Adjustment of System Planning Models*, Federal Highway Administration, December 1990. In the second stage, detailed link volumes were calibrated with the SPME procedure in TransCAD. The guidelines provided in the FHWA report "Calibration and Adjustment of System Planning Models" was used to measure model effectiveness.

**Forecasting**

Future year forecasts were based on a simple Fratar process. Since the Fratar process is based on factoring, growth factors from 1990 to 1996, 1999/2000, 2010, and 2020 had to be defined for each zone. For the internal zones in the study area, the growth factors were based on changes in auto registrations and employment at the zonal level. The external station growth factors were based on historic traffic growth. The future year socioeconomic data were then used with the trip generation equations to obtain zonal growth factors for each forecast year. The Fratar model in TransCAD was then applied to the base year 1990 calibrated trip table to arrive at forecast year trip tables. Also, the design engineers often preferred the growth factors for each TAZ to future year volumes obtained from detailed traffic assignments. Hence, a matrix of growth factors for different forecast years for each town was created.

**Applications of the Model**

The RISM was applied in several projects in a regional as well as statewide level to test and
demonstrate its potential uses. Some of the projects and the type of application in which the model was used are given below:

- Air Quality Analysis--Conformity Analysis
- East Providence Case Study--Corridor Planning
- Washington Bridge Case Study--Traffic Management
- Combination of Projects--Strategic Planning
- Moshassuck Case Study--Test Land Use Scenarios
- Route 10 Upgrade Project--HOV Modeling
- Apponaug Circulator Project--Project Level Modeling

Coordination with Rhode Island Agencies

Throughout the course of the contract, LBA coordinated extensively with the Rhode Island Department of Transportation (RIDOT), the Division of Intermodal Planning, and the Rhode Island Department of Administration, the Division of Planning (RIDOA/P). Extensive coordination meetings provided both agencies with the opportunity to review the model in its developmental stages. Accordingly, as work by LBA progressed, revisions were made to the RI State Model to address the needs of both agencies.

Model Documentation

LBA also prepared an extensive documentation of the RI State Model. The document provides detailed documentation of the model; its development; data used in model preparation; the sources of that data; any assumptions used in model preparation; and the results of alternative tests conducted during model development. Appropriate chapters also include a discussion of the relevant TransCAD procedures used and clarifications and/or corrections to the step-by-step process for those procedures provided in the TransCAD users' manual and/or in supplements provided by Caliper Corporation entitled TransCAD Reference Manual, Version 2.0.

MODEL DESCRIPTION

Modeled Area

The Rhode Island Statewide Travel Demand Forecasting Model (RI State Model) includes the entire state of Rhode Island (including New Shoreham) as well as municipalities which border Rhode Island in Massachusetts and Connecticut. There are a total of 62 municipalities in the RI State Model. Table 1 shows the list of municipalities included in the RI State Model.

Municipalities in Massachusetts and Connecticut adjacent to Rhode Island were included in the RI State Model for three main reasons:

- to capture work trips into Rhode Island from these municipalities,
to capture all trips between the municipalities on either side of the Rhode Island state lines, and in an attempt to limit the number of external cordon stations.

Roadway Network

In Rhode Island, the RI State Model includes all roads that are part of the Federal-Aid System. This portion on the roadway network of the RI State Model was created using the Rhode Island Geographic Information System (RIGIS) database did not contain interchange configurations. Therefore, interchange configurations for all interstates, freeways, and expressways were coded based on information provided by the Rhode Island Department of Transportation (RIDOT) and based on street maps of Rhode Island. Roadway attributes, i.e. speed, capacity, direction, and number of lanes, were assigned to roadways based on functional classification. Supplementary functional classification information for additional links was obtained from State of Rhode Island Federal-Aid Systems, prepared by the Rhode Island Department of Transportation in June 1985.

The roadway network for municipalities in Massachusetts and Connecticut was constructed based on U.S. Census TIGER/Line data. The coverage in Massachusetts and Connecticut consists of all roads classified as state highways and higher. Roadway attributes, i.e. speed, capacity, direction, and number of lanes, were assigned based on functional classification.

