In-Vehicle Navigation System
Model Deployment Initiative
Acceptance Test Plan

Version 1.1

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Acronym List

ASCII	American Standard Code for Information Interchange
ATP	Acceptance Test Plan
CRC	Cyclic Redundancy Check
DS	Data Server
ETA	Estimated Time of Arrival
FM	Frequency Modulation
GUI	Graphical User Interface
IVN	In-Vehicle Navigation
LR	Location Reference
LRMS	Location Reference Message Specification
MCS	Master Computer Software
MDI	Model Deployment Initiative
STIC	Subcarrier Traffic Information Channel
STM	STIC Transmission Message
SwRI	Southwest Research Institute
TIM	Traffic Information Message
TMC	Traffic Management Center
TxDOT	Texas Department of Transportation

In-Vehicle Navigation System
Acceptance Test Plan

1.0 Scope

Real-time in-vehicle navigation is a significant traveler information service added to the TransGuide system during the Model Deployment Initiative (MDI). The TransGuide In-Vehicle Navigation (IVN) system includes an IVN unit that provides travelers with route guidance, vehicle position, and regional points of interest information. Units currently available on the market utilize a database of transit times for each road segment to calculate the shortest travel time from where the vehicle is located to a point the driver inputs as the destination. These databases are static, as they contain typical transit times that by definition cannot account for real-time congestion caused by traffic accidents, rush hours, public events, etc. The MDI implementation of IVN addresses this shortcoming by providing the units with real-time traffic data. The system includes the infrastructure necessary to deliver the real-time information to vehicles in the San Antonio area and the initial deployment of 590 IVN units that utilize the real-time traffic data.

1.1 Identification

This Acceptance Test Plan (ATP) is developed to provide the acceptance criteria and tests for the In-Vehicle Navigation system of the Texas Department of Transportation Model Deployment Initiative. The basis for the development of this ATP document is the *In-Vehicle Navigation System Model Deployment Initiative Design Document, Version 1.0*. The ATP is developed for testing the components of the IVN system including the IVN Master Computer Software, Version 1.0. The IVN Master Computer Software is identified in the *In-Vehicle Navigation System Model Deployment Initiative Version Description Document, Version 1.0*.

1.2 System Overview

The IVN system obtains real-time traffic data from the MDI Data Server (DS) and distributes the data to moving vehicles. The IVN system consists of the following four major components:

- IVN master computer,
- Subcarrier Traffic Information Channel (STIC) message encoder,
- STIC receiver,
- In-vehicle navigation unit.

The IVN master computer obtains information from the DS and formats the information into efficient messages. The master computer then communicates the data over a dial-up modem connection to the STIC message encoder. The STIC message encoder, located in the transmission room of a commercial FM radio station, generates a data signal containing the traffic information that is modulated and broadcast as a sub-carrier to the FM radio signal. The STIC receiver (installed in a vehicle) receives the FM radio signal, decodes the messages, and passes the messages to the navigation unit over a serial data link. The navigation unit decodes the messages, displays the real-time information along with the map data, and calculates the quickest route to a traveler-entered destination using the real-time data. The *In-Vehicle Navigation Model Deployment Initiative System Design Document*, referenced below, contains a complete description of the system components and functions.

1.3 Goals and Objectives

The purpose of the IVN system is to communicate real-time traffic information maintained at the TransGuide Traffic Management Center (TMC) to travelers in the San Antonio metropolitan area and present the information in a manner useful for making navigation decisions.

1.4 Referenced Documents

- Texas Department of Transportation, *Request for Offer (RFO) for the Model Deployment Initiative System Integration, 60115-7-70030,* Specification No. TxDOT 795-SAT-01, October, 1996.
- Southwest Research Institute, *Proposal for the 6015-7-70030: Request for Offer, Model Deployment Initiative System Integration*, SwRI Proposal No. 10-20342, November, 1996.
- Southwest Research Institute, *In-Vehicle Navigation System Model Deployment Initiative Preliminary Design Document, Version 1.0*, February 14, 1997.
- Southwest Research Institute, *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol, Version 1.0*, May 29, 1997.
- Southwest Research Institute, *In-Vehicle Navigation System Model Deployment Initiative Design Document, Version 1.0*.
- Southwest Research Institute, *In-Vehicle Navigation System Model Deployment Initiative Version Description Document, Version 1.0*.

2.0 Acceptance Test Methods and Procedures

This section describes the test methods and procedures for executing the IVN system ATP. The test cases to be completed during execution of this ATP have been designed to demonstrate that the IVN system meets all specified requirements. Each of these requirements is further documented in Section 3 in the traceability matrix. For each requirement, the matrix contains traceability information to show the relationship between the requirement and other requirements, design elements, and the ATP.

The ATP is divided into individual test cases that are grouped by function. Each test case will include a synopsis of the system component or function being tested, the requirements being verified, special test configurations, the test procedure, and an appropriate space for recording test results. The tests will be identified with a project unique identifier. This identifier will have the following format:

<System Mnemonic>-<Subsystem Mnemonic>-<Test Number>

System Mnemonic

The system mnemonic uniquely identifies the IVN system to distinguish its acceptance tests from the tests of the other MDI systems. The system mnemonic for the IVN system is *IVN*.

Subsystem Mnemonic

The mnemonic for each set of subsystem tests are:

- SYS - System components,
- MC - Master computer,
- NU - Navigation unit,
- INSTALL – Installation.

Test Number

The tests are numbered sequentially within a given subsystem.

The goal of this ATP is to demonstrate the capability of the IVN system in its operational environment and to validate that it meets TxDOT requirements. Test cases contained in this ATP have been derived from the requirements contained in the *In-Vehicle Navigation System Model Deployment Initiative Design Document.*

Plausible use testing will be employed to ensure that frequently used operations and scenarios are robust and thoroughly tested. Boundary value analysis will be employed to ensure test cases exercise boundary values within each defined set of input values. The IVN system will be tested with real-world data when available.

Test cases will be implemented using one or more of the following qualification methods:

- Inspection. The visual examination of system component.
- Demonstration. The operation of the system, or a part of the system, that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis.
- Test. The operation of the system, or a part of the system, using instrumentation or other special test equipment to collect data for later analysis.

- Analysis. The process of accumulating data obtained from other qualification methods. Examples are reduction, interpretation, or extrapolation of test results.

Problems detected during execution of the IVN ATP will be classified by category as follows:

- Software problem. The software does not operate according to the specified requirements and the requirements are correct.
- Hardware problem. The hardware does not operate according to the specified requirements and the requirements are correct.
- Documentation problem. The software/hardware does not operate according to the specified requirements but the software/hardware operation is correct.
- Design problem. The software/hardware operates according to the specified requirements but a design deficiency exists. The design deficiency may not always result in a direct observable operational problem but possesses the potential for creating further problems.

Problems detected during execution of the IVN ATP will be classified by priority as follows:

- Priority 1: A problem that prevents the accomplishment of an operational or essential capability.
- Priority 2: A problem that results in user/operator inconvenience or annoyance but does not affect required operational or essential capability.
- Priority 3: Any other effect.

