ITS Evaluatory Design

Prepared by:

Lockheed Martin Federal Systems
Odetics Intelligent Transportation Systems Division

Prepared for:

Federal Highway Administration
US Department of Transportation
Washington, D. C. 20590

June 1996

Table of Contents

Table of Contents

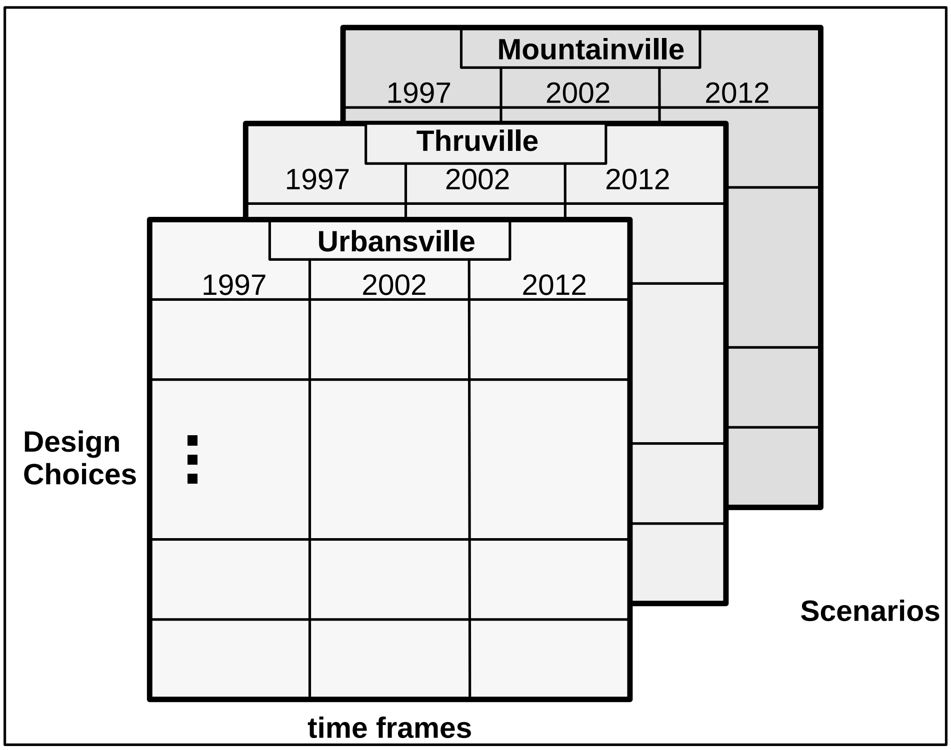
List of Figures

List of Tables

Executive Summary

The Evaluatory Design Document provides a unifying set of assumptions for the other evaluations to utilize. Many of the evaluation activities require the definition of an actual implementation in order to be performed. For example, to cost the elements of a Traffic Management function we must define how many intersections, what type of controller, and what type of communications is used between the roadside and the TMC. In addition it is important that the same set of assumptions be used in all evaluations of an implementation so that true comparisons can be made (for example cost vs benefits). The Evaluatory Design captures the sets of common assumptions regarding the implementations evaluated.

The Evaluatory Design contains a common set of deployment assumptions for use in various evaluation efforts. The assumptions are for each of the three government provided scenarios (urban, inter−urban, and rural) across the three time frames (5, 10, and 20 year) as shown in the following figure. By providing one consistent set of design assumptions and decisions, this document makes the different evaluation results more meaningful.



The Evaluation Dimensions

This document provides overviews of the key design choices made in each of these environments. These assumptions and decisions are reflected in the cost, performance and benefits, traffic and communication simulation, and data loading analyses.

The basis for the evaluatory design is the list of Equipment Packages provided in the Physical Architecture. An Equipment Package is a collection of hardware and/or software in a single subsystem which is used to perform some portion of a user service. For example, in the vehicle are Equipment Packages such as Route Guidance and In−Vehicle

Signing. Equipment packages are combined (possibly across Subsystems) to form Market Packages. The Evaluatory Design is captured by defining specific implementations for each Equipment Package present in the scenario, and by defining the quantities of each Equipment Package. In order to define the quantities of each Equipment Package the total population for which the package is applicable is defined, and then a market penetration is developed. The multiplication of these two items provides the quantities of each Equipment Package which forms the basis for the Cost Analysis.

The evaluatory design defines the quantities at 1997, 2002, and 2012. No explicit definition is made of how the quantities grow in the intervening years. This is not important to most of the evaluations, and if it is, the specific assumptions made are defined in the evaluation.

The first step in the definition of the Evaluatory Design is to define the applicable total population numbers. These are contained in a table of Source Parameters. These parameters define the set of potential users or uses of any number of equipment packages against which a market penetration can be assigned.

The penetration values for the different equipment packages have been developed not as a single number but as a range of values. Each equipment package and each time frame has a low and a high penetration value to provide the reader and eventual users of this design a range of values to study to decide on the right mix of packages and services for a given situation.

The penetration values are useful for items that can be marketed to a mass audience such as commercial drivers, private vehicle owners, transit commuters, etc. In situations where an equipment package is going is purchased and funded in small, fixed increments, such as management centers or signalized intersections, it makes more sense to adjust the parameter values over time as technology improves, funding is committed, and interest is raised.

Also useful in building the penetration matrices was the Market Package Deployment Timing in the Implementation Strategy document. This framework is arranged by Market Package rather than Equipment Package; however, consistency between the IS and the evaluatory design has been sought. For market packages that are not deployed in an early time frame but grow over time, a similar pattern is reflected in the penetration and parameter tables.

The evaluatory design information is presented in table format. The tables are the output of a spreadsheet and are printed at the end of the document. Text to explain the content of the tables and to guide the reader through the tables is in section 3.

1. Introduction

An important element of the National Architecture Program is to evaluate the performance, benefits and costs of the architecture developed. The Loral and Rockwell teams believe that a careful evaluation is vital to developing and to reaching consensus with stakeholders on an effective ITS system architecture. An architecture is an abstract definition of the framework for connecting elements of ITS. Many of the evaluation activities require the definition of an actual implementation in order to be performed. For example, to cost the elements of a Traffic Management function we must define how many intersections, what type of controller, and what type of communications is used between roadside and the TMC. In addition it is important that the same set of assumptions be used in all evaluations of an implementation so that true comparisons can be made (for example cost vs benefits). This document, the Evaluatory Design Document, captures the sets of common assumptions regarding the implementations to be evaluated.

1.1. Purpose and Scope

The Evaluatory Design Document contains the evaluatory deployment decisions that have been assumed in the various evaluation efforts in each of the three government provided scenarios (urban, inter−urban, and rural) across the three time frames (5, 10, and 20 year). By providing one consistent set of design assumptions and decisions, this document will make the different evaluation results more meaningful.

This document provides overviews of the key design choices made in each of these environments. These assumptions and decisions will be reflected in the cost, performance and benefits, traffic and communication, and data loading analyses. What is contained in this document is an estimated inventory of equipment, facilities, and estimated number of users in the three timeframes. The various analyses that use this evaluatory design will use these quantities in their analysis.

Exactly what baseline existed in the 3 scenarios in 1992 is not specified. For most evaluations this is not needed. The cost analysis is an exception; see that document for a definition of its 1992 baseline assumptions.

This document contains summary information about the high−level design choices and information such as:

- Choice of communications media and other enabling technologies
- Density of communications and roadway infrastructure required
- Number and characteristics of traffic, transit, and other management centers
- Market penetrations of ITS services being evaluated
- Types of services and equipment packages available to end users
- Service provider characteristics

Detailed discussions of parameters used in the simulation studies will be reported in the Evaluation Results documents for the traffic and communication simulations.

1.2. Structure of Document

Following this introductory section, Section 2 contains overall design methodology and any global data.

Section 3 contains text to explain the content of the evaluatory design tables and to guide the reader through the tables. Section 3 also contains the design descriptions for each of the government provided scenarios. Within each scenario section a set of overall information will be provided that is relevant across all of the time frames. Subsections for each time frame in a given scenario will contain text to describe the design choices.

Section 4 contains the output from the evaluatory design spreadsheet. The output is presented in 3 tables: parameters, market penetrations, quantities.

2. Evaluatory Design Overview

The evaluation activities analyzed the architecture for three time frames: 5, 10, 20 years (from the year 1992), and three scenarios: urban (Urbansville), interurban (Thruville), and rural (Mountainville). Figure 1 illustrates the dimensions of the architecture evaluation pictorially.

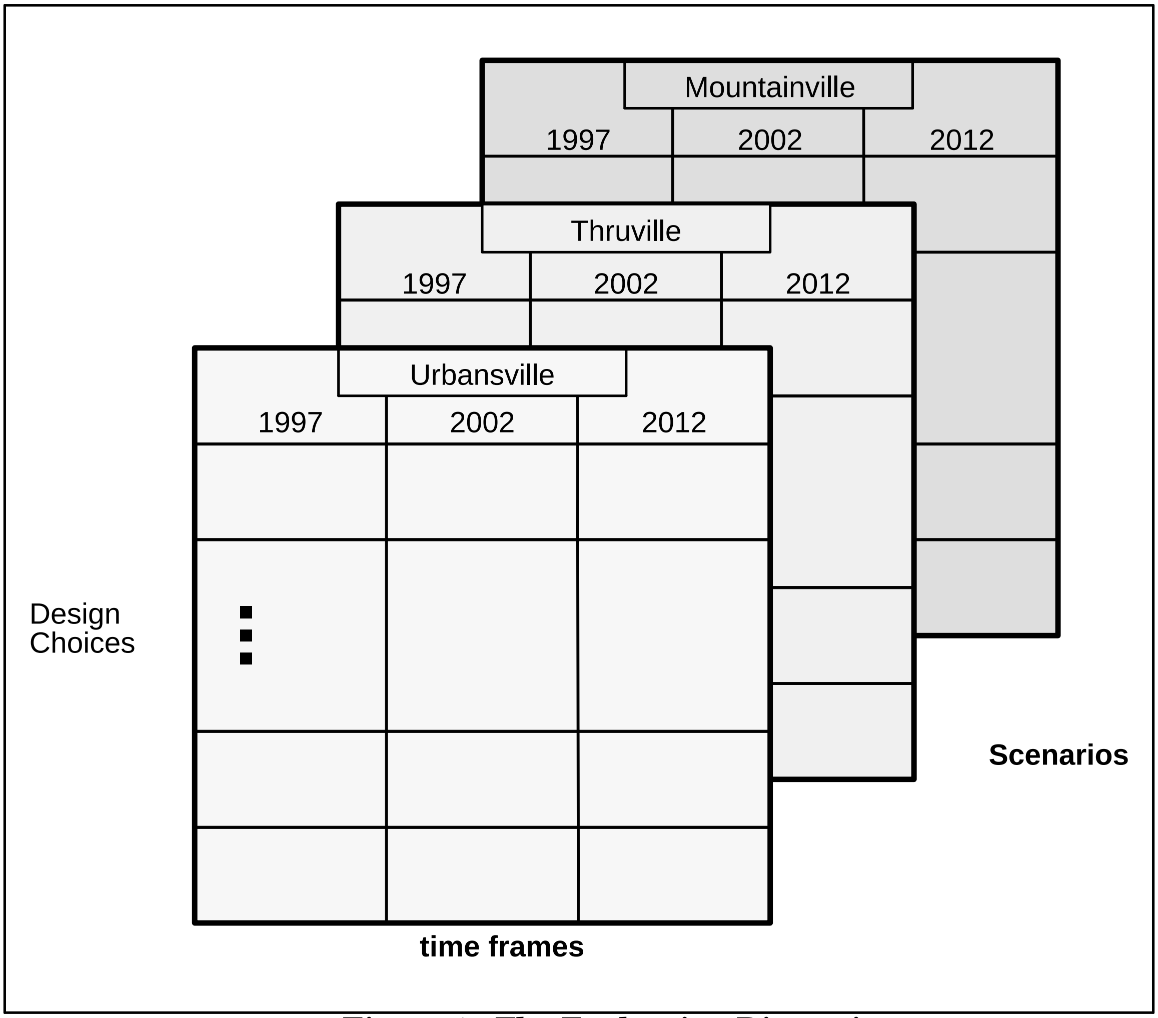


Figure 1. The Evaluation Dimensions

The basis for the evaluatory design is the list of Equipment Packages provided in the Physical Architecture. An Equipment Package is a collection of hardware and/or software in a single subsystem which is used to perform some portion of a user service. For example, in the vehicle are Equipment Packages such as Route Guidance and In–Vehicle Signing. Equipment packages are combined (possibly across Subsystems) to form Market Packages.

The Evaluatory Design is captured by defining specific implementations for each Equipment Package present in the scenario, and by defining the quantities of each Equipment Package. In order to define the quantities of each Equipment Package the total population for which the package is applicable is defined, and then a market penetration is developed. The multiplication of these two items provides the quantities of each Equipment Package which forms the basis for the Cost Analysis.

In Section 3 the 3.x subsections represent the government provided scenarios. Within each of those sections are sub−sections for the three time components of the evaluatory design. The first step in the definition of the Evaluatory Design is to define the applicable total population numbers. These are contained in a table of Source Parameters. These parameters define the set of potential users or uses of any number of equipment packages against which a market penetration can be assigned.

The text describes how a given parameter was derived and from what source the values were taken. Some design parameters are entered directly from the government provided scenario guide. Others use the scenario guide data and other source material to calculate the potential users or possible locations for a particular parameter.

Wherever possible the government provided scenario guides were used to help define the parameter. Most of that data is used directly in the simulations but some of the parameters were used in this document to build the design of equipment packages.

In the 3.x.2 subsections the equipment packages are listed with the parameter(s) that forms the basis for the estimated quantities and penetration values are assigned. The assignment of parameters to Equipment Package should be global across the 3 different scenarios but the penetrations and resultant quantities vary significantly.

The penetration values for the different equipment packages have been developed not as a single number but as a range of values. Each Equipment Package and each time frame has a low and a high penetration value to provide the reader and eventual users of this design a range of values to study to decide on the right mix of packages and services for a given situation.