Zone Structure

Traffic analysis zones (TAZs) in Massachusetts and Connecticut coincide with 1990 U.S. Census tracts. TAZs in Rhode Island coincide with 1990 U.S. Census block groups. This zone structure was selected for the following reasons:

- the ease of importing data from the 1990 U.S. Census data products (e.g., STF 3A, CTPP, etc.) at this detailed level,
- the ability of the hardware and software of present-day micro-computers to analyze a large amount of data both accurately and efficiently,
- to improve the accuracy of VMT estimates by creating small TAZs, and
- to minimize the need to further sub-divide TAZs for sub-area or project-level modeling, thereby allowing greater consistency with the RI State Model.

The internal TAZ structure follows 1990 block group geography in Rhode Island and 1990 census tract geography in Massachusetts and Connecticut. There are a total of 971 TAZs in the RI State Model: 892 are located in Rhode Island, 61 are located in Massachusetts and 18 are located in Connecticut.

External stations, demarcated by a triangle, were created for all major roadways serving trips into and out of the RI State Model study area. Roadways classified as State Highways or higher were chosen as external stations. A total of 36 external stations were identified. Table 2 lists the attributes stored in the TAZ layer of the database.

SOFTWARE EVALUATION
Preceding development of the Rhode Island Statewide Travel Demand Forecasting Model (RI State Model), several software packages were assessed as possible platforms for development of the RI State Model. This review was conducted for the following modeling packages:

- TRANPLAN
- MINUTP
- QRSII for Windows
- TransCAD

Each of these models was examined relative to a common set of evaluation criteria. These criteria included:

- ease of use of the model and transferability to Rhode Island Department of Transportation (RIDOT) with minimal training,
- the inclusion within the model configuration of multiple travel mode analyses,
- the relative ease with which existing data and databases can be accepted by each of the models,
- the comprehensiveness and clarity of the model’s documentation relative to its application to a range of simulation conditions, and
- the inclusion in the model of input and output display functions and capabilities.

After detailed review and assessment of the above software, it was recommended to RIDOT by LBA that the RI State Model utilize the TransCAD software package. The additional considerations leading to this recommendation included:

- TransCAD has the necessary capabilities to simulate the state-wide network and has the flexibility to incorporate additional computational model elements that can function on the existing networks and databases.
- TransCAD provides accessibility to a significant array of databases including TIGER/Line and other U.S. Census data files.
- TransCAD provides ready compatibility with the Rhode Island Department of Administration, Division of Planning (RIDOA/P) data sources and analyses because of their use and application of TransCAD’s geographic informational system (GIS) functions.

TransCAD is a Geographic Information System (GIS) that helps transportation professionals store, display, manage, and analyze transportation data. Information on transportation networks, freight flows, routes, schedules, traffic analysis zones, and transportation system performance can be stored, displayed, and analyzed at any spatial scale. TransCAD provides:

- Broad end-user access to transportation and related geographic data;
- A full-featured GIS with extended data models to support transportation planning and travel demand modeling;
• Tools for presenting and visualizing transportation data; and
• A powerful applications development capability.

SOCIOECONOMIC DATABASE

Much of the 1990 socioeconomic data needed for the trip generation equations was obtained from the 1990 Census of Population and Housing conducted by the Bureau of the Census, U.S. Department of Commerce. The following is a list of the 1990 U.S. Census data products from which 1990 socioeconomic data was extracted for use in the Rhode Island Statewide Travel Demand Forecasting Model (RI State Model):

The following socioeconomic variables from the TAZ layer area database were used in the modeling process: population, vehicle registration, retail employment, and non-retail employment. In addition, other socioeconomic variables such as total households, dwelling units, auto availability, and autos per household were also included in the TAZ layer for analysis, future reference, and to test various trip generation models. Data for these additional variables were included in this database for the year 1990 only. All other socioeconomic variables were included in this database for the base year 1990, and the four forecast years: 1996, 1999/2000, 2010, and 2020. These socioeconomic variables were used in the trip generation equations.