Re-testing will consist of repeating a subset of the test cases after corrections have been made to correct problems found in previous testing. Re-testing will be considered complete if 1) all test cases that revealed problems in the previous testing have been repeated and the results have met acceptance criteria, and 2) all test cases that revealed no problems during the previous testing, but test components that are affected by the corrections, have been repeated and the results have met acceptance criteria.

2.1 IVN-MC

The following tests apply to the IVN master computer hardware and software.

~~1.1.1~~2.1.1 Test Preparation

Many of the IVN-MC tests require the use of a test version of the Realtime Receive process. The Realtime Receive process is one component of the Data Server software that resides on the IVN master computer and accepts traffic data input from the Data Server master computer. The Realtime Receive process communicates traffic data to the IVN MCS when requested by the IVN MCS. The test version of the Realtime Receive process accepts input from a text file as opposed to the Data Server master computer. The traffic data that should be included in the text file is specified in each test case that uses the test version of the Realtime Receive process. In preparation for those test cases, a text file must be created that contains the specified traffic data.

~~1.1.2~~2.1.2 Test Descriptions

The individual test methods are described in the following sections.

~~1.1.1.1~~2.1.2.1 IVN-MC-1

This test verifies the hardware requirements of the IVN master computer are met. Since TxDOT procured the Data Server master computer hardware, TxDOT will be responsible for resolving any issues that arise if the equipment does not meet the physical requirements.

~~1.1.1.1.1~~2.1.2.1.1 Requirements Addressed

IVN-2.2 The IVN master computer shall be a Sun Microsystems Ultra SPARCStation with the following components:

- 167 MHz SPARC (RISC) CPU
- 128 MB RAM
- 4.2 GB hard disk space
- Floppy disk drive
- Sun CD-ROM drive
- Turbo GX+ graphics
- 20" color monitor
- 8 port modem server (SCSI attached)
- Dual ethernet interfaces
- Dual SCSI channels

IVN-2.3 The master computer shall be located in the TransGuide Operations Center.

~~1.1.1.1.2~~2.1.2.1.2 Prerequisite Conditions

The IVN master computer must be properly installed and fully operational as described in the IVN system design document.

~~1.1.1.1.3~~2.1.2.1.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.1.4 Test Results Evaluation

The test will be considered successful if all the hardware components inspected during the test meet the requirements listed above.

~~1.1.1.1.5~~2.1.2.1.5 Test Procedure

1. Locate the IVN master computer and verify that it resides in the TransGuide computer room.
2. Open a command shell window on the IVN master computer.
3. Enter the UNIX command *dmesg* in the window.
4. Inspect the output of the command, and verify that the line starting with 'cpu…' specifies a 167MHz SPARC CPU or better.
5. Inspect the same output, and verify that the line starting with 'mem…' specifies at least 128 MB of memory.
6. Inspect the same output, and verify that there are at least 2 Ethernet interfaces (lines that contain one of the strings 'hme0' or 'hme1').

7. Enter the UNIX command *df*. Inspect the output generated by the command, and verify that there is a line that indicates the presence of a floppy disk drive (/dev/fd). Visually inspect the computer to verify that the case has a CD ROM drive installed.
8. Login as root, and type the UNIX command *format*. The output of this command lists the existing Hard Disk drive(s). Verify that the size(s) of the disk(s) add up to at least 4.2 GB. Specify a disk drive number as requested by the prompt. Then enter '*quit*' after the format menu has been displayed. (Do NOT format the disk).
9. Press the keys labeled 'Stop' and 'A' simultaneously. This will bring up a command line and the text 'ok'. Enter the UNIX command *probe-scsi-all*. Inspect the output of this command, and verify that it lists at least 2 SCSI channels.
10. Enter '*go*' to return to the Desktop GUI.
11. Visually inspect the monitor and verify that it is a 20" Sun color monitor, or better.

2.1.2.1.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.2 IVN-MC-2

This test verifies that the IVN MCS transmits process status information to the Data Server.

~~1.1.1.1.1~~2.1.2.2.1 Requirements Addressed

IVN-2.1.1 The IVN MCS shall transmit IVN process status information to the Data Server every 60 seconds.

~~1.1.1.1.2~~2.1.2.2.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The Realtime Receive process must be running on the IVN master computer.
3. The STIC message encoder installed in the radio station transmission room must be operating normally.
4. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.2.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.2.4 Test Results Evaluation

The test is passed if the IVN status log file includes log messages indicating a successful heartbeat issued to the Data Server every 60 seconds ± 1 second.

~~1.1.1.1.5~~2.1.2.2.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *LogAttr.debugmsgstologfile* to 1. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Edit the IVN status log file on the IVN master computer, *$ATMS/log/ivn_status.xxx*, where the file extension, *xxx*, is a three character abbreviation of the current weekday.
4. From the end of the status log file, search backward for the message "IVN process started". From that position in the file, search forward for the message "Heartbeat sent to data server" and record the message timestamp.
5. Continue searching forward for the heartbeat message and verify that each consecutive message falls at 60-second intervals.
6. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and reset the value of the parameter *LogAttr.debugmsgstologfile* to 0. Save the configuration file.

2.1.2.2.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.3 IVN-MC-3

This test verifies that the IVN MCS extracts link ID information from the Data Server Realtime Subsystem.

~~1.1.1.1.1~~2.1.2.3.1 Requirements Addressed

IVN-2.1.2 The IVN MCS shall extract link ID information from the Data Server Realtime Subsystem.

~~1.1.1.1.2~~2.1.2.3.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed data as defined in Section 1 of Appendix A must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.3.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.3.4 Test Results Evaluation

The test is passed if the link IDs in the IVN link data file match the link IDs in the simulated real-time data.

2.1.2.3.5 Test Procedure

1. Start the IVN main process, let it run for 1 minute, then stop the process.
2. Edit or print the IVN link data file on the IVN master computer (file name to be determined).
3. Compare the simulated data defined in Appendix A to IVN link data file and verify that for each link ID in the simulated real-time data, a matching link ID is found in the IVN link data file.

2.1.2.3.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.4 IVN-MC-4

This test verifies that the IVN MCS extracts link location information from the Data Server Realtime Subsystem.

~~1.1.1.1.1~~2.1.2.4.1 Requirements Addressed

IVN-2.1.3 The IVN MCS shall extract link location information from the Data Server Realtime Subsystem.

~~1.1.1.1.2~~2.1.2.4.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed data as defined in Section 1 of Appendix A must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.4.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.4.4 Test Results Evaluation

The test is passed if the link ID locations in the IVN link data file match the link ID locations in the simulated real-time data. For locations to match, the longitude and latitude of a location defined in the link data file must be within 25 microdegrees of the longitude and latitude of the same location in the simulated data.

2.1.2.4.5 Test Procedure

1. Start the IVN main process, let it run for 1 minute, then stop the process.
2. Edit or print the IVN link data file on the IVN master computer (file name to be determined).
3. Compare the simulated data defined in Appendix A to the IVN link data file and verify that for each link ID in the simulated data, the link location (start/end longitude, latitude and altitude), and the street name match those for the corresponding link ID in the IVN link data file.