Expected market penetration is difficult to predict because the architecture includes new technologies or existing technologies in a new context; thus the demand/supply is not yet known. For this evaluatory design the penetrations are primarily based upon three sources to produce a reliable design:

- University of Michigan Transportation Research Institute (UMTRI) report, *IVHS Technical Report #92−1, The Future of Intelligent Vehicle Highway Systems Revisited: A Delphi Forecast of Selected Markets, 1991*. This study dealt with the user services to determine the market penetration given different government investment scenarios and user costs across 11 market segments.
- Independent analysis done by the Rockwell team in Phase I of the architecture program. This market analysis indicated customer interest in purchasing ITS services at specific price levels. Data for this analysis came from evidence on user response to existing ITS and ITS−like services as well as market research that explored customer reaction.
- Expert opinion on market penetration for user services not covered by the other studies

The low and high values for the market penetrations were developed from the previous studies that provided different values for similar services. For instance, the Rockwell Phase I analysis yielded a 7% penetration for the in−vehicle portion of route guidance while the UMTRI Delphi study had 32% for the route guidance user services. This information combined with consensus developed during Phase II to yield a range of 5% to 30% for the Vehicle Route Guidance in the 20 year timeframe.

The penetration values are useful for equipment packages that can be marketed to a mass audience such as commercial drivers, private vehicle owners, transit commuters, etc. In situations where an Equipment Package is going to be purchased and funded in small, fixed increments, such as management centers or signalized intersections, it makes more sense to adjust the parameter values over time as technology improves, funding is committed, and interest is raised. This is reflected in the penetration tables where a 100% may be recorded from the 5 year low across to the 20 year high yet the summary quantity grows.

Also useful in building the penetration matrices was the Market Package Deployment Timing in the Implementation Strategy document. This framework is arranged by Market Package rather than Equipment Package; however, consistency between it and the evaluatory design has been sought. For Market Packages that are not deployed in an early time frame but grow over time, a similar pattern is reflected in the penetration and parameter tables.

The final subsections under each scenario reflect the multiplication of the parameter and the penetration values to give quantities. This document defines the quantity of a particular Equipment Package that will likely be deployed in the various time frames across the three scenarios. These equipment packages may be comprised of one or more products which are described in the Cost Analysis document. Details about items such as the communications media are discussed in the Communications Analysis document and the Cost Analysis.

3. Evaluatory Design Descriptions

Section 3 describes the evaluatory design for each of the scenarios and time frames to be analyzed.

The Evaluatory Design is divided into the three government provided scenarios: Urbansville, Thruville, and Mountainville. The scenarios are drawn from metropolitan Detroit, portions of New Jersey, and Lincoln County, Montana. These scenarios were used in the analysis and simulation activities and were meant to represent typical urban, inter–urban, and rural settings, respectively. The parameter quantities and market penetrations for the equipment packages deployed in each scenario are meant to represent a possible deployment strategy of ITS in those areas and are not necessarily representative of the actual market in the physical regions: Detroit, New Jersey, and Montana.

By defining the evaluatory design at the Equipment Package level some details about the design are missed. The choice of communications media for example, will be a mix of wireline, wireless, and satellite based networks. Wireline will be used by the centers to communicate with the roadside equipment. Wireless technologies will be used primarily to communicate with mobile users. In rural areas and as the technology becomes more available, Satellite based systems will be used to communicate with mobile users.

Equipment packages are grouped by Subsystem as defined in the current Physical Architecture. The Subsystems are listed in Table 1. The "Entity" is the subsystem identifier that appears in the market penetration and quantity tables of this document.

Table 1. Physical Architecture Subsystem Entities

Entity	Entity Name
CVAS	Commercial Vehicle Administration Subsystem
CVCS	Commercial Vehicle Check Subsystem
CVS	Commercial Vehicle Subsystem
EM	Emergency Management Subsystem
EMMS	Emissions Management Subsystem
EVS	Emergency Vehicle Subsystem
FMS	Fleet and Freight Management Subsystem
ISP	Information Service Provider Subsystem
PIAS	Personal Information Access Subsystem
PMS	Parking Management Subsystem
PS	Planning Subsystem
RS	Roadway Subsystem
RTS	Remote Traveler Support Subsystem
TAS	Toll Administration Subsystem
TCS	Toll Collection Subsystem
TMS	Traffic Management Subsystem
TRMS	Transit Management Subsystem
TRVS	Transit Vehicle Subsystem
VS	Vehicle Subsystem

The roadside equipment is another area that requires more detail than can be adequately defined at the Equipment Package level. For instance, the Roadway Basic Surveillance Equipment Package is made up of many different components and at any given time can include a different mix of such components as loop detectors, video surveillance cameras, and ramp meters. The evaluatory design tables show a quantity of 1 package and a penetration of 100% for this particular example. The Cost Analysis document includes the unit price information for the individual pieces that make up this Equipment Package.

The Information Dissemination packages can also include several different types of equipment depending on the scenario and time frame. The equipment includes Changeable Message Signs (CMS), Highway Advisory Radio (HAR), and Fixed Message Signs, which are used primarily in rural settings. Again, the text in this document and the Cost Analysis document define the details for these packages.

For Commercial Vehicle operations the general assumption is that there are no domestic check facilities located within the Urbansville area. Because there are two states involved, two such facilities have been assumed for Thruville. One check facility has been assumed for Mountainville. The administrative facilities to support those facilities will be deployed wherever there are check facilities, i.e. Thruville and Mountainville. The International CV check and administration facilities have been placed in Urbansville.

3.1. Urbansville (Urban Scenario)

The definition of the urban scenario is contained in the "URBAN SCENARIO GUIDE, URBANSVILLE, PHASE II" and the following text is taken from that document.

Urbansville is based on the southeast Michigan metropolitan area. The City of Detroit and portions of Wayne County, Oakland County, and Macomb County constitute the area of Urbansville. However, selected facilities and characteristics do not correspond exactly with the Detroit area. Some facilities and characterizations have been altered to allow for the inclusion of typical facilities not found in the Detroit area. For example, toll and HOV facilities are modeled in the 2012 Urbansville scenario, but are not currently implemented in the Detroit area.

The area is traversed by an array of transportation facilities as shown in Figure 2. The urban region represented here is approximately 800 square miles and contains a population of 3.7 million persons at the 20 year time frame.

Much of the detailed information contained in the Scenario Guide is used directly by the Traffic and Communication Simulation. Some of the demographic data was used as source material for the parameter definitions contained in the next section. The source of the parameter values highlights which values were based on information contained in the Scenario Guide.

3.1.1. Urbansville Evaluatory Design Parameters

This section describes How Many (a number) of What Parameter can potentially use a given Equipment Package, for each time frame. This section is grouped into the following classes of parameters: Vehicles, Users, Facilities, Centers, and Roadway Characteristics.

Table 2, Evaluatory Design Source Parameters on page 26 identifies each parameter used in the evaluatory design.

3.1.1.1. Urbansville Vehicle Parameters

Commercial Vehicles: The number of commercial vehicles, long and short–haul, is based on calculations using a Census Bureau report, *1987 Truck Inventory and Use Survey*, of truck types and computed the numbers of each type of vehicle for the region under study.

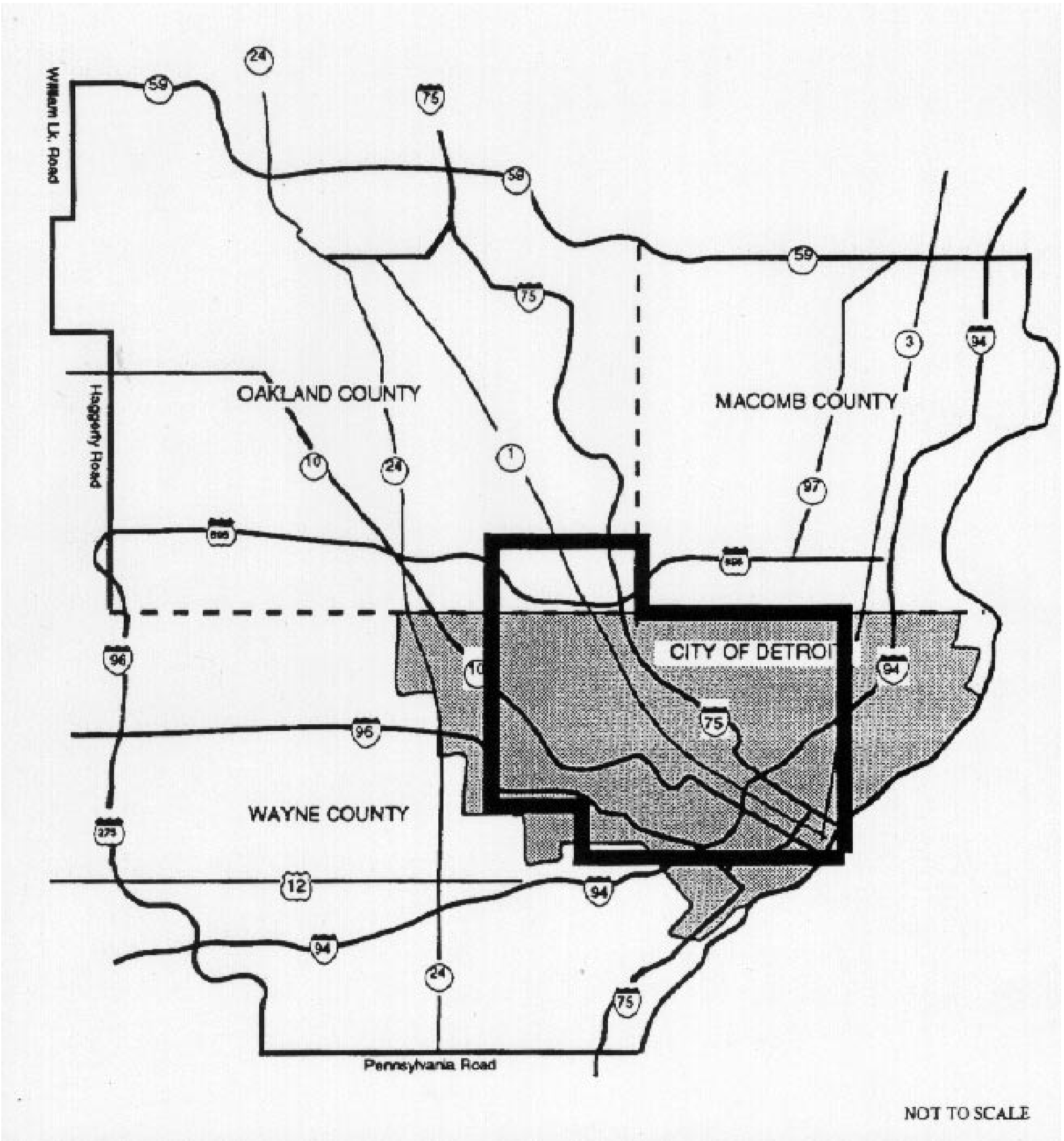


Figure 2. The Urban Region: Urbansville

This Census report indicated that there were a total of 1 million trucks nationwide that fit the definition of long–haul trucks. Using the US population for 1987 (242,804,000), this is approximately one truck for every 243 people. It is assumed that these trucks spend half of their work day within a metropolitan area, resulting in 500,000 trucks within metropolitan areas, or approximately one truck for every 486 people. Trucks are assigned to the Urbansville metropolitan region as a proportion of its population to that of the entire US, so that the Urbansville regional population given in the scenario guide for each time frame is divided by the number of people per truck to arrive at the number of long–haul trucks within the region.

Likewise, for short–haul trucks the same Census report indicated that there were a total of 7 million trucks nationwide that fit the definition of short–haul truck. This group includes short–haul trucks, taxis, and automobile fleets. Using the US population for 1987 that is approximately one short–haul vehicle for every 35 people. Vehicles are assigned to the Urbansville metropolitan region as a proportion of its population to that of the entire US, so that the Urbansville regional population given in the scenario guide for each time frame is divided by the number of people per truck to arrive at the number of short–haul trucks within the region.

<u>Household Vehicles:</u> This number is taken directly from the Scenario Guides. It is used in the calculation of Total Vehicles.

<u>Public Transit Vehicles:</u> This number is calculated using 1991 National Transportation Statistics and 1990 Census data to derive the number of 472 transit vehicles per million US residents. This number is then multiplied against the population of region under study for each time frame.

<u>Para Transit Vehicles:</u> These are transit vehicles that are used for non–fixed routes. It is assumed that the number of para transit vehicles will be approximately one–fourth of the number of public transit vehicles. While currently no equipment packages are uniquely defined for Para Transit Vehicles the number is used to calculate the Total Vehicles.

<u>Transit Vehicles All:</u> This is the sum of the Public and Para Transit vehicles.

<u>Emergency Vehicles:</u> According to the Scenario Guides 0.25% of the total vehicles are emergency vehicles in Urbansville.

<u>Peak Period Private Vehicles and Probe Vehicles:</u> These parameters are not tied to a particular Equipment Package but they are used in the Data Loading Analysis. They are calculated using the following formulas.

The number of private vehicles operating in an area during the peak periods is approximately 45% of the total number of household vehicles based on a Texas Transportation Institute study, *Roadway Congestion in Major Urban Areas 1982 to 1988.*

The goal is to provide a uniform distribution of probe vehicles throughout the region studied. The limited access highways and arterial surface streets need coverage throughout the day. In order to determine a data loading model, a scenario was developed for optimizing the distribution of probe vehicles in the region. The number of probe vehicles required is assumed to be one vehicle for every mile of limited access highways and arterial surface streets in both directions. This number is adjusted by a factor of two to allow for traffic density variations and variations in local directional flow.

3.1.1.2. Urbansville User Parameters

<u>Population</u>: This is defined in the Scenario Guides for each of the regions under study.

Transit Customers: This number is calculated using the following formula to calculate the number of potential users of traveler information services. This was based on the population of the region under study multiplied by the average number of peak period passenger trips per metropolitan area resident per day calculated . With information from a 1991 National Personal Transportation Survey from Oak Ridge National Laboratory it was calculated that there were 3,016,000 public transportation passengers per day in the US. The US population in metropolitan areas at the time of the Transportation Survey was 197,467,000 according to Census Bureau. This yields an average of 1.527% of the metro residents using public transportation each day.

Transit customers are assigned to the Urbansville metropolitan region as a proportion of its population to that of the entire US, so that the Urbansville regional population given in the scenario guide for each time frame is multiplied by 0.01527 to arrive at the number of transit customers within the region.