HIGHWAY NETWORK DATABASE

The network database was created using the database provided by RIGIS (Rhode Island Geographic Information System). The RIGIS database was digitized in ARCINFO using USGS maps, RIDOT county maps, and 1988 aerial photographs. This database was imported into TransCAD using the ARCXLATE utility. The following node and link attributes were available from this database:

NODE LAYER------ID, Longitude and Latitude

LINK LAYER------ID, Length, Road Class, Functional Class, Road Name, Route Number, Town, MCD and County

TRAFFIC VOLUMES

Several data sources were used to compile the traffic volumes in the network database. These include:
• Data from permanent count stations;
• Data from 1990 Traffic Flow Map from RIDOT; and
• Data from special count stations throughout Rhode Island.

CORDON TRIP TABLE

*Calibration and Adjustment of System Planning Models*, published by the Federal Highway Administration in December 1990, provides a means of identifying the approximate percentages of all external trips that are external-external trips based upon the urban area population.
The external-external trip table was estimated using a gravity model. The distribution was based upon the relative volumes at the external stations. The relative separation, distance, and friction factors between the stations were not considered.

**TRIP GENERATION**

Four trip production models were tested for the RI State Model. Three basic criteria were used to evaluate the alternative trip generation models:

1. accuracy in representing existing activity,
2. predictive power, and
3. relative ease in forecasting the required input variables.

It is essential that the trip generation models accurately reflect existing zonal activity. Factors influencing trip generation include vehicle ownership, population, household size, income, and employment. Verifying which factors had indeed the greatest influence on transportation activity in Rhode Island was the first step in validating the trip generation equations. By using the journey-to-work data at the block group level for modifying trip rates and calibrating coefficients, validation is already embedded for HBW trips. However, no other data sources were available for evaluating other trip purposes, therefore, model calibration was relied upon for final validation.

The ability of the trip generation models to accurately forecast trips into the future was also considered. Historic growth in trip ends was compared against historic traffic volume growth to determine how well the models reflect transportation activity over time. Traffic counts obtained from the Rhode Island Highway Performance Monitoring Station (HPMS) traffic volume count database were used for this purpose.

**Selected Trip Generation Model**

The final analysis allow the following conclusions: a) the NCHRP trip generation rates need to be adjusted to account for the recent travel demand characteristics, b) the use of auto registrations as one of the independent variables appears to be appropriate as they are not only correlated to the historic traffic growth trends, but also are relatively easy in terms of data collection. Consequently, auto registration was used as one of the independent variables in the final trip generation model. The other variable included in the final trip generation model is population. Use of a trip generation model to estimate person trips using only auto registration was deemed inappropriate and potentially inaccurate. A final trip generation model using population, employment and auto registration was implemented in the RI State Model. The trip production and attraction equations used in this model are shown below:

\[
\text{Trip Productions} = 4.02 \times \text{(Auto Registrations)} + 0.91 \times \text{(Population)}
\]

\[
\text{HBW Attractions} =
\]
1.7*(Total Employment)

**HBNW Attractions** =
10.0*(Retail Employment) + 0.5*(Non-Retail Employment) + 0.39*(Population)

**NHB Attractions** =
2.0*(Retail Employment) + 2.5*(Non-Retail Employment) + 0.20*(Zonal Population)

In order to model external-internal trips, cordon trip productions and attractions must also be defined. The cordon productions were defined as the total volume count at the external station for each of the 36 external zones. The cordon attractions were computed using the following equation developed by the Michigan Department of Transportation Travel Demand Analysis Section:

**Cordon Trip Attractions** =
67 + 2.28*(Retail Employment) + 0.5*(Non-Retail Employment) + 0.08*(Population)

**TRIP DISTRIBUTION**

The traditional Gravity Model was used to distribute trips among traffic analysis zones.