2.1.2.4.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.5 IVN-MC-5

This test verifies that the IVN MCS extracts link speed information from the Data Server Realtime Subsystem.

~~1.1.1.1.1~~2.1.2.5.1 Requirements Addressed

IVN-2.1.4 The IVN MCS shall extract link speed information from the Data Server Realtime Subsystem.

~~1.1.1.1.2~~2.1.2.5.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed data as defined in Section 1 of Appendix A must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.5.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.5.4 Test Results Evaluation

The test is passed if the speed for each link in the simulated real-time data matches the speed of the corresponding link recorded in the IVN status log file.

2.1.2.5.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *LogAttr.debugdatatologfile* to 1. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Edit the IVN status log file on the IVN master computer, *$ATMS/log/ivn_status.xxx*, where the file extension, *xxx*, is a three character abbreviation of the current weekday.
4. From the end of the status log file, search backward for the message "IVN process started". From that position in the file, search forward for the message "TG Link ID Speeds".
5. Verify that the speed of each link in the simulated real-time data matches the speed of the corresponding link recorded in the IVN status log file.
6. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and reset the value of the parameter *LogAttr.debugdatatologfile* to 0. Save the configuration file.

2.1.2.5.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.6 IVN-MC-6

This test verifies that the IVN MCS extracts incident information from the Data Server Realtime Subsystem.

~~1.1.1.1.1~~2.1.2.6.1 Requirements Addressed

IVN-2.1.5 The IVN MCS shall extract incident information from the Data Server Realtime Subsystem.

~~1.1.1.1.2~~2.1.2.6.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed and incident data as defined in Sections 1 and 2 of Appendix A must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.6.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.6.4 Test Results Evaluation

The test is passed if the information for each incident in the simulated real-time data matches the information for the corresponding incident recorded in the IVN status log file.

2.1.2.6.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *LogAttr.debugdatatologfile* to 1. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Edit the IVN status log file on the IVN master computer, *$ATMS/log/ivn_status.xxx*, where the file extension, *xxx*, is a three character abbreviation of the current weekday.
4. From the end of the status log file, search backward for the message “IVN process started”. From that position in the file, search forward for the message “TG Incident Data”.
5. Verify that the information for each incident defined in the simulated real-time data matches the information for the corresponding incident recorded in the IVN status log file.
6. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and reset the value of the parameter *LogAttr.debugdatatologfile* to 0. Save the configuration file.

2.1.2.6.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.7 IVN-MC-7

This test verifies that the IVN MCS transmits link speed information to the STIC message encoder.

~~1.1.1.1.1~~2.1.2.7.1 Requirements Addressed

IVN-2.1.6 The IVN MCS shall transmit link speed information to the STIC message encoder every 60 seconds.

~~1.1.1.1.2~~2.1.2.7.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The Realtime Receive process must be running on the IVN master computer.
3. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
4. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.7.3 Test Inputs

The test inputs are the actual TransGuide link ID locations and speeds supplied by the Data Server to the Realtime subsystem.

~~1.1.1.1.4~~2.1.2.7.4 Test Results Evaluation

The test is passed if the IVN status log file includes log messages indicating that the link speed data was successfully transmitted to the STIC message encoder at least every 60 seconds and the STIC message encoder displays the link speed data.

~~1.1.1.1.5~~2.1.2.7.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *LogAttr.debugmsgstologfile* to 1. Also, set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Save the configuration file.
2. Stop and restart the STIC message encoder. Press the "Z" key on the STIC message encoder and verify that it displays no messages in its buffer.
3. Start the IVN main process, let it run for 5 minutes, then stop the process.
4. Edit the IVN status log file on the IVN master computer, *$ATMS/log/ivn_status.xxx*, where the file extension, *xxx*, is a three character abbreviation of the current weekday.
5. From the end of the status log file, search backward for the message "IVN process started". From that position in the file, search forward for the message "STIC add message successful. Type = speed, reference = local" and record the message timestamp.
6. Continue searching forward for the same message and verify that each consecutive message falls within 60 second intervals.
7. Press the "Z" key on the STIC message encoder. When the message data starts to display, immediately press the "Print Screen" key to capture a screen of data. Verify that the messages displayed by the STIC message encoder contain link speed data. Note: Displays of very long

messages may cause the STIC message encoder software to abort. This is acceptable since this feature is used only for testing and debugging.

8. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and reset the value of the parameter *LogAttr.debugmsgstologfile* to 0. Also, restore the value of the parameter *SticPhoneNumber* to the phone number for the STIC message encoder installed in the radio station transmission room. Save the configuration file.

2.1.2.7.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.8 IVN-MC-8

This test verifies that the IVN MCS transmits incident information to the STIC message encoder.

~~1.1.1.1.1~~2.1.2.8.1 Requirements Addressed

IVN-2.1.7 The IVN MCS shall transmit incident information to the STIC message encoder every 60 seconds.

~~1.1.1.1.2~~2.1.2.8.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer with all links set active and at 55 miles per hour.
3. Simulated real-time incident data as defined in Section 2 of Appendix A must be input to the test version of the Realtime Receive process.
4. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.8.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.8.4 Test Results Evaluation

The test is passed if the IVN status log file includes log messages indicating that the incident data was successfully transmitted to the STIC message encoder at least every 60 seconds and the STIC message encoder displays the incident data.

2.1.2.8.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *LogAttr.debugmsgstologfile* to 1. Also, set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Save the configuration file.
2. Stop and restart the STIC message encoder. Press the "Z" key on the STIC message encoder and verify that it displays no messages in its buffer.
3. Start the IVN main process, let it run for 5 minutes, then stop the process.
4. Edit the IVN status log file on the IVN master computer, *$ATMS/log/ivn_status.xxx*, where the file extension, *xxx*, is a three character abbreviation of the current weekday.
5. From the end of the status log file, search backward for the message "IVN process started". From that position in the file, search forward for the message "STIC add message successful. Type = incident, reference = local" and record the message timestamp.
6. Continue searching forward for the same message and verify that each consecutive message falls within 60 second intervals.

7. Press the "Z" key on the STIC message encoder. When the messages finish displaying, press the “Print Screen” key to capture the last screen of data. Verify that the messages displayed by the STIC message encoder contain incident data. Note: Displays of very long messages may cause the STIC message encoder software to abort. This is acceptable since this feature is used only for testing and debugging.
8. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and reset the value of the parameter *LogAttr.debugmsgstologfile* to 0. Also, restore the value of the parameter *SticPhoneNumber* to the phone number for the STIC message encoder installed in the radio station transmission room. Save the configuration file.