Personal Travel Info Users: These are the people that will access travel related information provided by the ISPs and delivered using the PIAS, RTS, and VS subsystems. The number is calculated by adding the number of drivers of private vehicles during the peak periods of each day to the number of transit customers on a given day. This then is multiplied by factors of 25, 30, and 40 percent for each of the 5, 10, 20 year timeframes, respectively. This factor is based on an estimated percentage of households that will have access to the technology necessary for this services (i.e., a home computer with prerequisite communications hardware). This is an assumed percentage but is based loosely on a Census Bureau report, October 1993 Current Population Survey. This stated that the percentage of all US households with a computer has risen from 8.2 % on 1984 to 22.8 % in 1993.

3.1.1.3. Urbansville Facility Parameters

Commercial Vehicle Administration Facilities and Commercial Vehicle Check Stations: Since weigh station type facilities generally exist outside an urban area along open highways no facilities were assumed to exist within Urbansville. However, Urbansville does sit adjacent to an International border, so international check and administration facilities for Commercial Vehicle Operations were assumed for Urbansville.

Parking Lots: The number of lots represents the number of lots in the region under study that are candidates to take advantage of ITS services. The total number of parking lots is based on an assumption that there is a parking lot for every 4 square miles in a metropolitan area that is a candidate for ITS services.

Kiosks: These are devices that provide information and perform services for travelers. The kiosks will be located in transit centers as well as other public places such as shopping malls or sports/civic arenas. The number of such sites is given as an assumption for the region in each time frame. It is assumed that the deployment of these devices will grow over time.

Transit Stops: This is an assumption that is used by the Remote Transit Security I/F Equipment Package. These would be possible locations where cameras and other security equipment could be placed.

Toll Booths: This number is as defined in the Scenario Guide.

3.1.1.4. Urbansville Center Parameters

Traffic Management Centers: These figures are based on the assumption that there exists a natural division of labor between State DOTs and the local municipalities. For Urbansville it is assumed that the state of Michigan and the city of Detroit will operate their own centers. It is also assumed that as time goes on the suburban counties will build and staff their own centers.

Fleet Management Centers: This number represents the commercial fleets that will operate management centers within the region under study. This is not necessarily all of the fleets whose trucks will operate within the region at any given time. The specific numbers are assumptions.

Emergency Management Centers: The number of EMCs in Urbansville is based on an average EMC coverage of 200 square miles. This is typical for a densely populated county jurisdiction.

Emissions and Environmental Data Management Centers: The number of such centers in Urbansville is based on an assumption that the functions are performed by two separate agencies.

Independent Service Providers: The number of ISPs operating in a particular area will grow over time as the benefits of ITS are more widely available and accepted by the marketplace. For Urbansville, one ISP has been assumed for the 5 year time frame growing to 4 then 8 by the 20 year point.

ITS Regional Planners: As ITS services are brought online within each region, it is assumed that ITS planning will fall under a Metropolitan Planning Organization (MPO), a government agency that will operate a central planning office to coordinate the implementation of ITS.

Toll Administration Center: It is assumed that there is a single toll administration center to manage the toll roads in the region.

Virtual TMC: The virtual TMC provides for special requirements of rural road systems; therefore none are assumed for Urbansville.

Transit Center: These centers manage the operations for the public transit fleets in a given municipality. For Urbansville, 3 such centers have been assumed.

3.1.1.5. Urbansville Roadway Parameters

Note that some of the roadway characteristics for Urbansville have been based upon the actual plans for the metropolitan Detroit area, which is the model for Urbansville.

Intersections: The 2,560 intersections are the total number of signalized intersections throughout the 800 square mile Urbansville region based on information from the Scenario Guides. This represents the total number of potential sites that can be controlled by the TMCs in the region.

3.1.1.5.1. Roadway Surveillance Equipment

Ramp Meters: The number of ramp meters is based on information about the current plan for metro Detroit.

Detection Sensors: This includes loop detectors and other detection/monitor devices (e.g. RADAR). Based on information about the current plan for metro Detroit it is assumed that in the 5 year time frame 350 detectors will be installed on the freeways. At 10 years the spacing of detectors on the freeways will increase to 3 per mile. At 20 years, detection/monitor devices will be added to half of the major arterial roadways at a spacing of 2 miles in each direction.

CCTV Basic Surveillance Cameras: Assuming there are 2,560 intersections in Urbansville and 400 ramps onto the freeways the total pool of potential locations for surveillance cameras is 4 cameras per intersection and one camera per ramp. Based on information about the current plan for metro Detroit it is assumed that in the 5 year time frame 150 cameras will be installed along the freeways. At 10 years it is assumed that more detection cameras will be added to the freeway system and the arterials will begin to be equipped. By 20 years, it is assumed that the freeway system and 10% of the major intersections will be equipped with basic surveillance cameras.

CCTV Advanced Visual Detection Cameras: The number of advanced cameras at the 5 year time frame is based on the information about the current plan for metro Detroit. The number grows over time proportionately with the growth of the other surveillance cameras.

3.1.1.5.2. Roadway Traffic Information Dissemination Equipment

Changeable Message Signs: The number of CMS locations is based on information about the current plan for metro Detroit.

Highway Advisory Radio: The number of HAR transmitters is based on information about the current plan for metro Detroit.

Fixed Message Signs: This is a advanced fiber optic warning sign and is another component of traffic information dissemination. The fixed message sign bears one message and can be illuminated via remote control by a TMC or locally to alert the driver of icy bridges or foggy areas. There are no such signs assumed for Urbansville.

Fixed Environmental Message Signs: These signs are tied directly to the environmental sensors to disseminate advisories in remote areas. There are no such signs assumed for Urbansville.

3.1.1.5.3. Roadway Beacon−type Equipment

Roadway Probe Beacons: These devices are used to monitor traffic flow in major intersections and on main highways for urban areas and to monitor road conditions using mobile equipment and wireless communication. It is assumed that the spacing of such beacons will be one for every 5 miles of freeway at 5 years, one for every 3 miles at 10 years and one for every mile of freeway at 20 years.

Automated Road Signing Beacons: This type of beacon is used in rural areas controlled by a virtual TMC. There are none in Urbansville.

In−Vehicle Signing Beacons: These devices are used to support in−vehicle signing. It is assumed that there will be 25 such transmitter/beacons in Urbansville at the 10 year time frame. At 20 years there will be 50 transmitter/beacons.

3.1.1.5.4. Other Roadway Characteristics

HOV lane mileage: The assumption is that there will be a total of 10 miles of HOV roadway in Urbansville. Entrances to the HOV lanes are assumed to be located every 2 miles along the HOV roadway. The equipment used to monitor and control the lane usage will be described in the Cost Analysis document.

Environmental Sensors: These devices support weather monitoring and information dissemination. The assumption is that the number of sensors will grow over time as funding for ITS services grows.

Emissions Sensors: These devices support pollution monitoring and information dissemination. The assumption is that the number of sensors will grow over time as funding for ITS services grows. These are separate devices from the environmental sensors and are fielded in very different locations.

AHS Lane Checkpoint Beacons: These devices are positioned at points of entry and exit to/from an AHS lane. The equipment provides the capability of safely controlling access to and egress from an AHS. It also provides the capability for roadside to vehicle communication. At the 20 year time frame, it is assumed that there will be a total of 10 miles of AHS roadway with these beacons spaced at every tenth of a mile.

3.1.2. Urbansville Equipment Package Penetrations

Table 4. Evaluatory Design Equipment Package Market Penetrations on page 29 shows what percentage of the total number of potential users or sites described in the last section will likely be using a given Equipment Package in Urbansville for each time period.

3.1.3. Urbansville Equipment Package Quantities

Table 5. Evaluatory Design Equipment Package Quantities on page 32 represents the multiplication of the parameter values against the market penetrations for each Equipment Package.

3.2. Thruville (Inter−Urban Scenario)

The definition of the inter−urban scenario is contained in the "INTER−URBAN SCENARIO GUIDE, THRUVILLE, PHASE II" and the following text is taken from that document.

The Thruville scenario was based on information from the Delaware Valley Regional Planning Commission (DVRPC). The regional area depicted consists of a portion of the I−95 corridor from the Delaware/Pennsylvania state line to the I−95/I−295 junction in New Jersey, as shown in Figure 3. Included in this area are portions of three Pennsylvania counties and four New Jersey counties that contain the corridor and various complementary facilities. The names of the counties have been slightly altered to [avoid] confusion with the actual counties and additionally indicate that the counties in the scenario do not directly correspond to the actual counties in the DVRPC area. The regional domain is estimated to cover 1375 square miles of fairly level terrain. The corridor is 38 miles long. The Thruville region is governed by a myriad of jurisdictions and authorities. There are two states that are separated by the Delaware river. There is one metropolitan planning authority composed of representatives from the two states, Pennsylvania and New Jersey, two Bridge commissions, the 7 counties that comprise this segment of the I−95 corridor, the New Jersey Turnpike authority, one regional rail authority, and the inter−regional rail service that supplies rail transportation through the corridor.

The two bridge commissions are designated as the Upper Delaware Bridge Commission (UDBC) and the Lower Delaware Bridge Commission (LDBC). The UDBC operates and maintains the bridges above and including the I−276 bridge. The LDBC operates and maintains the bridges below the I−276 bridge.

The New Jersey Turnpike is a toll facility running parallel to I−95 on the New Jersey side of the Delaware River. The collection of tolls is determined by miles traveled and are assessed upon exiting the facility. The initial scenario does not simulate the operations of toll booth.

Rail service for the corridor consists of service between "Philly" area and the "Trent" area and points in−between. The regional rail authority supports two lines serving trips between "Philly" and "Trent" on two lines. Another service that transports trips in and through the corridor runs on the same tracks as one of regional rail service lines.

Much of the detailed information contained in the Scenario Guide is used directly by the Traffic and Communication Simulation. Some of the demographic data was used as source material for the parameter definitions contained in the next section. The source of the parameter values will highlight which values were based on information contained in the Scenario Guide.

Because the primary area of interest is along the turnpike within the Thruville region the population and number of household vehicles used were pulled from the scenario guide to only include the three counties along the turnpike: Burlton, Camen, and Glouster Counties. The Communications modeling; however, used the total region's population to derive the total amount of communications traffic in the region.

3.2.1. Thruville Evaluatory Design Parameters

This section describes How Many (a number) of What Parameter can potentially use a given Equipment Package, for each time frame. This section is grouped into the following classes of parameters: Vehicles, Users, Facilities, Centers, and Roadway Characteristics. Much of the methodology for defining the parameters for Thruville is based on the same methodology used in defining the Urbansville parameters.

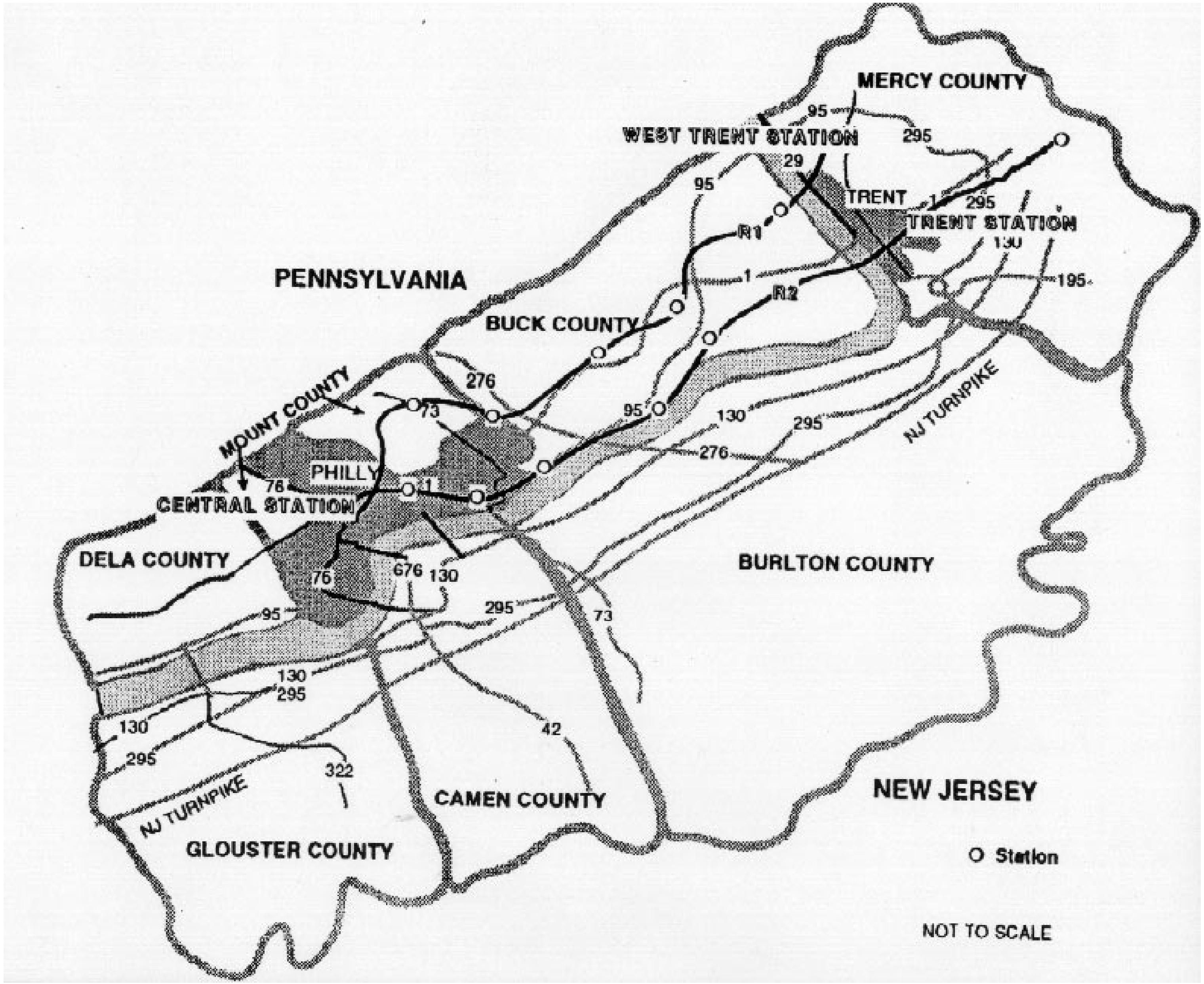


Figure 3. The Inter–Urban Region: Thruville

Table 2 Evaluatory Design Source Parameters on page 26 identifies each parameter used in the evaluatory design.