\[ T_{ij} = P_i \frac{A_j F_{ij} K_{ij}}{\sum A_j F_{ij} K_{ij}} \]

Mathematically, the gravity model is formulated as follows:

where:
- \( T_{ij} \) = number of trips produced in zone I and attracted to zone j
- \( P_i \) = number of trips produced by zone I
- \( A_j \) = number of trips attracted to zone j
- \( F_{ij} \) = travel-time factor
- \( K_{ij} \) = specific zone-to-zone adjustment factor
In order to apply the gravity model, the travel times between each zone and the friction factors for each trip purpose are required in addition to the trip generation results. Travel Time Matrix was developed by computing the travel times between each TAZ pair. Computation of travel times are typically based on the shortest path method using free flow speed, distance between zones and terminal times at the zones as input.

**Friction Factors by Trip Purpose**

Due to the lack of availability of trip length data, the friction factors were initially developed based on data from NCHRP Report # 187. These friction factors are currently available within TransCAD. However, during model calibration, these initial friction factors were fine-tuned. One method of fine tuning home based work trips is to use the work distribution data from the Census Transportation Planning Package (CTPP). However, it was deemed important to maintain the relationship between the four trip types for the RI State Model. Therefore, rather than skew only the home based work trips based on the CTPP data, the CTPP trip distribution data was not used. All four trip types were adjusted in the same manner.

**MODE CHOICE MODEL**

**Mode Choice Analysis**

The mode choice model for an area is developed to determine the number of trips using different modes of travel (auto, transit etc.). The ultimate goal of this analysis in our study area was to determine the percent split of travel between transit and auto. As mentioned earlier transit service in the state of Rhode Island is provided by Rhode Island Public Transportation Authority (RIPTA) serving most of the state. The methodology used in the analysis was developed by the U.S. Department of Transportation, and it is discussed in the following sections.

The mode choice model utilizes transit and auto disutilities to calculate the percent split between the two modes. The transit disutility is formulated as shown in the following equation:

\[
\text{Disutility} = (\text{access time}) \times (\text{walk weight}) + (\text{wait headway}) \times (\text{wait weight}) + (\text{wait penalty}) + (\text{riding time}) + (\text{transfer penalty}) + (\text{transfer headway}) \times (\text{transfer weight}) + (\text{egress time}) \times (\text{walk weight}) + (\text{fare/value of time})
\]
TRAFFIC ASSIGNMENT

User Equilibrium Assignment

User equilibrium on a transportation network occurs when no trips can be made by an alternative path without increasing the total travel time of all trips in the network. The assignment process consists of an iterative series of all-or-nothing traffic assignments with an adjustment of travel times reflecting delays encountered in the associated iteration. The traffic volumes from each assignment after the first iteration are combined with the volumes from the previous iteration in such a way as to minimize the travel impedance (travel time) of each trip and thus reducing the number of iterations to find the equilibrium volumes. Equilibrium assignment is multi-path because the final link volumes are a linear combination of the all-or-nothing volumes from each iteration.

The travel time adjustment based on link volumes (in order to reflect congestion delays) is performed using the widely used Bureau of Public Roads capacity restraint formula:

\[ T_n = T_{n-1} \left( 1.0 + \alpha \left( \frac{\text{AssignedVolume}}{\text{PracticalCapacity}} \right)^\beta \right) \]

where \( n \) is the current iteration. The values \( \alpha \) and \( \beta \) represent a speed-flow relationship appropriate for the facility type. For the RI State Model, standard \( \alpha \) and \( \beta \) values of 0.47 and 4 were used.