2.1.2.8.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.9 IVN-MC-9

This test verifies that the IVN MCS generates messages in accordance with the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.1~~2.1.2.9.1 Requirements Addressed

IVN-2.1.8 The IVN MCS shall transmit locally referenced link speed information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.2~~2.1.2.9.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed data as defined in Section 1 of Appendix A must be input to the test version of the Realtime Receive process.
4. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.9.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.9.4 Test Results Evaluation

The test is passed if the STM data displayed by the STIC message encoder conforms to the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol.*

2.1.2.9.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Press the "Z" key on the STIC message encoder and verify that the STIC message encoder displays messages. The data values that the message encoder displays are actual STMs sent by the MCS. Use the “Print Screen” key to print this information.
4. Referring to the IVN messaging protocol and the simulated real-time input data, validate the data fields of an STM as described below.
5. Verify the STIC transmission message (STM) format of the first STIC message.
   a) Locate the start of the STM by searching for the start of message flag.
   b) Verify that the byte count field matches the actual number of bytes of data in the STM.
   c) Verify that the day code field has the day code for the current day.
   d) Verify that the sequence number field has a non-zero value.

e) Verify the link data TIM format (see below).
f) Verify that the CRC field contains a 2-byte value.

6. Verify the link data TIM format.
   a) Verify that the message code is that for link data TIMs.
   b) Verify that the message timestamp corresponds within 5 minutes to the time that the process was executed on the IVN master computer.
   c) Verify that the data format code is for speed in meters/seconds.
   d) Verify that the number of segments per link is 1.
   e) Verify the LR format of the location reference header (see below).
   f) Verify that the link count matches the actual number of links in the TIM.
   g) Verify the LR format of the first link (see below).
   h) Verify that the travel data matches that in the simulated real-time data ± 3 m/s.

7. Verify the LR format of the location reference header.
   a) Verify that the LRMS profile start code and LR type are correct for an LR header.
   b) Verify that the sequence type and LR sequence ID is for locally referenced LRs.
   c) Verify that the datum is for WGS-84.
   d) Verify that the origin type is short local reference.
   e) Verify that the origin longitude, latitude, and ID match the values defined for the origin in the IVN MCS configuration file, *$ATMS/etc/ivn_main.cfg*.

8. Verify the LR format of the first link (short locally referenced link).
   a) Verify that the LRMS profile start code and LR type are correct for a short locally referenced link LR.
   b) Verify that the starting and ending delta longitude and delta latitude when added to the origin stored in the LR header match the longitude and latitude values in the simulated real-time data.
   c) Verify that the start and end level codes match the values in the simulated real-time data.
   d) Verify that the value of the street name data flag matches the value in the simulated real-time data.
   e) Verify that the street name data type is ASCII.
   f) If the street name data flag is set, verify that the street name length field matches the byte count of the street name data.
   g) If the street name data flag is set, verify that the street name data matches the value in the simulated real-time data.

9. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and restore the value of the parameter *SticPhoneNumber* to the phone number for the STIC message encoder installed in the radio station transmission room. Save the configuration file.

2.1.2.9.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.10 IVN-MC-10

This test verifies that the IVN MCS generates messages in accordance with the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.1~~2.1.2.10.1 Requirements Addressed

IVN-2.1.9 The IVN MCS shall transmit globally referenced link speed information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.2~~2.1.2.10.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed data as defined in Section 1 of Appendix A must be input to the test version of the Realtime Receive process.
4. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.10.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.10.4 Test Results Evaluation

The test is passed if the STM data displayed by the STIC message encoder conforms to the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol.*

2.1.2.10.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Press the "Z" key on the STIC message encoder and verify that the STIC message encoder displays messages. The data values that the message encoder displays are actual STMs sent by the MCS. Use the “Print Screen” key to print this information.
4. Referring to the IVN messaging protocol and the simulated real-time input data, validate the data fields of an STM as described below.
5. Verify the STIC transmission message (STM) format of the second STIC message.
   a) Locate the start of the STM by searching for the start of message flag.
   b) Verify that the byte count field matches the actual number of bytes of data in the STM.
   c) Verify that the day code field has the day code for the current day.
   d) Verify that the sequence number field has a non-zero value.

e) Verify the link data TIM format (see below).
f) Verify that the CRC field contains a 2-byte value.

6. Verify the link data TIM format.
   a) Verify that the message code is that for link data TIMs.
   b) Verify that the message timestamp corresponds within 5 minutes to the time that the process was executed on the IVN master computer.
   c) Verify that the data format code is for speed in meters/seconds.
   d) Verify that the number of segments per link is 1.
   e) Verify the LR format of the location reference header (see below).
   f) Verify that the link count matches the actual number of links in the TIM.
   g) Verify the LR format of the first link (see below).
   h) Verify that the travel data matches that in the simulated real-time data ± 3 m/s.

7. Verify the LR format of the location reference header.
   a) Verify that the LRMS profile start code and LR type are correct for an LR header.
   b) Verify that the sequence type and sequence ID is for globally referenced LRs.
   c) Verify that the datum is for WGS-84.

8. Verify the LR format of the first link (globally referenced link).
   a) Verify that the LRMS profile start code and LR type are correct for a globally referenced link LR.
   b) Verify that the starting and ending longitude and latitude match the longitude and latitude values in the simulated real-time data.
   c) Verify that the start and end level codes match the values in the simulated real-time data.
   d) Verify that the LR sequence ID is for locally referenced LRs.
   e) Verify that the value of the street name data flag matches the value in the simulated real-time data.
   f) Verify that the street name data type is ASCII.
   g) If the street name data flag is set, verify that the street name length field matches the byte count of the street name data.
   h) If the street name data flag is set, verify that the street name data matches the value in the simulated real-time data.

9. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and restore the value of the parameter *SticPhoneNumber* to the phone number for the STIC message encoder installed in the radio station transmission room. Save the configuration file.

2.1.2.10.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.11 IVN-MC-11

This test verifies that the IVN MCS generates messages in accordance with the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.1~~2.1.2.11.1 Requirements Addressed

IVN-2.1.10 The IVN MCS shall transmit locally referenced incident information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.2~~2.1.2.11.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed and incident data as defined in Sections 1 and 2 of Appendix A must be input to the test version of the Realtime Receive process.
4. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.11.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.11.4 Test Results Evaluation

The test is passed if the STM data displayed by the STIC message encoder conforms to the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol.*

2.1.2.11.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Press the "Z" key on the STIC message encoder and verify that the STIC message encoder displays messages. The data values that the message encoder displays are actual STMs sent by the MCS. Use the “Print Screen” key to print this information.
4. Referring to the IVN messaging protocol and the simulated real-time input data, validate the data fields of an STM as described below.
5. Verify the STIC transmission message (STM) format of the third STIC message.
   a) Locate the start of the STM by searching for the start of message flag.
   b) Verify that the byte count field matches the actual number of bytes of data in the STM.
   c) Verify that the day code field has the day code for the current day.
   d) Verify that the sequence number field has a non-zero value.

e) Verify the incident data TIM format (see below).
f) Verify that the CRC field contains a 2-byte value.