3.2.1.1. Thruville Vehicle Parameters

Commercial Vehicles: The number of commercial vehicles, long and short–haul, is based on a similar set of calculations as were performed for Urbansville.

The portion of the Thruville regional population given in the scenario guide for the 3 counties along the turnpike (Burlton, Camen, Glouster Counties) for each time frame is divided by the number of people per long–haul truck in the US to arrive at the number of long–haul trucks within the region.

The number of long–haul trucks is then increased by 33% to account for the number of trucks passing through the region. That is, they did not originate from within the region. This assumed percentage is based on work done by Mitretek for similar inter–city corridors where much of the traffic on the freeway is generated by vehicles on trips that neither originate nor end within the region under study.

The portion of the Thruville regional population given in the scenario guide for the 3 counties along the turnpike (Burlton, Camen, Glouster Counties) for each time frame is divided by the number of people per short–haul truck in the US to arrive at the number of short–haul trucks within the region.

Household Vehicles: This number is taken directly from the Scenario Guides for the 3 counties along the turnpike (Burlton, Camen, Glouster Counties). It is used in the calculation of Total Vehicles.

The number of household vehicles is then increased by 33% to account for the number of cars passing through the region. That is, they did not originate from within the region.

Public Transit Vehicles: As was done for Urbansville, the number of public transit vehicles is calculated by multiplying the number of 472 transit vehicles per million US residents against the population of the region under study for each time frame.

Para Transit Vehicles: These are transit vehicles that are used for non–fixed routes. It is assumed that the number of para transit vehicles will be approximately one–fourth of the number of public transit vehicles. While currently no equipment packages are uniquely defined for Para Transit Vehicles the number is used to calculate the Total Vehicles.

Transit Vehicles All: This is the sum of the Public and Para Transit vehicles.

Emergency Vehicles: According to the Scenario Guides 0.25% of the total vehicles are emergency vehicles in Thruville.

Peak Period Private Vehicles and Probe Vehicles: The same methodology used for Urbansville was applied to Thruville. Peak Period Private Vehicles is 45% of the total household vehicles. The number of probe vehicles is proportionate to the total of assumed mileage of freeway and major arterials in the region under study.

3.2.1.2. Thruville User Parameters

Population: This is defined in the Scenario Guides for each of the regions under study.

Transit Customers: The same formula used in the Urbansville calculation was used here. The population used was sum of the 3 counties along the turnpike.

Personal Travel Info Users: The same formula used in the Urbansville calculation was used here. The population used was sum of the 3 counties along the turnpike.

3.2.1.3. Thruville Facility Parameters

Commercial Vehicle Administration Facilities and Commercial Vehicle Verification Stations: Two administration facilities were assumed for Thruville because of the two different states in Thruville. Also, since weigh station type facilities generally exist close to state boundaries, two such facilities were assumed to exist within the Thruville region. There is no international border found in or near Thruville so no such facilities were assumed.

Parking Lots: The number of lots represents the assumed number of lots in the region under study that are candidates to take advantage of ITS services.

Kiosks: These are devices that will provide information and perform services for travelers. The kiosks will be located in transit centers as well as other public places such as shopping malls or sports/civic arenas. The number of such sites is given as an assumption for the region in each time frame. It is assumed that the deployment of these devices will grow over time.

Transit Stops: This is an assumption that is used by the Remote Transit Security I/F Equipment Package. These would be possible locations where cameras and other security equipment could be placed.

Toll Booths: This number is assumed based on the toll roads and bridges in the region.

3.2.1.4. Thruville Center Parameters

Traffic Management Centers: These figures are based on the assumption that there exists a natural division of labor between State DOTs and the local municipalities. For Thruville it is assumed that each of the two states involved, Pennsylvania and New Jersey, and the city of Philadelphia will operate their own centers. As time goes on the suburban counties will build and staff their own centers.

Fleet Management Centers: This number represents the commercial fleets that will operate management centers within the region under study. This is not necessarily all of the fleets whose trucks will operate within the region at any given time. The specific numbers are assumptions.

Emergency Management Centers: The assumed number of EMCs in Thruville is based on an even distribution of EMCs between the two states involved.

Emissions and Environmental Data Management Centers: The number of such centers in Thruville is based on an assumption that the functions are performed by two separate agencies.

Independent Service Providers: The number of ISPs operating in a particular area will grow over time as the benefits of ITS are more widely available and accepted by the marketplace. For Thruville, one ISP has been assumed for the 5 year time frame growing to 2 then 4 by the 20 year point.

ITS Regional Planners: As ITS services are brought online within each region, it is assumed that ITS planning will fall under a Metropolitan Planning Organization (MPO), a government agency that will operate a central planning office to coordinate the implementation of ITS. One such region is assumed for Thruville.

Toll Administration Center: It is assumed that there is a single toll administration center to manage the toll roads in the region.

Virtual TMC: The virtual TMC provides for special requirements of rural road systems; therefore none are assumed for Thruville.

Transit Center: These centers manage the operations for the public transit fleets in a given municipality. For Thruville, 3 such centers have been assumed.

3.2.1.5. Thruville Roadway Parameters

Note that the roadway characteristics for Thruville have been based upon assumptions made after analyzing the area defined in the Scenario Guide.

Intersections: The intersections are the total number of signalized intersections in the 3 county portion of Thruville along the turnpike. This represents the total number of potential sites that can be controlled by the TMCs in the region.

3.2.1.5.1. Roadway Surveillance Equipment

Ramp Meters: The number of ramp meters is an assumption given the amount of freeway mileage in the region.

Detection Sensors: This includes loop detectors and other detection/monitor devices (e.g. RADAR). Beginning with an assumption that in the 5 year time frame 425 detectors will be installed on the freeways. At 10 years the assumed spacing of detectors on the freeways will increase to 3 per mile. At 20 years, detection/monitor devices will be added to half of the major arterial roadways at an assumed spacing of 2 miles in each direction.

CCTV Basic Surveillance Cameras: Assuming there are 1,040 intersections in the area of interest and 360 ramps onto the freeways the total pool of potential locations for surveillance cameras is 4 cameras per intersection and one camera per ramp. It is assumed that in the 5 year time frame 180 cameras will be installed along the freeways. At 10 years it is assumed that more detection cameras will be added to the freeway system and the arterials will begin to be equipped. By 20 years, it is assumed that the freeway system and 10% of the major intersections will be equipped with basic surveillance cameras.

CCTV Advanced Visual Detection Cameras: The number of advanced cameras at the 5 year time frame is based on an assumption that the number of advanced cameras will be installed at the same proportion of basic cameras in Urbansville. The number grows over time proportionately with the growth of the other surveillance cameras.

3.2.1.5.2. Roadway Traffic Information Dissemination Equipment

Changeable Message Signs: The number of CMS locations is an assumption about the region under study.

Highway Advisory Radio: The number of HAR transmitters is an assumption about the region under study

Fixed Message Signs: Another component of traffic information dissemination is the fixed message sign which bears one message and can be illuminated by a TMC or locally to alert the driver of icy bridges or foggy areas. There are 10 such signs assumed for Thruville.

Fixed Environmental Message Signs: These signs are tied directly to the Environmental sensors to disseminate advisories in remote areas. There are 2 such signs assumed for Thruville.

3.2.1.5.3. Roadway Beacon−type Equipment

Roadway Probe Beacons: These devices are used to monitor traffic flow in major intersections and on main highways for urban areas and to monitor road conditions using mobile equipment and wireless communication. It is assumed that none will be deployed at 5 years but the spacing of such beacons will be one for every 5 miles of freeway at 10 years, one for every 3 miles at 20 years.

Automated Road Signing Beacons: This type of beacon is used in areas controlled by a virtual TMC. There are none in Thruville.

In−Vehicle Signing Beacons: These devices are used to support in−vehicle signing. It is assumed that there will be 30 such transmitter/beacons in Thruville at the 10 year time frame. At 20 years there will be 60 transmitter/beacons.

3.2.1.5.4. Other Roadway Characteristics

HOV lane mileage: The assumption is that there will be a total of 25 miles of HOV roadway in Thruville. Entrances to the HOV lanes are assumed to be located every 2 miles along the HOV roadway. The equipment used to monitor and control the lane usage will be described in the Cost Analysis document.

Environmental Sensors: These devices support weather monitoring and information dissemination. The assumption is that the number of sensors will grow over time as funding for ITS services grows.

Emissions Sensors: These devices support pollution monitoring and information dissemination. The assumption is that the number of sensors will grow over time as funding for ITS services grows. These are separate devices from the environmental sensors and are fielded in very different locations.

AHS Lane Checkpoint Beacons: These devices are positioned at points of entry and exit to/from an AHS lane. The equipment provides the capability of safely controlling access to and egress from an AHS. It also provides the capability for roadside to vehicle communication. At the 20 year time frame, it is assumed that there will be a total of 10 miles of AHS roadway with these beacons spaced at every tenth of a mile.

3.2.2. Thruville Equipment Package Penetrations

Table 4. Evaluatory Design Equipment Package Market Penetrations on page 29 shows what percentage of the total number of potential users or sites described in the last section will likely be using a given Equipment Package in Urbansville for each time period.

3.2.3. Thruville Equipment Package Quantities

Table 5. Evaluatory Design Equipment Package Quantities on page 32 represents the multiplication of the parameter values against the market penetrations for each Equipment Package.

3.3. Mountainville (Rural Scenario)

The definition of the rural scenario is contained in the “RURAL SCENARIO GUIDE, MOUNTAINVILLE, PHASE II” and the following text is taken from that document.

The Mountainville scenario was based on Lincoln County, Montana. Lincoln County is a mountainous region located in the northwestern corner of Montana. Data was obtained from the Bureau of Transportation Statistics and the Highway Performance Traffic Volume section, both part of the U.S. Department of Transportation. Most of the data presented in this guide is consistent with the actual data that depicts the characteristics of Lincoln County. However, various roadway characteristics have been altered in order to create Mountainville, the rural scenario.

Mountainville, the regional domain, depicted in Figure 4, roughly covers 3500 square miles of mountainous terrain. The region is governed by two entities. The predominate jurisdictions covered by each agency is determined by roadway designation. The state has jurisdiction over all Interstates, U.S. highways, or state routes. The county is responsible for all county routes and all other public roads. The county works in cooperation with the few municipalities located in the region to maintain and plan for roadways located and serving those communities. All roadways used in the analysis of Mountainville are either under state or county jurisdiction.

Much of the detailed information contained in the Scenario Guide is used directly by the Traffic and Communication Simulation. Some of the demographic data was used as source material for the parameter definitions contained in the next section. The source of the parameter values will highlight which values were based on information contained in the Scenario Guide.

3.3.1. Mountainville Evaluatory Design Parameters

This section describes How Many (a number) of What Parameter can potentially use a given Equipment Package, for each time frame. This section is grouped into the following classes of parameters: Vehicles, Users, Facilities, Centers, and Roadway Characteristics. Much of the methodology for defining the parameters for Mountainville is based on the same methodology used in defining the Urbansville parameters (i.e. population, vehicles, and mileage proportions).

Table 2, Evaluatory Design Source Parameters on page 26 identifies each parameter used in the evaluatory design.

3.3.1.1. Vehicles

Commercial Vehicles: The number of commercial vehicles, long and short−haul, is based on a similar set of calculations as were performed for Urbansville.

The Mountainville regional population given in the scenario guide for each time frame is divided by the number of people per long−haul truck in the US to arrive at the number of long−haul trucks within the region.

The Mountainville regional population given in the scenario guide for each time frame is divided by the number of people per short−haul truck in the US to arrive at the number of short−haul trucks within the region.

Household Vehicles: This number is taken directly from the Scenario Guides. It is used in the calculation of Total Vehicles.

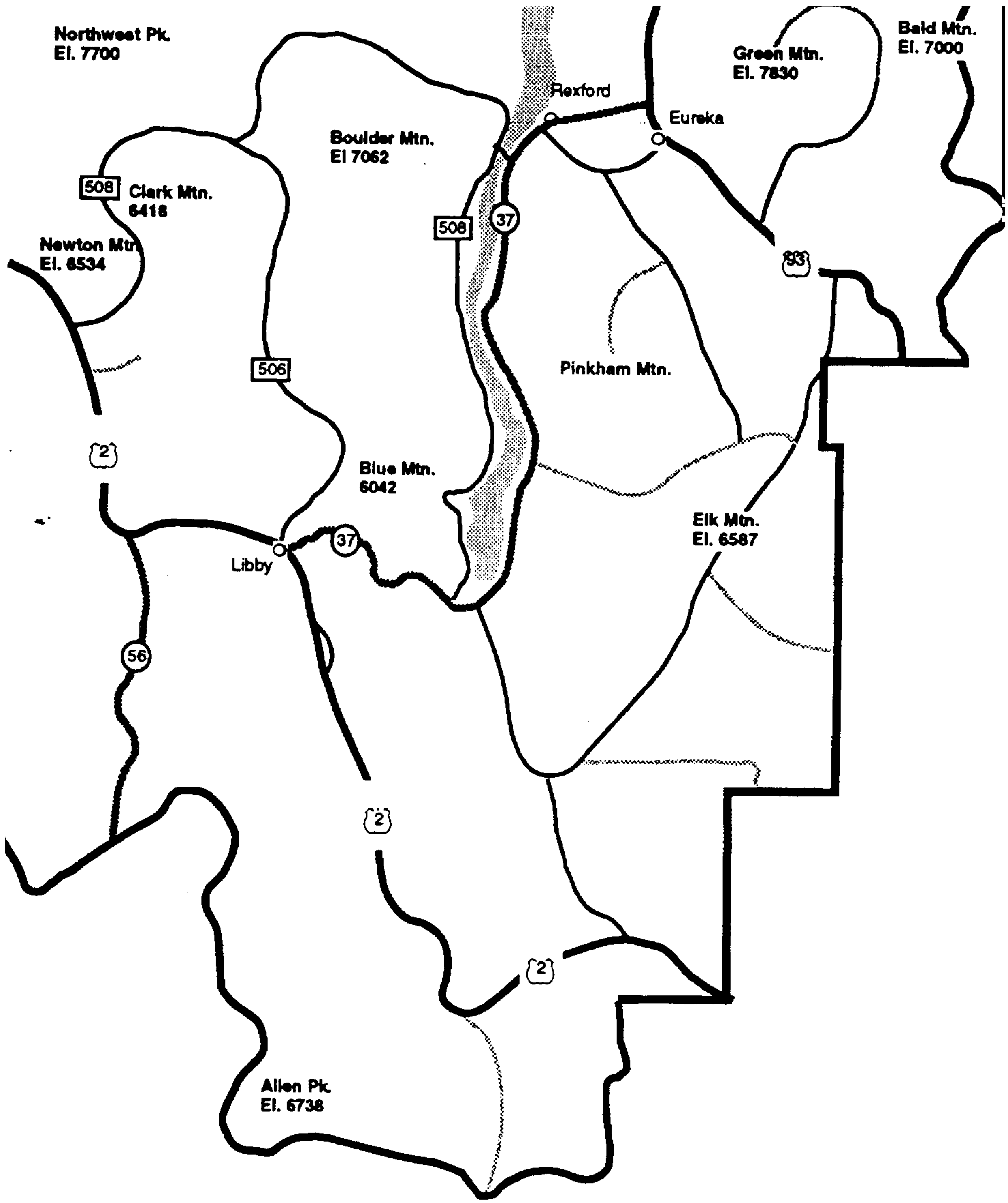


Figure 4. The Rural Region: Mountainville

Public Transit Vehicles: As was done for Urbansville, the number of public transit vehicles is calculated by multiplying the number of 472 transit vehicles per million US residents against the population of the region under study for each time frame. For Mountainville, the number of transit vehicles was set to zero at 5 years because no ITS services for transit are anticipated by that time frame.