MODEL CALIBRATION

Calibration was performed in two stages: in the first stage, cordon line and cut line calibration was performed in accordance with Calibration and Adjustment of System Planning Models, Federal Highway Administration, December 1990. In the second stage, detailed link volumes were calibrated with the SPME procedure in TransCAD. Detailed discussion of the two stages are provided below:

First-Stage Calibration

In the first stage of calibration, cordon lines surrounding the study area and cut lines across critical links were established. Calibration at this stage involved running and adjusting the model until total simulated traffic flows across each of these lines matched ground counts. Although this sort of calibration can involve adjusting trip generation and distribution and other model elements, the focus here was on adjusting network speeds and capacities in order to improve the routing of assigned volumes through the network. Attributes of both roadway links and zone connector links were revised during this process.

Second-Stage Calibration
In the second stage of calibration, the Single Path Matrix Estimation (SPME) procedure in TransCAD was used to better match individual link volumes.

**Model Calibration Guidelines**

The FHWA report “Calibration and Adjustment of System Planning Models” provides guidelines to measure model effectiveness. These guidelines fall under the following broad categories:

- Areawide VMT
- VMT by functional class
- Distribution of VMT by functional class
- VMT per person
- Link volumes by volume groups
- Correlation coefficient
- Screenlines
- Cutlines
- Individual link volumes

The guidelines provided in the FHWA report were used to assess the model effectiveness during the calibration process.

**MODEL VALIDATION AND CONCLUSION**

Based on the results presented in the preceding sections, it can be concluded that the 1990 base year highway model has attained reasonable consistency with several observed statistics such as VMTs, screenline and cutline volumes, and volumes at permanent count stations. While every effort was made to adequately model flows throughout the study area, there will still be pockets where the modeled volumes could be improved to better reflect counts. Considering the size of the model, these are better handled through project level analysis. These improvements were made during the case studies phase on an as needed basis. In addition, as a validation process, 1994 VMTs were developed by interpolating between the 1990 VMTs and the 1996 forecast VMTs and compared to the 1994 HPMS based VMTs. This comparison is shown in Table 3.

**TRAVEL DEMAND FORECASTS**

Future year forecasts were based on a simple Fratar process. Since the Fratar process is based on factoring, growth factors from 1990 to 1996, 1999/2000, 2010, and 2020 had to be defined for each zone. For the internal zones in the study area, the growth factors were based on changes in auto registrations and employment at the zonal level. The external station growth factors were based on historic traffic growth. The future year socioeconomic data were then used with the trip generation equations to obtain zonal growth factors for each forecast year. The Fratar model in TransCAD was then
applied to the base year 1990 calibrated trip table to arrive at forecast year trip tables. Also, the design engineers often preferred the growth factors for each TAZ to future year volumes obtained from detailed traffic assignments. Hence, a matrix of growth factors for different forecast years for each town was created.

CASE STUDIES

The Rhode Island Statewide Travel Demand Forecasting Model (RI State Model) was used in several case studies to demonstrate its use and applications. These case studies are listed below:

The Air Quality Conformity Analysis

This case study evaluated projects on Rhode Island’s Transportation Improvement Plan (TIP) for conformity with the 1990 Clean Air Act Amendments (CAAA) and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. This case study examined the entire State of Rhode Island.

Metacolm Avenue

This case study examined the effects of this project on the county.

East Providence

This case study used the RI State Model to evaluate the effects within a municipality due to proposed roadway improvements. The two projects under consideration were Waterfront Drive and the Henderson Bridge Connector.

Washington Bridge

The RI State Model was used to test the effect of lane restrictions on an interstate highway and the resulting traffic diversion during peak periods of travel.

Moshassuck Valley Industrial Highway

This case study evaluated the effect that completion of an industrial highway and the resulting land use changes would have on traffic volumes and travel patterns in the immediate area.

Combination of Projects

This project evaluated combination of several projects on a statewide level for strategic planning and policy making purposes.

Route 10 Upgrade Project
The RI State Model was used to model alternatives involving HOV lanes on Route 10.

**Apponaug Circulator Project**

This case study involved the using the RI State Model for project level analysis. A small subarea was extracted from the statewide model to build a new model for the Apponaug Circulator study area.