6. Verify the incident data TIM format.
   a) Verify that the message code is that for incident report TIMs.
   b) Verify that the message timestamp corresponds within 5 minutes to the time that the process was executed on the IVN master computer.
   c) Verify the LR format of the location reference header (see below).
   d) Verify that the incident count matches the actual number of incidents in the TIM.
   e) Verify that the incident type of the first link incident matches the value in the simulated real-time data.
   f) Verify the LR format of the first link incident (see below).
   g) Verify that the incident begin time of the first link incident matches the value in the simulated real-time data.
   h) Verify that the incident end time of the first link incident is 0.
   i) Verify that the incident type of the first point incident matches the value in the simulated real-time data.
   j) Verify the LR format of the first point incident (see below).
   k) Verify that the incident begin time of the first point incident matches the value in the simulated real-time data.
   l) Verify that the incident end time of the first point incident is 0.

7. Verify the LR format of the location reference header.
   a) Verify that the LRMS profile start code and LR type are correct for an LR header.
   b) Verify that the sequence type and sequence ID is for locally referenced LRs.
   c) Verify that the datum is for WGS-84.
   d) Verify that the origin type is short local reference.
   e) Verify that the origin longitude, latitude, and ID match the values defined for the origin in the IVN MCS configuration file, *$ATMS/etc/ivn_main.cfg*.

8. Verify the LR format of the first link incident (short locally referenced link).
   a) Verify that the LRMS profile start code and LR type are correct for a short locally referenced link LR.
   b) Verify that the starting and ending delta longitude and delta latitude when added to the origin stored in the LR header match the longitude and latitude values in the simulated real-time data.
   c) Verify that the start and end level codes match the values in the simulated real-time data.
   d) Verify that the value of the street name data flag matches the value in the simulated real-time data.
   e) Verify that the street name data type is ASCII.
   f) If the street name data flag is set, verify that the street name length field matches the byte count of the street name data.
   g) If the street name data flag is set, verify that the street name data matches the value in the simulated real-time data.

9. Verify the LR format of the first point incident (short locally referenced point).
   a) Verify that the LRMS profile start code and LR type are correct for a short locally referenced point LR.
   b) Verify that the delta longitude and delta latitude when added to the origin stored in the LR header match the longitude and latitude values in the simulated real-time data.
   c) Verify that the level code matches the value in the simulated real-time data.

d) Verify that the value of the street name data flag matches the value in the simulated real-time data.
e) Verify that the street name data type is ASCII.
f) If the street name data flag is set, verify that the street name length field matches the byte count of the street name data.
g) If the street name data flag is set, verify that the street name data matches the value in the simulated real-time data.

10. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and restore the value of the parameter *SticPhoneNumber* to the phone number for the STIC message encoder installed in the radio station transmission room. Save the configuration file.

2.1.2.11.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.12 IVN-MC-12

This test verifies that the IVN MCS generates messages in accordance with the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.1~~2.1.2.12.1 Requirements Addressed

IVN-2.1.11 The IVN MCS shall transmit globally referenced incident information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.

~~1.1.1.1.2~~2.1.2.12.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time link speed and incident data as defined in Sections 1 and 2 of Appendix A must be input to the test version of the Realtime Receive process.
4. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.12.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

2.1.2.12.4 Test Results Evaluation

The test is passed if the STM data displayed by the STIC message encoder conforms to the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol.*

2.1.2.12.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Save the configuration file.
2. Start the IVN main process, let it run for 5 minutes, then stop the process.
3. Press the "Z" key on the STIC message encoder and verify that the STIC message encoder displays messages. The data values that the message encoder displays are actual STMs sent by the MCS. Use the “Print Screen” key to print this information.
4. Referring to the IVN messaging protocol and the simulated real-time input data, validate the data fields of an STM as described below.
5. Verify the STIC transmission message (STM) format of the fourth STIC message.
   a) Locate the start of the STM by searching for the start of message flag.
   b) Verify that the byte count field matches the actual number of bytes of data in the STM.
   c) Verify that the day code field has the day code for the current day.
   d) Verify that the sequence number field has a non-zero value.

e) Verify the incident data TIM format (see below).
f) Verify that the CRC field contains a 2-byte value.

6. Verify the incident data TIM format.
   a) Verify that the message code is that for incident report TIMs.
   b) Verify that the message timestamp corresponds within 5 minutes to the time that the process was executed on the IVN master computer.
   c) Verify the LR format of the location reference header (see below).
   d) Verify that the incident count matches the actual number of incidents in the TIM.
   e) Verify that the incident type of the first link incident matches the value in the simulated real-time data.
   f) Verify the LR format of the first link incident (see below).
   g) Verify that the incident begin time of the first link incident matches the value in the simulated real-time data.
   h) Verify that the incident end time of the first link incident is 0.
   i) Verify that the incident type of the first point incident matches the value in the simulated real-time data.
   j) Verify the LR format of the first point incident (see below).
   k) Verify that the incident begin time of the first point incident matches the value in the simulated real-time data.
   l) Verify that the incident end time of the first point incident is 0.

7. Verify the LR format of the location reference header.
   a) Verify that the LRMS profile start code and LR type are correct for an LR header.
   b) Verify that the sequence type and sequence ID is for globally referenced LRs.
   c) Verify that the datum is for WGS-84.

8. Verify the LR format of the first link incident (globally referenced link).
   a) Verify that the LRMS profile start code and LR type are correct for a globally referenced link LR.
   b) Verify that the starting and ending longitude and latitude match the longitude and latitude values in the simulated real-time data.
   c) Verify that the start and end level codes match the values in the simulated real-time data.
   d) Verify that the LR sequence ID is for globally referenced LRs.
   e) Verify that the value of the street name data flag matches the value in the simulated real-time data.
   f) Verify that the street name data type is ASCII.
   g) If the street name data flag is set, verify that the street name length field matches the byte count of the street name data.
   h) If the street name data flag is set, verify that the street name data matches the value in the simulated real-time data.

9. Verify the LR format of the first point incident (globally referenced point).
   a) Verify that the LRMS profile start code and LR type are correct for a globally referenced point LR.
   b) Verify that the longitude and latitude match the longitude and latitude values in the simulated real-time data.
   c) Verify that the level code matches the value in the simulated real-time data.
   d) Verify that the LR sequence ID is for globally referenced LRs.
   e) Verify that the value of the street name data flag matches the value in the simulated real-time data.

f) Verify that the street name data type is ASCII.
g) If the street name data flag is set, verify that the street name length field matches the byte count of the street name data.
h) If the street name data flag is set, verify that the street name data matches the value in the simulated real-time data.

10. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and restore the value of the parameter *SticPhoneNumber* to the phone number for the STIC message encoder installed in the radio station transmission room. Save the configuration file.

2.1.2.12.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.13 IVN-MC-13

This test verifies that the IVN MCS generates a table of TransGuide link information.

~~1.1.1.1.1~~2.1.2.13.1 Requirements Addressed

IVN-2.1.12 The IVN MCS shall generate a table of TransGuide link information that includes link ID, starting coordinate, ending coordinate, and street name.

~~1.1.1.1.2~~2.1.2.13.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time data as defined in Appendix A must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.13.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendix A.