Para Transit Vehicles: These are transit vehicles that are used for non–fixed routes. It is assumed that the number of para transit vehicles will be approximately one–fourth of the number of public transit vehicles. While currently no equipment packages are uniquely defined for Para Transit Vehicles the number is used to calculate the Total Vehicles. For Mountainville, the number of para transit vehicles was set to zero at 5 years because no ITS services for transit are anticipated by that time frame.

Transit Vehicles All: This is the sum of the Public and Para Transit vehicles.

Emergency Vehicles: According to the Scenario Guide, 0.1% of the total vehicles are emergency vehicles in Mountainville.

Peak Period Private Vehicles and Probe Vehicles: The same methodology used for Urbansville was applied to Mountainville. Peak Period Private Vehicles is 45% of the total household vehicles. The number of probe vehicles is proportionate to the total of assumed mileage of freeway and major arterials in the region under study.

3.3.1.2. Mountainville User Parameters

Population: This is defined in the Scenario Guides for each of the regions under study.

Transit Customers: Transit customers are assigned to the Mountainville region as a proportion of its population to that of the entire US, so that the Mountainville regional population given in the scenario guide for each time frame is multiplied by the 1.527% of residents using public transportation each day to arrive at the number of transit customers within the region.

Personal Travel Info Users: These are the people that will access travel related information provided by the ISPs and delivered using the PIAS, RTS, and VS subsystems. The number is calculated by adding the number of drivers of private vehicles during the peak periods of each day to the number of transit customers on a given day.

3.3.1.3. Mountainville Facility Parameters

Commercial Vehicle Administration Facilities and Commercial Vehicle Verification Stations: One roadside facility and an accompanying administration facility were assumed for Mountainville.

Parking Lots: No such facilities have been assumed for the Mountainville region because of the low population.

Kiosks: No such devices have been assumed for the Mountainville region because of the low population.

Transit Stops: This is an assumption that is used by the Remote Transit Security I/F Equipment Package. These would be possible locations where cameras and other security equipment could be placed.

Toll Booths: There are no toll roads in Mountainville.

3.3.1.4. Mountainville Center Parameters

Traffic Management Centers: For Mountainville, no fixed Traffic Management Centers are assumed to be operational in the region. Some of the TMC–based services are provided by a Virtual TMC in rural areas.

Fleet Management Centers: This number represents the commercial fleets that will operate management centers within the region under study. This is not necessarily all of the fleets whose trucks will operate within the region at any given time. The specific numbers are assumptions.

Emergency Management Centers: There is one assumed EMC in Mountainville based on the fact that there is one county jurisdiction in the region.

Emissions and Environmental Data Management Centers: There is one environmental management center assumed for Mountainville. This could be thought of as a single "facility" with the Virtual TMC.

Independent Service Providers: The number of ISPs operating in a particular area will grow over time as the benefits of ITS are more widely available and accepted by the marketplace. For Mountainville, one ISP has been assumed for the 20 year time frame.

ITS Regional Planners: There are no ITS Planning facilities assumed for the Mountainville region.

Toll Administration Center: There are no toll roads in Mountainville.

Virtual TMC: The virtual TMC provides for special requirements of rural road systems. Instead of a central TMC, the traffic management is distributed over a very wide area. (e.g. a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package includes smart probes on vehicles which are capable of measuring road conditions, and in–vehicle signing for informing drivers of detected road conditions. One virtual TMC is assumed to be operational for the rural region at the 10 and 20 year time frames.

Transit Center: These centers manage the operations for the public transit fleets in a given municipality. For Mountainville, 1 such center has been assumed at the 10 and 20 year time frames.

3.3.1.5. Mountainville Roadway Parameters

Note that the roadway characteristics for Mountainville have been based upon assumptions made after analyzing the area defined in the Scenario Guide.

Intersections: The total number of signalized intersections is not used in Mountainville because no instrumentation of the intersections will be assumed.

3.3.1.5.1. Roadway Surveillance Equipment

Ramp Meters: There are no freeways in the Mountainville region.

Detection Sensors: No fixed detection sensor devices have been assumed for Mountainville.

CCTV Basic Surveillance Cameras: No surveillance cameras have been assumed for Mountainville.

CCTV Advanced Visual Detection Cameras: No visual detection cameras have been assumed for Mountainville.

3.3.1.5.2. Roadway Traffic Information Dissemination Equipment

Changeable Message Signs: The number of CMS locations is an assumption about the region under study.

Highway Advisory Radio: The number of HAR transmitters is an assumption about the region under study.

Fixed Message Signs: There are 5 such signs assumed for Mountainville.

Fixed Environmental Message Signs: There is 1 such sign assumed for Mountainville.

3.3.1.5.3. Roadway Beacon−type Equipment

Roadway Probe Beacons: These devices are used to monitor traffic flow in major intersections and on main highways and to monitor road conditions using mobile equipment and wireless communication. A fixed number of 25 beacons have been assumed for the Mountainville region in the 10 year timeframe and 50 such beacons in the 20 year time frame.

Automated Road Signing Beacons: This type of beacon is used in rural areas controlled by a virtual TMC. They can be locally or autonomously controlled from probe transmissions or centrally controlled from the virtual TMC. The number of beacons deployed will grow over time as the rural areas make use of ITS services. For Mountainville, the first time frame at which the virtual TMC will be deployed is 10 years at which time it is assumed that there will be a spacing of 1 beacon for every 4 miles of the 200 miles of major roadway. At 20 years, the beacons will be spaced at one for every 2 miles.

In−Vehicle Signing Beacons: These devices are used to support in−vehicle signing. It is assumed that there will be 20 such transmitter/beacons in Mountainville at the 10 year time frame. At 20 years there will be 40 transmitter/beacons.

3.3.1.5.4. Other Roadway Characteristics

HOV lane mileage: There is no HOV roadway in Mountainville

Environmental Sensors: These devices support weather monitoring and information dissemination. The assumption is that the number of sensors will grow over time as funding for ITS services grows.

Emissions Sensors: No emissions sensors are assumed for the Mountainville region.

AHS Lane Checkpoint Beacons: There is no AHS roadway in Mountainville.

3.3.2. Mountainville Equipment Package Penetrations

Table 4. Evaluatory Design Equipment Package Market Penetrations on page 29 shows what percentage of the total number of potential users or sites described in the last section will likely be using a given Equipment Package in Urbansville for each time period.

3.3.3. Mountainville Equipment Package Quantities

Table 5. Evaluatory Design Equipment Package Quantities on page 32 represents the multiplication of the parameter values against the market penetrations for each Equipment Package.

4. Evaluatory Design Tables

This section contains the tables of information that comprise the evaluatory design. The first set of tables contains the quantities of parameters used in each of the scenarios and time frames. Following the Evaluatory Design parameters is a set of tables which contains all of the market penetrations assumed in each scenario and timeframe. This set of tables is broken out by Equipment Package from the Physical Architecture. Finally a set of tables containing the quantities of that are assumed for each Equipment Package. These numbers are calculated by multiplying the source parameter listed by each Equipment Package by the market penetration values. This is done for each scenario and each time frame. Also, quantities are included for a low and high range of penetration values.

Table 2. Evaluatory Design Source Parameters

	Urbansville			Thruville			Mountainville		
Phase II Source Parameters	**5 yr**	**10 yr**	**20 yr**	**5 yr**	**10 yr**	**20 yr**	**5 yr**	**10 yr**	**20 yr**
Vehicles									
COM_Vehicles_Long_Haul	5,797	6,397	7,802	2,753	2,891	3,194	36	37	39
COM_Vehicles_Short_Haul	81,155	89,565	109,226	28,979	30,428	33,616	504	517	543
COM_Vehicles_All	86,951	95,962	117,027	31,732	33,319	36,810	540	554	582
Household Vehicles	1,688,970	1,842,105	2,273,176	851,272	893,836	987,476	6,735	6,904	7,260
Public_Transit_Vehicles	1,329	1,466	1,788	474	498	550	0	8	9
ParaTransit_Vehicles	332	367	447	119	125	138	0	2	2
Transit_Vehicles_All	1,661	1,833	2,235	593	623	688	0	11	11
Total Vehicles	1,777,582	1,939,900	2,392,439	883,597	927,778	1,024,973	7,275	7,468	7,853
Emergency_Vehicles	4,444	4,850	5,981	2,128	2,319	2,562	7	7	8
Peak_Period_Private_Vehicles	760,036	828,947	1,022,929	383,072	402,226	444,364	3,031	3,107	3,267
Probe_Vehicles	7,704	7,704	7,704	3,900	3,900	3,900	800	800	800
Users									
Population	2,814,950	3,106,674	3,788,627	1,005,185	1,055,445	1,166,015	17,480	17,920	18,845
Transit Customers	42,980	47,440	57,850	15,350	16,120	17,810	270	270	290
Personal Travel Information Users	200,750	262,920	432,310	99,610	125,500	184,870	830	1,010	1,420
Facilities									
CV_Central_ Admin_Facility	0	0	0	2	2	2	1	1	1
CV_Central_ Admin_Facility_Intl	1	1	1	0	0	0	0	0	0
CVO_Facility	0	0	0	2	2	2	1	1	1
CVO_Facility_Intl	1	1	1	0	0	0	0	0	0
Parking_Lots	200	200	200	50	50	50	0	0	0
Kiosks	50	100	200	25	50	100	0	0	0
Transit Stops	400	400	400	200	200	200	20	20	20
Toll Booths	14	14	14	20	20	20	0	0	0
Centers									
Traffic_Management_Centers	2	3	5	1	1	2	0	0	0
Fleet_Management_Centers	100	100	100	10	10	10	2	2	2
Emergency_Management_Centers	4	4	4	2	2	2	1	1	1

Phase II Source Parameters	5 yr	10 yr	20 yr	5 yr	10 yr	20 yr	5 yr	10 yr	20 yr
Information_Service_Providers	1	4	8	1	2	4	0	0	1
ITS_Regional_Planners	1	1	1	1	1	1	0	0	0
Toll Administration	1	1	1	1	1	1	0	0	0
Virtual TMC	0	0	0	0	0	0	0	1	1
Emissions & Environment Mgt Centers	2	2	2	0	2	2	0	1	1
Transit Center	3	3	3	3	3	3	0	1	1
Roadway Characteristics									
Miles of Freeway	225	225	225	275	275	275	0	0	0
Miles of arterial surface streets	1,701	1,701	1,701	700	700	700	200	200	200
Intersections	2,560	2,560	2,560	1,040	1,040	1,040	20	20	20
Freeway Ramps	400	400	400	360	360	360	0	0	0
Ramp meters	59	59	59	0	70	70	0	0	0
Detection Sensors (Loops)	350	1,350	3,910	0	1,650	2,690	0	0	0
CCTV Basic Surveillance Cameras	150	425	850	0	410	570	0	0	0
CCTV Advanced Detection Cameras	10	30	60	0	28	38	0	0	0
Changeable Message Signs	59	59	59	30	60	60	0	2	2
Highway Advisory Radio	12	12	12	0	18	18	0	3	3
Fixed Message Signs	0	0	0	0	10	10	0	5	5
Fixed Environmental Message Signs	0	0	0	0	2	2	0	1	1
Roadway Probe Beacons	45	75	225	0	55	92	0	25	50
Automated Road Signing Beacons	0	0	0	0	0	0	0	25	50
In–Vehicle Signing Beacons	0	25	50	0	30	60	0	20	40
HOV lane mileage	10	10	10	25	25	25	0	0	0
Environmental sensors	10	25	50	0	15	30	0	2	4
Emmissions sensors	10	25	50	0	10	20	0	0	0
AHS Lane Checkpoints (10/AHS lane mi)	0	0	100	0	0	100	0	0	0

Table 3. Other Parameters

These parameters were used to calculate the source parameters for the evaluatory design listed in Table 2.