**FUTURE ENHANCEMENTS**

The Rhode Island Statewide Travel Demand Forecasting Model (RISM) has been calibrated successfully as per the RIDOT's requirement for ISTEA and Clean Air Act Amendment of 1990. However, we anticipate that some of the features and aspects of the model should be refined and enhanced to meet the growing demand for more detailed air quality analysis and evaluation of congestion, operational improvements and economic feasibility for various highway and non-highway projects. Also, the assumptions made due to unavailability of data while developing the RISM could also be tested and confirmed with the proposed enhancements to the model for truck trip table estimation, mode choice/HOV model development, peak hour models etc. The following are some of the proposed refinements and enhancements for the RISM:

*Integration with HPMS*

Integration of the RISM with HPMS would allow a continuous update of traffic volumes and speeds on the highway network. This has the dual advantage of calibration of the model with respect to traffic volumes as well as with speed, which would be good for air quality analysis.

*Peak Hour Models*

The peak hour models in the RISM need to be fully calibrated to link and turning movement volumes. The current peak hour models in the RISM could only be used for studies which involve comparison of various alternative project options.

*Truck Trip Table/Freight Modeling*

Additional enhancement to the RISM could be done by using the existing RISM database for freight modeling. This could be especially useful for tracking and analyzing the flow of different commodities by mode, generate a statewide truck trip table as well as forecasting future truck traffic. The truck movement estimation would be extremely useful in developing truck routes and restriction, pavement management systems, air quality analysis and other planning processes.

*Integration with Different Management Systems*

Enhancement to the RISM could be made by integrating it with different management systems used by the state. A GIS based model such as RISM is particularly suitable for storing and retrieving data spatially and can be a valuable asset for several management systems like Safety, Pavement and Congestion Management Systems.
Transit/HOVModel

The mode choice model in the RI state model was calibrated on the basis of statewide average share of autos and transit rather than calibrating it by individual link or roadway segment. Hence, a more detailed calibration of the mode choice model would be necessary before it is used for any serious application. There is a need for differentiating person trips from auto and transit trips for calibration as well as evaluation of different transit projects. To facilitate HOV lane modeling, it is also necessary to estimate the drive alone, two plus and three plus vehicle occupancy trips. Even though the RISM database consists of RIPTA, Rail and Water network, the mode choice model considers only the personal automobile and RIPTA mode. Hence, other non-highway modes of transportation such as Rail and Water could also be easily incorporated into a more comprehensive multi-mode choice model. A calibrated multi-modal RISM would allow simulation of different non-highway projects and its effect on all modes of transportation in the state.

MODEL DOCUMENTATION

LBA also prepared an extensive documentation of the RI State Model. The document provides detailed documentation of the model; its development; data used in model preparation; the sources of that data; any assumptions used in model preparation; and the results of alternative tests conducted during model development. Appropriate chapters also include a discussion of the relevant TransCAD procedures used and clarifications and/or corrections to the step-by-step process for those procedures provided in the TransCAD users’ manual and/or in supplements provided by Caliper Corporation entitled TransCAD Reference Manual, Version 2.0.
Table 1 Municipalities Included in the RI State Model

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<td>Providence</td>
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<td>North Providence</td>
<td>Exeter</td>
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</table>

| Massachusetts        |                           |                           |                           |                           |                           |
| Webster              | Blackstone                | Wrentham                  | Attleboro                 | Swansea                   |
| Douglas              | Bellingham                | Plainville                | Seekonk                   | Somerset                  |
| Uxbridge             | Franklin                  | North Attleboro           | Rehoboth                  | Fall River                |
| Millville            | Westport                  |                           |                           |                           |

| Connecticut          |                           |                           |                           |                           |                           |
| Thompson             | Killingly                 | Voluntown                 | Stonington                | North Stonington          |
| Putnam               | Sterling                  | Plainfield                |                           |                           |
Table 2 TAZ Layer Attributes

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<th>Description</th>
<th>Field No.</th>
<th>Name</th>
<th>Description</th>
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<td>Zone ID</td>
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## Table 3 1994 VMTs by Functional Classes

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