~~1.1.1.1.4~~2.1.2.13.4 Test Results Evaluation

The test is passed if the information in the IVN link data file includes a link ID, starting coordinate, ending coordinate, and street name for each link used by the system. The longitude and latitude of a location defined in the link data file must be within 25 microdegrees of the longitude and latitude of the same location in the simulated data.

2.1.2.13.5 Test Procedure

1. Start the IVN main process, let it run for 1 minute, then stop the process.
2. Edit or print the IVN link data file on the IVN master computer (file name to be determined).
3. Verify that the information in the IVN link data file includes the link ID, starting coordinate, ending coordinate, and street name for each link defined in Appendix A.

2.1.2.13.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.14 IVN-MC-14

This test verifies that the IVN MCS displays process status.

~~1.1.1.1.1~~2.1.2.14.1 Requirements Addressed

IVN-2.1.13 The IVN MCS shall provide a display of the process status which shall be updated every 60 seconds.

~~1.1.1.1.2~~2.1.2.14.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The Realtime Receive process must be running on the IVN master computer.
3. The STIC message encoder installed in the radio station transmission room must be operating normally.
4. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.
5. The values of the parameters in the IVN process status GUI configuration file shall be as defined in Appendix C.

2.1.2.14.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.14.4 Test Results Evaluation

The test is passed if the last update time displayed on the IVN process status GUI is updated every 60 seconds ± 1 second when the IVN process is running.

~~1.1.1.1.5~~2.1.2.14.5 Test Procedure

1. Start the IVN process status GUI.
2. Start the IVN main process.
3. Monitor for five minutes the last update time displayed on the process status GUI and verify that it is updated every 60 seconds.

2.1.2.14.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.15 IVN-MC-15

This test verifies that the IVN MCS can be started and stopped from the process status GUI.

~~1.1.1.1.1~~2.1.2.15.1 Requirements Addressed

IVN-2.1.14 The IVN MCS shall be capable of being started and stopped through the IVN process status GUI.

~~1.1.1.1.2~~2.1.2.15.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The Realtime Receive process must be running on the IVN master computer.
3. The STIC message encoder installed in the radio station transmission room must be operating normally.
4. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.
5. The values of the parameters in the IVN process status GUI configuration file shall be as defined in Appendix C.

2.1.2.15.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.15.4 Test Results Evaluation

The test is passed if the IVN main process can be started, stopped, and restarted through the IVN process status GUI.

~~1.1.1.1.5~~2.1.2.15.5 Test Procedure

1. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the values of the parameter *LogAttr.debugmsgstostdout* to 1. Save the configuration file.
2. Start the IVN process status GUI.
3. Using the 'START' button on the IVN status GUI, start the IVN main process. On startup, the IVN process will log the message "IVN process started" to the standard output.
4. Use the UNIX "ps" command to verify that the IVN main process is running.
5. Using the 'STOP' button on the IVN status GUI, stop the IVN main process. When stopped, the IVN process will log the message "IVN process stopped" to the standard output.
6. Use the UNIX "ps" command to verify that the IVN main process is no longer running.
7. Repeat steps 3 through 6.
8. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the values of the parameter *LogAttr.debugmsgstostdout* to 0. Save the configuration file.

2.1.2.15.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.16 IVN-MC-16

This test verifies that the IVN MCS displays communication component status.

~~1.1.1.1.1~~2.1.2.16.1 Requirements Addressed

IVN-2.1.15 The IVN MCS shall provide a display of the status of communication to peripheral systems with which it exchanges data.

~~1.1.1.1.2~~2.1.2.16.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The Realtime Receive process must be running on the IVN master computer.
3. A STIC message encoder with external modem connected to a telephone line must be set up in the TransGuide IVN lab and be running the STIC message encoder software.
4. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.
5. The values of the parameters in the IVN process status GUI configuration file shall be as defined in Appendix C.
6. The values of the parameters in the IVN equipment status GUI configuration file shall be as defined in Appendix D.

2.1.2.16.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.16.4 Test Results Evaluation

The test is passed if errors in communication between the IVN MCS and either the modem, the STIC message encoder, or the real-time subsystem are indicated on the IVN equipment status GUI within 120 seconds after occurrence.

~~1.1.1.1.5~~2.1.2.16.5 Test Procedure

1. Install a RS-232 breakout box between the serial port on the STIC message encoder and the external modem. Set all RS-232 pins to closed. Restart the STIC Subcarrier Modulator program.
2. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and set the value of the parameter *SticPhoneNumber* to the phone number for the modem connected to the STIC message encoder in the TransGuide IVN lab. Also set the value of both of the parameters *ModemAttr.connnectretry* and *SticAttr.msgretry* to 2. Finally, set the value of the parameter *MaxLinkUpdateInterval* to -60. Save the configuration file.
3. Start the IVN process status GUI and activate the IVN equipment status GUI.
4. Start the IVN main process and verify that the equipment status GUI displays ‘Okay’ for both Realtime Feed and Data Server within 1 minute after the process is started. Verify that the status displayed for Realtime Feed changes to ‘Warning’ within 2 minutes after the process is started.

5. Wait until the connection to the STIC is completed, which is indicated by the legend 'Okay' displayed for the modem status on the equipment status GUI.
6. Break the modem connection by disconnecting the phone line to the modem connected to the STIC message encoder.
7. Verify that the equipment status GUI shows 'Warning' for modem status within 2 minutes after the connection is broken. Verify that the equipment status GUI shows 'Error' for modem status within 5 minutes after the connection is broken.
8. Reconnect the phone line to the modem and wait until the modem equipment status is 'Okay'.
9. Disable replies from the STIC message encoder to the IVN MCS by opening the receive data line (pin 3) on the RS-232 breakout box.
10. Verify that the equipment status GUI shows 'Warning' for STIC status within 2 minutes after the line is opened. Verify that the equipment status GUI shows 'Error' for STIC status within 5 minutes after the line is opened.
11. Close the receive data line on the RS-232 breakout box and wait until the STIC equipment status is 'Okay'.
12. Stop the update of real-time data by killing the Realtime Receive process running on the IVN master computer.
13. Verify that the equipment status GUI shows 'Error' for real-time data status within 2 minutes after the process is killed.
14. Stop the IVN main process.
15. Edit the IVN MCS configuration file on the IVN master computer, *$ATMS/etc/ivn_main.cfg*, and restore the parameters *SticPhoneNumber, ModemAttr.connnectretry, SticAttr.msgretry* and *MaxLinkUpdateInterval* to their original values.. Save the configuration file.

2.1.2.16.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.1.2.17 IVN-MC-17

This test verifies that the IVN MCS generates a message log.

~~1.1.1.1.1~~2.1.2.17.1 Requirements Addressed

IVN-2.1.16 The IVN MCS shall log informational messages, warning messages, and error messages to a status log file.

~~1.1.1.1.2~~2.1.2.17.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The Realtime Receive process must NOT be running on the IVN master computer.
3. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.1.2.17.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.17.4 Test Results Evaluation

The test is passed if informational messages, warning messages and error messages are logged to the IVN status log file.