US Population in 1987	242,804,000					
LH Trucks in US in 1987	1,000,000					
SH Trucks in US in 1987	7,000,000					
% of LH Trucks operating in a Metro Area	50%					
% of SH Trucks operating in a Metro Area	100%					
% of US metro residents using public transportation each day	1.527%					
Public Transit Vehicles / million metro residents	472					
% of US households with computers	25%	30%	40%			
Population/Vehicles by county in Thruville:	5 yr		10 yr		20 yr	
* Indicates which are used above.	Population	Household Vehicles	Population	Household Vehicles	Population	Household Vehicles
Philly Suburbs	1526867	525978	1603210	552277	1771166	610134
Dela County	442049	300438	464151	315460	515777	348508
Mount County	191618	134518	201199	141244	222277	156041
Buck County	377769	259671	396657	272655	438212	601218
Mercy County	340106	202735	357111	212872	394523	235173
Burlton County *	353438	246411	371110	258732	409988	285837
Camen County *	477492	278558	501367	292486	553891	323127
Glouster County *	174255	115085	182968	120839	202136	133499
Regional Total	3883594	2063394	4077773	2166565	4504970	239537
Additional Long Haul Trucks and Household Vehicles which are on Thruville highways (as a % of current):						33%

Table 4. Evaluatory Design Equipment Package Market Penetrations

				Urbansville Penetrations						Thruville Penetrations						Mountainville Penetrations					
Subsystem	EP ID	Equipment Package Name	Phase II Source Parameters (Basis of Estimate)	5 yr Low	5 yr High	10 yr Low	10 yr High	20 yr Low	20 yr High	5 yr Low	5-yr High	10 yr Low	10 yr High	20 yr Low	20 yr High	5 yr Low	5 yr High	10yr Low	10 yr High	20yr Low	20yr High
CVAS	CVA1	Credentials and Taxes Administration	CV_Central_ Admin_Facilities	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVAS	CVA2	CV Information Exchange	CV_Central_ Admin_Facilities	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVAS	CVA3	CV Safety Administration	CV_Central_ Admin_Facilities	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVAS	CVA4	International CV Administration	CV_Central_ Admin_Facility_Intl	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CVCS	CVC1	Citation and Accident Electronic Recording	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVCS	CVC2	International Border Crossing	CVO_Facility_Intl	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CVCS	CVC3	Roadside Electronic Screening	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVCS	CVC4	Roadside Safety Inspection	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVCS	CVC5	Roadside WIM	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
CVS	CVS1	On-board Cargo Monitoring	COM_Vehicles_Long_Haul	0%	5%	5%	10%	20%	50%	0%	5%	5%	10%	20%	50%	0%	5%	5%	10%	20%	50%
CVS	CVS2	On-board CV Electronic Data	COM_Vehicles_Long_Haul	1%	2%	10%	20%	50%	80%	1%	2%	10%	20%	50%	80%	1%	2%	10%	20%	50%	80%
CVS	CVS3	On-board CV Safety	COM_Vehicles_Long_Haul	1%	2%	5%	10%	20%	30%	1%	2%	5%	10%	20%	30%	1%	2%	5%	10%	20%	30%
CVS	CVS4	On-board Trip Monitoring	COM_Vehicles_All	2%	5%	10%	20%	50%	80%	2%	5%	10%	20%	50%	80%	2%	5%	10%	20%	50%	80%
EM	EM1	Emergency and Incident Management Communication	EMCs	0%	50%	25%	75%	100%	100%	0%	50%	25%	75%	100%	100%	0%	50%	25%	75%	100%	100%
EM	EM2	Emergency Mayday and E-911 I/F	EMCs	25%	50%	50%	100%	100%	100%	0%	50%	50%	100%	100%	100%	0%	50%	50%	100%	100%	100%
EM	EM3	Emergency Response Management	EMCs	0%	50%	25%	75%	100%	100%	0%	50%	25%	75%	100%	100%	0%	50%	25%	75%	100%	100%
EM	EM4	Emergency Vehicle Routing and communications	EMCs	0%	50%	25%	75%	100%	100%	0%	50%	25%	75%	100%	100%	0%	50%	25%	75%	100%	100%
EMMS	EMM1	Emissions and Environmental Data Management	EMMS Centers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
EVS	EVS1	On-board EV Incident Management Communication	Emergency_Vehicles	10%	20%	33%	66%	100%	100%	10%	20%	33%	66%	100%	100%	10%	20%	33%	66%	100%	100%
EVS	EVS2	On-board Vehicle Signal Coordination	Emergency_Vehicles	10%	20%	33%	66%	100%	100%	10%	20%	33%	66%	100%	100%	10%	20%	33%	66%	100%	100%
FMS	FMS1	Fleet Administration	Fleet_Mgt_Centers	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%
FMS	FMS2	Fleet Credentials and Taxes Management and Reporting	Fleet_Mgt_Centers	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%
FMS	FMS3	Fleet HAZMAT Management	Fleet_Mgt_Centers	1%	5%	5%	10%	10%	15%	1%	5%	5%	10%	10%	15%	1%	5%	5%	10%	10%	15%
FMS	FMS5	Fleet Maintenance Management	Fleet_Mgt_Centers	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%
FMS	FMS4	Freight Administration and Management	Fleet_Mgt_Centers	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%	10%	25%	25%	50%	50%	85%
ISP	ISP1	Basic Information Broadcast	ISPs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%
ISP	ISP2	EM Route Plan Information Dissemination	ISPs	0%	25%	0%	50%	100%	100%	0%	25%	0%	50%	100%	100%	0%	0%	0%	0%	0%	0%
ISP	ISP3	Infrastructure Provided Dynamic Ridesharing	ISPs	0%	0%	0%	25%	25%	75%	0%	0%	0%	25%	25%	75%	0%	0%	0%	0%	0%	0%
ISP	ISP4	Infrastructure Provided Route Selection	ISPs	0%	25%	25%	75%	100%	100%	0%	25%	25%	75%	100%	100%	0%	0%	0%	0%	0%	100%
ISP	ISP5	Infrastructure Provided Yellow Pages & Reservation	ISPs	0%	100%	75%	100%	100%	100%	0%	100%	75%	100%	100%	100%	0%	0%	0%	0%	0%	0%
ISP	ISP6	Interactive Infrastructure Information	ISPs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%
ISP	ISP7	ISP Advanced Integrated Control Support	ISPs	0%	0%	0%	25%	25%	75%	0%	0%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%
ISP	ISP8	ISP Probe Information Collection	ISPs	100%	100%	100%	100%	100%	100%	0%	0%	0%	25%	25%	75%	0%	0%	0%	0%	0%	0%
PIAS	PIA1	Personal Basic Information Reception	Personal_Travel_Info_Users	0.1%	1%	0.5%	2%	1%	10%	0.1%	1%	0.5%	2%	1%	10%	0%	1%	0%	2%	1%	10%
PIAS	PIA2	Personal Interactive Information Reception	Personal_Travel_Info_Users	0.1%	1%	3%	5%	7%	15%	0.1%	1%	3%	5%	7%	15%	0%	0%	1%	2%	5%	10%
PIAS	PIA3	Personal Mayday I/F	Personal_Travel_Info_Users	0.1%	1%	5%	10%	15%	20%	0.1%	1%	5%	10%	15%	20%	0%	1%	5%	10%	15%	20%
PIAS	PIA4	Personal Route Guidance	Personal_Travel_Info_Users	0.1%	1%	5%	10%	7%	15%	0.1%	1%	5%	10%	7%	15%	0%	0%	0%	2%	1%	10%
PMS	PMS1	Parking Management	Parking_Lots	5%	15%	20%	35%	50%	90%	5%	15%	20%	35%	50%	90%	N/A	N/A	N/A	N/A	N/A	N/A
PS	PS1	Data Collection and ITS Planning	ITS_Regional_Planners	0%	0%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS1	Automated road signing	Automated road signing beacons	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0%	0%	100%	100%	100%	100%

RS	RS2	Roadside Signal Priority	Intersections	10%	20%	25%	50%	60%	85%	10%	20%	25%	50%	60%	85%	0%	0%	0%	0%	0%	0%
RS	RS3	Roadway Freeway Control	Ramp Meters	50%	75%	75%	100%	100%	100%	0%	0%	50%	75%	75%	100%	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS4	Roadway Signal Controls	Intersections	10%	20%	30%	50%	60%	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RS	RS5	Roadway Basic Surveillance	Loops + Add'l Params Below	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS6	Roadway HOV Usage	HOV Lane Mileage	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS7	Roadway In-Vehicle Signing	In-Vehicle Signing Beacons	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%
RS	RS8	Roadway Incident Detection	Advanced Cameras	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS9	Roadway Intersection Collision System	Intersections	0%	0%	0%	1%	1%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RS	RS10	Roadway Pollution and Environmental Hazards Indicators	Emmisions and Env. Sensors	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%
RS	RS11	Roadway Probe Beacons	Roadway Probe Beacons	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%
RS	RS12	Roadway Reversible Lanes	Intersections	2%	7%	10%	20%	25%	40%	0%	0%	2%	7%	10%	20%	0%	0%	0%	0%	0%	0%
RS	RS13	Roadway Systems for AHS	AHS Lane Checkpoints	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS14	Roadway Traffic Information Dissemination	CMS + Add'l Params Below	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
RTS	RTS5	Remote Basic Information Reception	Kiosks	50%	50%	50%	50%	100%	100%	50%	50%	50%	50%	100%	100%	50%	50%	50%	50%	100%	100%
RTS	RTS1	Remote Interactive Information Reception	Kiosks	0%	50%	50%	50%	75%	100%	0%	50%	50%	50%	75%	100%	0%	0%	50%	50%	75%	100%
RTS	RTS2	Remote Mayday I/F	Kiosks	50%	50%	50%	50%	100%	100%	50%	50%	50%	50%	100%	100%	50%	50%	50%	50%	100%	100%
RTS	RTS3	Remote Transit Fare Management	Kiosks	50%	50%	50%	50%	100%	100%	50%	50%	50%	50%	100%	100%	50%	50%	50%	50%	100%	100%
RTS	RTS4	Remote Transit Security I/F	Transit Stops	0%	25%	25%	75%	50%	100%	0%	0%	0%	25%	25%	75%	0%	0%	0%	0%	0%	25%
TAS	TAS1	Toll Administration	Toll Administration Centers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TCS	TCS1	Toll Plaza Toll Collection	Toll Booths	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS1	Collect Traffic Surveillance	TMCs	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS2	Distributed Road Management	Virtual TMC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100%	100%	100%	100%	100%	100%
TMS	TMS3	TMC Advanced Signal Control	TMCs	0%	0%	0%	0%	50%	100%	0%	0%	0%	0%	50%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS4	TMC Regional Traffic Control	TMCs	0%	50%	33%	67%	60%	100%	0%	50%	33%	67%	60%	100%	0%	0%	0%	0%	0%	50%
TMS	TMS5	TMC based Freeway Control	TMCs	100%	100%	100%	100%	100%	100%	0%	0%	0%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS6	TMC Basic Signal Control	TMCs	100%	50%	67%	33%	40%	0%	0%	0%	0%	0%	0%	0%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS7	TMC for AHS	TMCs	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%	20%	20%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS8	TMC HOV/Reversible Lane Management	TMCs	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS9	TMC Incident Detection	TMCs	100%	100%	100%	100%	100%	100%	0%	0%	100%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS10	TMC Incident Dispatch Coordination/Communication	TMCs	50%	100%	66%	100%	100%	100%	50%	100%	66%	100%	100%	100%	50%	100%	66%	100%	100%	100%
TMS	TMS11	TMC Input to In-Vehicle Signing	TMCs	0%	0%	0%	33%	20%	20%	0%	0%	0%	33%	20%	20%	0%	0%	0%	25%	25%	75%
TMS	TMS12	TMC Multi-Modal Coordination	TMCs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%
TMS	TMS13	TMC Probe Information Collection	TMCs	0%	50%	33%	65%	40%	80%	0%	50%	33%	65%	40%	80%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS14	TMC Toll/Parking Coordination	TMCs	25%	50%	50%	75%	75%	100%	25%	50%	50%	75%	75%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS15	TMC Traffic Information Dissemination	TMCs (incl virtual TMC)	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
TMS	TMS16	TMC Traffic Network Performance Evaluation	TMCs	0%	50%	33%	100%	100%	100%	0%	50%	33%	100%	100%	100%	N/A	N/A	N/A	N/A	N/A	N/A
TMS	TMS17	Traffic Maintenance	TMCs	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%
TRMS	TRM1	Fleet Maintenance Management	Transit Centers	33%	66%	66%	100%	100%	100%	0%	0%	33%	66%	66%	100%	0%	0%	33%	66%	66%	100%
TRMS	TRM2	Transit Center Fare and Load Management	Transit Centers	33%	66%	66%	100%	100%	100%	0%	0%	33%	66%	66%	100%	0%	0%	33%	66%	66%	100%
TRMS	TRM3	Transit Center Fixed-Route Operations	Transit Centers	33%	66%	66%	100%	100%	100%	33%	66%	66%	100%	100%	100%	0%	0%	33%	66%	100%	100%
TRMS	TRM4	Transit Center Multi-Modal Coordination	Transit Centers	0%	0%	66%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
TRMS	TRM5	Transit Center Paratransit Operations	Transit Centers	33%	66%	66%	100%	100%	100%	33%	66%	66%	100%	100%	100%	0%	0%	33%	66%	100%	100%
TRMS	TRM6	Transit Center Security	Transit Centers	33%	66%	66%	100%	100%	100%	0%	0%	33%	66%	66%	100%	0%	0%	33%	66%	100%	100%
TRMS	TRM7	Transit Center Tracking and Dispatch	Transit Centers	0%	33%	66%	100%	100%	100%	0%	33%	66%	100%	100%	100%	0%	33%	66%	100%	100%	100%

TRVS	TRV1	On-board Maintenance	Transit Vehicles All	0%	33%	66%	100%	100%	100%	0%	33%	66%	100%	100%	100%	0%	33%	66%	100%	100%	100%
TRVS	TRV2	On-board Transit Driver I/F	Transit Vehicles All	33%	66%	66%	100%	100%	100%	33%	66%	66%	100%	100%	100%	0%	0%	0%	100%	100%	100%
TRVS	TRV3	On-board Transit Fare and Load Management	Transit Vehicles All	33%	66%	66%	100%	100%	100%	0%	66%	66%	100%	100%	100%	0%	0%	0%	100%	100%	100%
TRVS	TRV4	On-board Transit Security	Transit Vehicles All	0%	33%	33%	100%	100%	100%	0%	33%	33%	100%	100%	100%	0%	0%	0%	100%	100%	100%
TRVS	TRV7	On-board Trip Monitoring	Transit Vehicles All	33%	66%	66%	100%	100%	100%	33%	66%	66%	100%	100%	100%	0%	0%	0%	100%	100%	100%
TRVS	TRV5	On-board Vehicle Signal Coordination	Transit Vehicles	0%	0%	33%	66%	100%	100%	0%	0%	33%	66%	100%	100%	0%	0%	0%	0%	0%	0%
TRVS	TRV6	Vehicle Dispatch Support	Transit Vehicles All	33%	66%	66%	100%	100%	100%	0%	33%	66%	100%	100%	100%	0%	0%	0%	100%	100%	100%
VS	VS1	Basic Vehicle Reception	Total_Vehicles	1%	3%	5%	10%	25%	50%	1%	3%	5%	10%	25%	50%	1%	3%	5%	10%	25%	50%
VS	VS2	Driver Safety Monitoring System	Total_Vehicles	0%	0%	1%	5%	10%	25%	0%	0%	1%	5%	10%	25%	0%	0%	1%	5%	10%	25%
VS	VS3	Driver Visibility Improvement System	Total_Vehicles	0%	0%	0%	0%	1%	5%	0%	0%	0%	0%	1%	5%	0%	0%	0%	0%	1%	5%
VS	VS4	In-Vehicle Signing System	Total_Vehicles	0%	0.5%	1%	5%	10%	20%	0%	0%	1%	5%	10%	20%	0%	0%	1%	5%	10%	20%
VS	VS5	Interactive Vehicle Reception	Total_Vehicles	0.3%	1%	3%	10%	7%	20%	0.3%	1%	3%	10%	7%	20%	0%	0%	3%	10%	7%	20%
VS	VS6	Probe Vehicle Software	Total_Vehicles	0.1%	0.4%	1%	2%	2%	5%	0%	0%	1%	2%	2%	5%	0%	0%	0.1%	0.4%	1%	2%
VS	VS7	Smart Probe	Total_Vehicles	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1%	0.4%	1%	2%
VS	VS8	Vehicle Intersection Collision Warning	Total_Vehicles	0%	0%	0%	0.1%	0.5%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VS	VS9	Vehicle Intersection Control	Total_Vehicles	0%	0%	0%	0%	1%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VS	VS10	Vehicle Lateral Control	Total_Vehicles	0%	0%	0%	0%	1%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VS	VS11	Vehicle Lateral Warning System	Total_Vehicles	0%	0%	0%	2%	5%	15%	0%	0%	0%	2%	5%	15%	0%	0%	0%	2%	5%	15%
VS	VS12	Vehicle Longitudinal Control	Total_Vehicles	0%	0%	0%	2%	5%	15%	0%	0%	0%	2%	5%	15%	0%	0%	0%	2%	5%	15%
VS	VS13	Vehicle Longitudinal Warning System	Total_Vehicles	0%	0.1%	5%	20%	25%	50%	0%	0.1%	5%	20%	25%	50%	0%	0.1%	1%	5%	5%	15%
VS	VS14	Vehicle Mayday I/F	Total_Vehicles	3%	5%	8%	15%	15%	30%	3%	5%	8%	15%	15%	30%	3%	5%	8%	15%	15%	30%
VS	VS15	Vehicle Pre-Crash Safety Systems	Total_Vehicles	0%	0%	0%	0%	1%	5%	0%	0%	0%	0%	1%	5%	0%	0%	0%	0%	1%	5%
VS	VS16	Vehicle Route Guidance	Total_Vehicles	0.3%	1%	2%	7%	5%	30%	0.3%	1%	2%	7%	5%	30%	0%	0%	1%	2%	7%	30%
VS	VS17	Vehicle Safety Monitoring System	Total_Vehicles	1%	2%	5%	20%	25%	50%	1%	2%	5%	20%	25%	50%	1%	2%	5%	20%	25%	50%
VS	VS18	Vehicle Systems for AHS	Total_Vehicles	0%	0%	0%	0%	0.1%	1%	0%	0%	0%	0%	0.1%	1%	0%	0%	0%	0%	0%	0%
VS	VS19	Vehicle Toll/Parking I/F	Total_Vehicles	1%	3%	2%	10%	10%	50%	1%	3%	2%	10%	10%	50%	0%	0%	0%	0%	0%	0%
xRS	XRS1	Basic Surveillance Additional Parameters - 1	Ramp Meters	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
xRS	XRS2	Basic Surveillance Additional Parameters - 2	Basic Cameras	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
xRS	XRS3	Information Dissemination Additional Parameters - 1	Highway Advisory Radios	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
xRS	XRS4	Information Dissemination Additional Parameters - 2	Fixed Message Signs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
xRS	XRS5	Information Dissemination Additional Parameters - 3	Fixed Env Message Signs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 5. Evaluatory Design Equipment Package Quantities

				Urbansville Quantities						Thruville Quantities						Mountainville Quantities					
Subsystem	EP ID	Equipment Package Name	Phase II Source Parameters (Basis of Estimate)	5 yr Low	5 yr High	10 yr Low	10 yr High	20 yr Low	20 yr High	5 yr Low	5 yr High	10 yr Low	10 yr High	20 yr Low	20 yr High	5 yr Low	5 yr High	10 yr Low	10 yr High	20 yr Low	20 yr High
CVAS	CVA1	Credentials and Taxes Administration	CV_Central_ Admin_Facilities	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1
CVAS	CVA2	CV Information Exchange	CV_Central_ Admin_Facilities	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1
CVAS	CVA3	CV Safety Administration	CV_Central_ Admin_Facilities	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1
CVAS	CVA4	International CV Administration	CV_Central_ Admin_Facility_Intl	1	1	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CVCS	CVC1	Citation and Accident Electronic Recording	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	2	2	2	2	2	2	1	1	1	1	1	1
CVCS	CVC2	International Border Crossing	CVO_Facility_Intl	1	1	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CVCS	CVC3	Roadside Electronic Screening	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	2	2	2	2	2	2	1	1	1	1	1	1
CVCS	CVC4	Roadside Safety Inspection	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	2	2	2	2	2	2	1	1	1	1	1	1
CVCS	CVC5	Roadside WIM	CVO_Facility	N/A	N/A	N/A	N/A	N/A	N/A	2	2	2	2	2	2	1	1	1	1	1	1

CVS	CVS1	On-board Cargo Monitoring	COM_Vehicles_Long_Haul	0	290	320	640	1,560	3,901	0	138	145	289	639	1,597	0	2	2	4	8	19
CVS	CVS2	On-board CV Electronic Data	COM_Vehicles_Long_Haul	58	116	640	1,279	3,901	6,241	28	55	289	578	1,597	2,555	0	1	4	7	19	31
CVS	CVS3	On-board CV Safety	COM_Vehicles_Long_Haul	58	116	320	640	1,560	2,341	28	55	145	289	639	958	0	1	2	4	8	12
CVS	CVS4	On-board Trip Monitoring	COM_Vehicles_All	1,739	4,348	9,596	19,192	58,514	93,622	635	1,587	3,332	6,664	18,405	29,448	11	27	55	111	291	466
EM	EM1	Emergency and Incident Management Communication	EMCs	0	2	1	3	4	4	0	1	1	2	2	2	0	1	0	1	1	1
EM	EM2	Emergency Mayday and E-911 I/F	EMCs	1	2	2	4	4	4	0	1	1	2	2	2	0	1	1	1	1	1
EM	EM3	Emergency Response Management	EMCs	0	2	1	3	4	4	0	1	1	2	2	2	0	1	0	1	1	1
EM	EM4	Emergency Vehicle Routing and communications	EMCs	0	2	1	3	4	4	0	1	1	2	2	2	0	1	0	1	1	1
EMMS	EMM1	Emissions and Environmental Data Management	EMMS Centers	2	2	2	2	2	2	0	0	2	2	2	2	0	0	1	1	1	1
EVS	EVS1	On-board EV Incident Management Communication	Emergency_Vehicles	444	889	1,600	3,201	5,981	5,981	213	426	765	1,531	2,562	2,562	1	1	2	5	8	8
EVS	EVS2	On-board Vehicle Signal Coordination	Emergency_Vehicles	444	889	1,600	3,201	5,981	5,981	213	426	765	1,531	2,562	2,562	1	1	2	5	8	8
FMS	FMS1	Fleet Administration	Fleet_Mgt_Centers	10	25	25	50	50	85	1	3	3	5	5	9	0	1	1	1	1	2
FMS	FMS2	Fleet Credentials and Taxes Management and Reporting	Fleet_Mgt_Centers	10	25	25	50	50	85	1	3	3	5	5	9	0	1	1	1	1	2
FMS	FMS3	Fleet HAZMAT Management	Fleet_Mgt_Centers	1	5	5	10	10	15	0	1	1	1	1	2	0	0	0	0	0	0
FMS	FMS5	Fleet Maintenance Management	Fleet_Mgt_Centers	10	25	25	50	50	85	1	3	3	5	5	9	0	1	1	1	1	2
FMS	FMS4	Freight Administration and Management	Fleet_Mgt_Centers	10	25	25	50	50	85	1	3	3	5	5	9	0	1	1	1	1	2
ISP	ISP1	Basic Information Broadcast	ISPs	1	1	4	4	8	8	1	1	2	2	4	4	0	0	0	0	1	1
ISP	ISP2	EM Route Plan Information Dissemination	ISPs	0	0	0	2	8	8	0	0	0	1	4	4	0	0	0	0	0	0
ISP	ISP3	Infrastructure Provided Dynamic Ridesharing	ISPs	0	0	0	1	2	6	0	0	0	1	1	3	0	0	0	0	0	0
ISP	ISP4	Infrastructure Provided Route Selection	ISPs	0	0	1	3	8	8	0	0	1	2	4	4	0	0	0	0	0	1
ISP	ISP5	Infrastructure Provided Yellow Pages & Reservation	ISPs	0	1	3	4	8	8	0	1	2	2	4	4	0	0	0	0	0	0
ISP	ISP6	Interactive Infrastructure Information	ISPs	1	1	4	4	8	8	1	1	2	2	4	4	0	0	0	0	1	1
ISP	ISP7	ISP Advanced Integrated Control Support	ISPs	0	0	0	1	2	6	0	0	0	0	0	2	0	0	0	0	0	0
ISP	ISP8	ISP Probe Information Collection	ISPs	1	1	4	4	8	8	0	0	0	1	1	3	0	0	0	0	0	0
PIAS	PIA1	Personal Basic Information Reception	Personal_Travel_Info_Users	201	2,008	1,315	5,258	4,323	43,231	100	996	628	2,510	1,849	18,487	0	8	0	20	14	142
PIAS	PIA2	Personal Interactive Information Reception	Personal_Travel_Info_Users	201	2,008	7,888	13,146	30,262	64,847	100	996	3,765	6,275	12,941	27,731	0	0	10	20	71	142
PIAS	PIA3	Personal Mayday I/F	Personal_Travel_Info_Users	201	2,008	13,146	26,292	64,847	86,462	100	996	6,275	12,550	27,731	36,974	0	8	51	101	213	284
PIAS	PIA4	Personal Route Guidance	Personal_Travel_Info_Users	201	2,008	13,146	26,292	30,262	64,847	100	996	6,275	12,550	12,941	27,731	0	0	0	20	14	142
PMS	PMS1	Parking Management	Parking_Lots	10	30	40	70	100	180	3	8	10	18	25	45	N/A	N/A	N/A	N/A	N/A	N/A
PS	PS1	Data Collection and ITS Planning	ITS_Regional_Planners	0	0	1	1	1	1	0	0	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A
RS	RS1	Automated road signing	Automated road signing beacons	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	25	25	50	50
RS	RS2	Roadside Signal Priority	Intersections	256	512	640	1,280	1,536	2,176	104	208	260	520	624	884	0	0	0	0	0	0
RS	RS3	Roadway Freeway Control	Ramp Meters	30	44	44	59	59	59	0	0	35	53	53	70	0	0	0	0	0	0
RS	RS4	Roadway Signal Controls	Intersections	256	512	768	1,280	1,536	2,304	0	0	0	0	0	0	0	0	0	0	0	0
RS	RS5	Roadway Basic Surveillance	Loops + Add'l Params Below	350	350	1,350	1,350	3,910	3,910	0	0	1,650	1,650	2,690	2,690	0	0	0	0	0	0
RS	RS6	Roadway HOV Usage	HOV Lane Mileage	10	10	10	10	10	10	0	0	25	25	25	25	0	0	0	0	0	0
RS	RS7	Roadway In-Vehicle Signing	In-Vehicle Signing Beacons	0	0	25	25	50	50	0	0	30	30	60	60	0	0	20	20	40	40
RS	RS8	Roadway Incident Detection	Advanced Cameras	10	10	30	30	60	60	0	0	28	28	38	38	0	0	0	0	0	0
RS	RS9	Roadway Intersection Collision System	Intersections	0	0	0	26	26	77	0	0	0	0	0	0	0	0	0	0	0	0
RS	RS10	Roadway Pollution and Environmental Hazards Indicators	Emmisions and Env. Sensors	20	20	50	50	100	100	0	0	25	25	50	50	0	0	2	2	4	4
RS	RS11	Roadway Probe Beacons	Roadway Probe Beacons	45	45	75	75	225	225	N/A	N/A	55	55	92	92	0	0	25	25	50	50
RS	RS12	Roadway Reversible Lanes	Intersections	51	179	256	512	640	1,024	0	0	21	73	104	208	0	0	0	0	0	0
RS	RS13	Roadway Systems for AHS	AHS Lane Checkpoints	0	0	0	0	100	100	0	0	0	0	100	100	0	0	0	0	0	0
RS	RS14	Roadway Traffic Information Dissemination	CMS + Add'l Params Below	59	59	59	59	59	59	30	30	60	60	60	60	0	0	2	2	2	2