~~1.1.1.1.5~~2.1.2.17.5 Test Procedure

1. Delete the existing IVN status log file on the IVN master computer, *$ATMS/log/ivn_status.xxx*, where the file extension, *xxx*, is a three character abbreviation of the current weekday.
2. Start the IVN main process. Wait until the equipment status GUI displays 'Error' for the status of the Realtime Feed, then stop the IVN process.
3. Edit the IVN status log file and verify that informational messages are logged indicating start/stop of the process and that warning and error messages are logged indicating the lack of availability of real-time data.

2.1.2.17.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.1.2.18 IVN-MC-18

This test verifies that the high-level MCS requirements are met.

~~1.1.1.1.1~~2.1.2.18.1 Requirements Addressed

IVN-2 The real-time traffic information shall be derived from the Data Server.

IVN-2.1 Software running on an IVN master computer shall be used to extract real-time information from the Data Server.

~~1.1.1.1.2~~2.1.2.18.2 Prerequisite Conditions

Tests IVN-MC-1 through IVN-MC-17 have been completed successfully.

~~1.1.1.1.3~~2.1.2.18.3 Test Inputs

None.

~~1.1.1.1.4~~2.1.2.18.4 Test Results Evaluation

This test will be considered successful if tests IVN-MC-1 through IVN-MC-17 were completed successfully.

~~1.1.1.1.5~~2.1.2.18.5 Test Procedure

Note the results of the IVN-MC and IVN-NU series of tests.

~~1.1.1.1.6~~2.1.2.18.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.2 IVN-NU

The following tests apply to hardware and software of the navigation units.

~~1.1.1~~2.2.1 Test Preparation

For the following tests, the navigation unit under test must be installed in a vehicle in accordance with the manufactured recommended installation procedures and in accordance with the *In-Vehicle Navigation System Model Deployment Initiative Design Document*. In addition, all IVN unit software settings must be set to the default settings, and the vehicle must be located in San Antonio, Texas.

2.2.2 Test Descriptions

The individual test methods are described in the following sections.

~~1.1.1.1~~2.2.2.1 IVN-NU-1

This test verifies that the Alpine and Zexel navigation units meet all IVN unit hardware requirements.

~~1.1.1.1.1~~2.2.2.1.1 Requirements Addressed

IVN-4.1 The IVN unit shall be composed of the following components:

- microprocessor,
- reconfigurable LCD color display,
- removable media for data storage,
- gyroscopic sensor, and
- GPS receiver.

2.2.2.1.2 Prerequisite Conditions

None.

~~1.1.1.1.3~~2.2.2.1.3 Test Inputs

None.

~~1.1.1.1.4~~2.2.2.1.4 Test Results Evaluation

The test will be considered successful if all the hardware components inspected during the test meet the requirements listed above.

~~1.1.1.1.5~~2.2.2.1.5 Test Procedure

1. Perform steps 2 through 6 for both the Alpine NVA-N751A and the Zexel Navmate navigation units.
2. Inspect the CPU of the navigation unit and verify that the CD-ROM (Alpine) or PCMCIA hard disk drive (Zexel) can be removed and replaced.
3. Inspect the navigation unit components and verify that a reconfigurable LCD display is included.
4. Inspect the connectors on the CPU and components of the navigation unit and verify that a GPS antenna connector and GPS antenna are present.
5. Read the product specifications for the navigation unit and verify that the system includes a microprocessor and gyroscopic sensor.

2.2.2.1.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

~~1.1.1.2~~2.2.2.2 IVN-NU-2

This test verifies that the Alpine navigation system meets the IVN unit software requirements listed below.

~~1.1.1.1.1~~2.2.2.2.1 Requirements Addressed

IVN-4.3 The IVN unit shall provide a means for the traveler to enter a destination of the following types:

- address,
- intersection,
- place or point of interest, or
- previous destination.

IVN-4.5 The IVN unit shall communicate the route information using a map display, guide display, and audible prompting.

IVN-4.6 The IVN unit guide display shall present the following information:

- distance to an upcoming turn,
- direction of an upcoming turn.

IVN-4.7 The IVN unit shall provide the following audible prompts:

- warning of an upcoming turn,
- indication to make a turn.

IVN-4.8 The IVN unit map display shall show the current location of the vehicle and the calculated route on an annotated map of the surroundings.

IVN-4.9 The information used to generate the map display shall be derived from the San Antonio, Texas Metropolitan Area database supplied by Navigation Technologies.

~~1.1.1.1.2~~2.2.2.2.2 Prerequisite Conditions

None.

~~1.1.1.1.3~~2.2.2.2.3 Test Inputs

None.

~~1.1.1.1.4~~2.2.2.2.4 Test Results Evaluation

This test will be considered successful if each step in the procedure is completed successfully and the IVN unit behaves as described.

~~1.1.1.1.5~~2.2.2.2.5 Test Procedure

1. Start the vehicle and verify that the IVN unit starts up and displays the disclaimer screen.
2. Press ENTER on the remote to leave the disclaimer screen. Verify that the map display appears with the vehicle icon.
3. Given the current location of the vehicle, verify that the vehicle icon is in the correct location on the map display and that the streets of the surrounding area are shown.

4. Press MENU on the remote and select the DEST menu. Verify that the destination input menu allows the option of entering destination by address, intersection, point of interest, and previous destination (or recent route).
5. Choose ADDRESS from the destination menu and CITY NAME from the menu that follows.
6. In the address input screens, enter San Antonio for the city name, Culebra Road for the street name, and 6220 for the address.
7. Confirm the destination by pressing OK TO PROCEED.
8. Allow some time for the IVN unit to compute a route. Verify that the map display reappears and a route from the current vehicle location to 6220 Culebra Road, San Antonio, Texas is highlighted.
9. Begin to drive the vehicle along the suggested route.
10. Once you are on the suggested route, press the MP/RG button on the remote and verify that a guide display appears indicating the distance to and direction of an upcoming turn.
11. Verify that as you approach the first turn on the suggested route, the IVN unit provides an audible prompt, warning the driver of the upcoming turn.
12. Make the suggested turn.
13. Verify that another audible prompt occurs, indicating the appropriate time to turn.
14. Safely park the vehicle.
15. Press MENU on the remote and select the DEST menu. Verify that the destination input menu appears.
16. Choose INTERSECTION from the destination menu and CITY NAME from the menu that follows.
17. In the intersection input screens, enter San Antonio for the city name, Culebra Road for the street name, and Callaghan for the cross street name.
18. Confirm the destination by pressing OK TO PROCEED.
19. Allow some time for the IVN unit to compute a route. Verify that the map display reappears and a route from the current vehicle location to the intersection of Culebra and Callaghan is highlighted.
20. Press MENU on the remote and select the DEST menu. Verify that the destination input menu appears.
21. Choose POINT OF INTEREST from the destination menu and PLACE NAME from the menu that follows.
22. In the point of interest input screen, enter San Antonio International Airport for the point of interest name.
23. Confirm the destination by pressing OK TO PROCEED.
24. Allow some time for the IVN unit to compute a route. Verify that the map display reappears and a route from the current vehicle location to San Antonio International Airport is highlighted.