RTS	RTS5	Remote Basic Information Reception	Kiosks	25	25	50	50	200	200	13	13	25	25	100	100	0	0	0	0	0	0
RTS	RTS1	Remote Interactive Information Reception	Kiosks	0	25	50	50	150	200	0	13	25	25	75	100	0	0	0	0	0	0
RTS	RTS2	Remote Mayday I/F	Kiosks	25	25	50	50	200	200	13	0	25	25	100	100	0	0	0	0	0	0
RTS	RTS3	Remote Transit Fare Management	Kiosks	25	25	50	50	200	200	13	13	25	25	100	100	0	0	0	0	0	0
RTS	RTS4	Remote Transit Security I/F	Transit Stops	0	100	100	300	200	400	0	0	0	50	50	150	0	0	0	0	0	5
TAS	TAS1	Toll Administration	Toll Administration Centers	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
TCS	TCS1	Toll Plaza Toll Collection	Toll Booths	14	14	14	14	14	14	20	20	20	20	20	20	0	0	0	0	0	0
TMS	TMS1	Collect Traffic Surveillance	TMCs	2	2	3	3	5	5	0	0	0	0	0	0	0	0	0	0	0	0
TMS	TMS2	Distributed Road Management	Virtual TMC	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	1	1	1	1
TMS	TMS3	TMC Advanced Signal Control	TMCs	0	0	0	0	3	5	0	0	0	0	1	2	0	0	0	0	0	0
TMS	TMS4	TMC Regional Traffic Control	TMCs	0	1	1	2	3	5	0	1	0	1	1	2	0	0	0	0	0	1
TMS	TMS5	TMC based Freeway Control	TMCs	2	2	3	3	5	5	0	0	0	1	2	2	0	0	0	0	0	0
TMS	TMS6	TMC Basic Signal Control	TMCs	2	1	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
TMS	TMS7	TMC for AHS	TMCs	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
TMS	TMS8	TMC HOV/Reversible Lane Management	TMCs	2	2	3	3	5	5	0	0	1	1	2	2	0	0	0	0	0	0
TMS	TMS9	TMC Incident Detection	TMCs	2	2	3	3	5	5	0	0	1	1	2	2	0	0	0	0	0	0
TMS	TMS10	TMC Incident Dispatch Coordination/Communication	TMCs	1	2	2	3	5	5	1	1	1	1	2	2	0	0	1	1	1	1
TMS	TMS11	TMC Input to In-Vehicle Signing	TMCs	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1
TMS	TMS12	TMC Multi-Modal Coordination	TMCs	2	2	3	3	5	5	1	2	1	1	2	2	0	0	0	0	0	0
TMS	TMS13	TMC Probe Information Collection	TMCs	0	1	1	2	2	4	0	1	0	1	1	2	0	0	0	0	0	0
TMS	TMS14	TMC Toll/Parking Coordination	TMCs	1	1	2	2	4	5	0	1	1	1	2	2	0	0	0	0	0	0
TMS	TMS15	TMC Traffic Information Dissemination	TMCs (incl virtual TMC)	2	2	3	3	5	5	0	1	1	1	2	2	0	0	1	1	1	1
TMS	TMS16	TMC Traffic Network Performance Evaluation	TMCs	0	1	1	3	5	5	0	1	0	1	2	2	0	0	0	0	0	0
TMS	TMS17	Traffic Maintenance	TMCs	2	2	3	3	5	5	0	1	1	1	2	2	0	0	0	0	0	0
TRMS	TRM1	Fleet Maintenance Management	Transit Centers	1	2	2	3	3	3	0	0	1	2	2	3	0	0	0	1	1	1
TRMS	TRM2	Transit Center Fare and Load Management	Transit Centers	1	2	2	3	3	3	0	0	1	2	2	3	0	0	0	1	1	1
TRMS	TRM3	Transit Center Fixed-Route Operations	Transit Centers	1	2	2	3	3	3	1	2	2	3	3	3	0	0	0	1	1	1
TRMS	TRM4	Transit Center Multi-Modal Coordination	Transit Centers	0	0	2	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
TRMS	TRM5	Transit Center Paratransit Operations	Transit Centers	1	2	2	3	3	3	1	2	2	3	3	3	0	0	0	1	1	1
TRMS	TRM6	Transit Center Security	Transit Centers	1	2	2	3	3	3	0	0	1	2	2	3	0	0	0	1	1	1
TRMS	TRM7	Transit Center Tracking and Dispatch	Transit Centers	0	1	2	3	3	3	0	1	2	3	3	3	0	0	1	1	1	1
TRVS	TRV1	On-board Maintenance	Transit Vehicles All	0	548	1,210	1,833	2,235	2,235	0	196	411	623	688	688	0	0	7	11	11	11
TRVS	TRV2	On-board Transit Driver I/F	Transit Vehicles All	548	1,096	1,210	1,833	2,235	2,235	196	391	411	623	688	688	0	0	0	11	11	11
TRVS	TRV3	On-board Transit Fare and Load Management	Transit Vehicles All	548	1,096	1,210	1,833	2,235	2,235	0	391	411	623	688	688	0	0	0	11	11	11
TRVS	TRV4	On-board Transit Security	Transit Vehicles All	0	548	605	1,833	2,235	2,235	0	196	205	623	688	688	0	0	0	11	11	11
TRVS	TRV7	On-board Trip Monitoring	Transit Vehicles All	548	1,096	1,210	1,833	2,235	2,235	196	391	411	623	688	688	0	0	0	11	11	11
TRVS	TRV5	On-board Vehicle Signal Coordination	Transit Vehicles	0	0	605	1,210	2,235	2,235	0	0	205	411	688	688	0	0	0	0	0	0
TRVS	TRV6	Vehicle Dispatch Support	Transit Vehicles All	548	1,096	1,210	1,833	2,235	2,235	0	196	411	623	688	688	0	0	0	11	11	11
VS	VS1	Basic Vehicle Reception	Total_Vehicles	17,776	53,327	96,995	193,990	598,110	1,196,219	8,513	25,538	46,389	92,778	256,243	512,487	73	218	373	747	1,963	3,927
VS	VS2	Driver Safety Monitoring System	Total_Vehicles	0	0	19,399	96,995	239,244	598,110	0	0	9,278	46,389	102,497	256,243	0	0	75	373	785	1,963
VS	VS3	Driver Visibility Improvement System	Total_Vehicles	0	0	0	0	23,924	119,622	0	0	0	0	10,250	51,249	0	0	0	0	79	393
VS	VS4	In-Vehicle Signing System	Total_Vehicles	0	8,888	19,399	96,995	239,244	478,488	0	0	9,278	46,389	102,497	204,995	0	0	75	373	785	1,571
VS	VS5	Interactive Vehicle Reception	Total_Vehicles	5,333	17,776	58,197	193,990	167,471	478,488	2,554	8,513	27,833	92,778	71,748	204,995	0	0	224	747	550	1,571
VS	VS6	Probe Vehicle Software	Total_Vehicles	1,778	7,110	19,399	38,798	47,849	119,622	0	0	9,278	18,556	20,499	51,249	0	0	7	30	79	157

VS	VS7	Smart Probe	Total_Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	30	79	157
VS	VS8	Vehicle Intersection Collision Warning	Total_Vehicles	0	0	0	1,940	11,962	47,849	0	0	0	0	0	0	0	0	0	0	0	0
VS	VS9	Vehicle Intersection Control	Total_Vehicles	0	0	0	0	23,924	47,849	0	0	0	0	0	0	0	0	0	0	0	0
VS	VS10	Vehicle Lateral Control	Total_Vehicles	0	0	0	0	23,924	119,622	0	0	0	0	0	0	0	0	0	0	0	0
VS	VS11	Vehicle Lateral Warning System	Total_Vehicles	0	0	0	38,798	119,622	358,866	0	0	0	18,556	51,249	153,746	0	0	0	149	393	1,178
VS	VS12	Vehicle Longitudinal Control	Total_Vehicles	0	0	0	38,798	119,622	358,866	0	0	0	18,556	51,249	153,746	0	0	0	149	393	1,178
VS	VS13	Vehicle Longitudinal Warning System	Total_Vehicles	0	1,778	96,995	387,980	598,110	1,196,219	0	851	0	0	0	0	0	7	75	373	393	1,178
VS	VS14	Vehicle Mayday I/F	Total_Vehicles	53,327	88,879	155,192	290,985	358,866	717,732	25,538	42,564	74,222	139,167	153,746	307,492	218	364	597	1,120	1,178	2,356
VS	VS15	Vehicle Pre-Crash Safety Systems	Total_Vehicles	0	0	0	0	23,924	119,622	0	0	0	0	10,250	51,249	0	0	0	0	79	393
VS	VS16	Vehicle Route Guidance	Total_Vehicles	5,333	17,776	38,798	135,793	119,622	717,732	2,554	8,513	18,556	64,944	51,249	307,492	0	0	75	149	550	2,356
VS	VS17	Vehicle Safety Monitoring System	Total_Vehicles	17,776	35,552	96,995	387,980	598,110	1,196,219	8,513	17,025	46,389	185,556	256,243	512,487	73	145	373	1,494	1,963	3,927
VS	VS18	Vehicle Systems for AHS	Total_Vehicles	0	0	0	0	2,392	23,924	0	0	0	0	1,025	10,250	0	0	0	0	0	0
VS	VS19	Vehicle Toll/Parking I/F	Total_Vehicles	17,776	53,327	38,798	193,990	239,244	1,196,219	8,513	25,538	18,556	92,778	102,497	512,487	0	0	0	0	0	0
xRS	XRS1	Basic Surveillance Additional Parameters - 1	Ramp Meters	59	59	59	59	59	59	0	0	70	70	70	70	0	0	0	0	0	0
xRS	XRS2	Basic Surveillance Additional Parameters - 2	Basic Cameras	150	150	425	425	850	850	0	0	410	410	570	570	0	0	0	0	0	0
xRS	XRS3	Information Dissemination Additional Parameters - 1	Highway Advisory Radios	12	12	12	12	12	12	0	0	18	18	18	18	0	0	3	3	3	3
xRS	XRS4	Information Dissemination Additional Parameters - 2	Fixed Message Signs	0	0	0	0	0	0	0	0	10	10	10	10	0	0	5	5	5	5
xRS	XRS5	Information Dissemination Additional Parameters - 3	Fixed Env Message Signs	0	0	0	0	0	0	0	0	2	2	2	2	0	0	1	1	1	1

A.0 List of Acronyms

A	
ABS	Antilock Brake System
ADA	Americans with Disabilities Act
AFD	Architecture Flow Diagram
AID	Architecture Interconnect Diagram
AHS	Automated Highway System
AMPS	Advanced Mobile Phone System
ATIS	Advanced Traveler Information System
ATM	Asynchronous Transfer Mode
ATMS	Advanced Traffic Management System
AVCS	Advanced Vehicle Control System
AVI	Automated Vehicle Identification
AVL	Automated Vehicle Location
AVO	Automated Vehicle Operation
C	
CAAA	Clean Air Act Amendment
CASE	Computer Aided Systems Engineering
CCTV	Closed Circuit TV
CDMA	Code Division Multiple Access
CDPD	Cellular Digital Packet Data
CMS	Changeable Message System
COTR	Contracting Officer Technical Representative
CSP	Communication Service Provider
CVAS	Commercial Vehicle Administration Subsystem
CVCS	Commercial Vehicle Check Subsystem
CVISN	Commercial Vehicle Information Systems and Networks
CVS	Commercial Vehicle Subsystem
CVO	Commercial Vehicle Operations
D	
DAB	Digital Audio Broadcast
DD	Data Dictionary
DDE	Data Dictionary Element
DFD	Data Flow Diagram
DGPS	Differential Global Positioning System
DOD	Department of Defense
DOT	Department of Transportation
DMV	Department of Motor Vehicles
DSRC	Dedicated Short Range Communications
DTA	Dynamic Traffic Assignment

E

ECPA	Electronic Communications Privacy Act
EDI	Electronic Data Interchange
EPA	Environmental Protection Agency
EM	Emergency Management Subsystem
EMC	Emergency Management Center
EMMS	Emissions Management Subsystem
ESMR	Enhanced SMR
ETA	Expected Time of Arrival
ETTM	Electronic Toll and Traffic Management

F

FARS	Fatal Accident Reporting System
FCC	Federal Communications Commission for the U.S.
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standard
FOT	Field Operational Test
FMS	Fleet Management Subsystem
FPR	Final Program Review
FTA	Federal Transit Administration

G

GIS	Geographic Information System
GPS	Global Positioning System

H

HAR	Highway Advisory Radio
HAZMAT	HAZardous MATerial(s)
HOV	High Occupancy Vehicle
HUD	Head–Up Display

I

IEEE	Institute of Electrical and Electronics Engineers, Inc.
IVIS	In Vehicle Information System
IP	Internet Protocol
IPR	Interim Program Review
ISO	International Standards Organization
ISP	Information Service Provider
ISTEA	Intermodal Surface Transportation Efficiency Act
ITE	Institute of Transportation Engineers
ITI	Intelligent Transportation Infrastructure
ITS	Intelligent Transportation Systems
ITS AMERICA	Intelligent Transportation Society of America
IVHS	Intelligent Vehicle Highway Systems

L

LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode

LEO	Low–Earth Orbit satellite system
LPD	Liability and Property Damage
LRMP	Location Reference Messaging Protocol
LRMS	Location Reference Messaging Standard

M

MAN	Metropolitan Area Network
MAUT	Multiattribute Utility Theory
MMI	Man–Machine Interface (or Interaction)
MOE	Measure Of Effectiveness
MPO	Metropolitan Planning Organization
MPH	Miles per Hour
MTC	Metro Traffic Control

N

NA	National Architecture
NAR	National Architecture Review
NEMA	National Electrical Manufacturers Association
NHPN	National Highway Planning Network
NHTSA	National Highway Traffic Safety Administration
NII	National Information Infrastructure (aka Information Superhighway)
NTCIP	National Transportation Communications for ITS Protocol

O

OEM	Original Equipment Manufacturer
OSI	Open Systems Interconnection
OTP	Operational Test Plan

P

PCS	Personal Communications System
PDA	Personal Digital Assistant
PIAS	Personal Information Access Subsystem
PMS	Parking Management Subsystem
PS	Planning Subsystem
PSA	Precursor System Architecture
PSPEC	Process Specification
PSTN	Public Switched Telephone Network

Q

QFD	Quality Functional Deployment

R

R&D	Research and Development
RDS	Radio Data Systems
RDS–TMC	Radio Data Systems incorporating a Traffic Message Channel
RTA	Regional Transit Authority

RS	Roadway Subsystem
RTS	Remote Traveler Support Subsystem

S

SAE	Society of Automotive Engineers
SDO	Standards Development Organization
SMR	Specialized Mobile Radio
SONET	Synchronous Optical Network
SOV	Single Occupancy Vehicle
STMF	Simple Transportation Management Framework
SQL	Standard Query Language

T

TAS	Toll Administration Subsystem
TCS	Toll Collection Subsystem
TDM	Travel Demand Management
TDMA	Time Division Multiple Access
TIGER	Topologically Integrated Geographic Encoding & Referencing files
TMC	1. Traffic Management Center 2. Traffic Message Channel. See RDS–TMC
TMS	Traffic Management Subsystem
TRMC	Transit Management Center
TRMS	Transit Management Subsystem
TRT	Technical Review Team
TRVS	Transit Vehicle Subsystem

V

VMS	Variable Message Sign
VRC	Vehicle/Roadside Communications
VS	Vehicle Subsystem

W

WAN	Wide Area Network
WIM	Weigh–in Motion
WWW	World Wide Web