25. Press MENU on the remote and select the DEST menu. Verify that the destination input menu appears.
26. Choose RECENT ROUTE from the destination menu.
27. Select 6220 Culebra, San Antonio from the list of addresses that appears.
28. Confirm the destination by pressing OK TO PROCEED.
29. Allow some time for the IVN unit to compute a route. Verify that the map display reappears and a route from the current vehicle location to 6220 Culebra Road, San Antonio, Texas is highlighted.
30. Turn off the vehicle.
31. Review the specifications and printed information that accompany the IVN unit, and verify that the unit uses the South Central map database provided by Navigation Technologies.

2.2.2.2.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

~~1.1.1.3~~2.2.2.3 IVN-NU-3

This test verifies that the IVN system communicates real-time traffic data to the Alpine navigation unit, the Alpine unit displays the information correctly, and the Alpine unit uses the information in route calculations.

~~1.1.1.1.1~~2.2.2.3.1 Requirements Addressed

IVN-1 The system shall communicate the following types of real-time traffic information to moving vehicles:
link speed data
incident information

IVN-4.2 The IVN unit shall accept real-time traffic data input from the STIC receiver.

IVN-4.4 The IVN unit shall calculate the shortest time route, based on the real-time information from the STIC receiver, from the current location of the vehicle to the traveler entered destination.

~~1.1.1.1.2~~2.2.2.3.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time data as defined in Appendices E, F, and G must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.2.2.3.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendices E, F, and G.

~~1.1.1.1.4~~2.2.2.3.4 Test Results Evaluation

This test will be considered successful if each step in the procedure is completed successfully and the IVN unit behaves as described.

~~1.1.1.1.5~~2.2.2.3.5 Test Procedure

1. Turn the ignition to the "On" position and verify that the IVN unit starts up and displays the disclaimer screen.
2. Press ENTER on the remote to leave the disclaimer screen. Verify that the map display appears with the vehicle icon.
3. Using the test version of the Realtime Receive process, initiate a simulation using the data described in Appendix E. This data simulates a traffic condition in which the speeds on several road segments in San Antonio have the same value. The speed value cycles through five different speeds.

4. Verify that the traffic data icon on the IVN unit display indicates that traffic data is being received.
5. Using the IVN unit remote, inspect the map display and verify that road segments on the map that correlate with those in the simulation data change colors in conjunction with the changes in speeds in the simulation data.
6. Using the IVN unit remote, inspect the map display and verify that icons appear on the map in locations that correlate with those in the simulation data.
7. Drive the vehicle to the parking lot of the TxDOT San Antonio District Office at the intersection of Callaghan and I-410.
8. Using the test version of the real-time receive process, initiate a simulation using the data described in Appendix F. This data simulates a traffic condition in which the speeds on several adjacent road segments of I-37 east of downtown is 5 mph.
9. Verify that the traffic data icon on the IVN unit display indicates that traffic data is being received and that the map display shows colored road segments on I-37 in the appropriate location.
10. Press MENU on the remote and select the DEST menu. Verify that the destination input menu appears.
11. Choose INTERSECTION from the destination menu and CITY NAME from the menu that follows.
12. In the intersection input screens, enter San Antonio for the city name, New Braunfels for the street name, and I-10/US-90 for the cross street name.
13. Confirm the destination by pressing OK TO PROCEED.
14. Allow some time for the IVN unit to compute a route. Verify that the map display reappears and a route from the current vehicle location to the intersection of I-10 and New Braunfels is highlighted. Also, verify that the route avoids I-37 on the east side of downtown.
15. Using the test version of the real-time receive process, initiate a simulation using the data described in Appendix G. This data simulates a traffic condition in which the speeds on several adjacent road segments of I-10 south of downtown is 5 mph.
16. Verify that the traffic data icon on the IVN unit display indicates that traffic data is being received and that the map display shows colored road segments on I-10 in the appropriate location.
17. Press MENU on the remote and select the DEST menu. Verify that the destination input menu appears.
18. Choose INTERSECTION from the destination menu and CITY NAME from the menu that follows.
19. In the intersection input screens, enter San Antonio for the city name, New Braunfels for the street name, and I-10/US-90 for the cross street name.
20. Confirm the destination by pressing OK TO PROCEED.
21. Allow some time for the IVN unit to compute a route. Verify that the map display reappears and a route from the current vehicle location to the intersection of I-10 and New Braunfels is highlighted. Also, verify that the route avoids I-10 on the south side of downtown.

2.2.2.3.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

~~1.1.1.4~~2.2.2.4 IVN-NU-4

This test verifies that the Zexel navigation system meets the IVN unit software requirements listed below.

~~1.1.1.1.1~~2.2.2.4.1 Requirements Addressed

IVN-4.3 The IVN unit shall provide a means for the traveler to enter a destination of the following types:

- address,
- intersection,
- place or point of interest, and
- previous destination.

IVN-4.5 The IVN unit shall communicate the route information using a map display, guide display, and audible prompting.

IVN-4.6 The IVN unit guide display shall present the following information:

- distance to an upcoming turn,
- direction of an upcoming turn.

IVN-4.7 The IVN unit shall provide the following audible prompts:

- warning of an upcoming turn,
- indication to make a turn.

IVN-4.8 The IVN unit map display shall show the current location of the vehicle and the calculated route on an annotated map of the surroundings.

IVN-4.9 The information used to generate the map display shall be derived from the San Antonio, Texas Metropolitan Area database supplied by Navigation Technologies.

~~1.1.1.1.2~~2.2.2.4.2 Prerequisite Conditions

None.

~~1.1.1.1.3~~2.2.2.4.3 Test Inputs

None.

~~1.1.1.1.4~~2.2.2.4.4 Test Results Evaluation

This test will be considered successful if each step in the procedure is completed successfully and the IVN unit behaves as described.

~~1.1.1.1.5~~2.2.2.4.5 Test Procedure

1. Start the vehicle and verify that the IVN unit starts up and displays the disclaimer screen.
2. Press ENTER to leave the disclaimer screen and then press the ROUTE/MAP key. Verify that the map display appears with the vehicle icon.
3. Given the current location of the vehicle, verify that the vehicle icon is in the correct location on the map display and that the streets of the surrounding area are shown.

4. Press ROUTE/MAP to display the destination menu. Verify that the destination menu allows the option of entering destination by address, intersection, point of interest, and previous destination (or destination memory).
5. Choose STREET ADDRESS from the destination menu.
6. In the address input screens, enter San Antonio for the city name, Culebra Road for the street name, and 6220 for the address.
7. Once the destination is input, choose the SHORTEST TIME ROUTE from the route criteria menu.
8. Allow some time for the IVN unit to compute a route then choose PROCEED in the ETA screen that follows. Verify that the map display reappears and a route from the current vehicle location to 6220 Culebra Road, San Antonio, Texas is highlighted.
9. Begin to drive the vehicle along the suggested route.
10. Once you are on the suggested route, press the ROUTE/MAP button and verify that a guide display appears indicating the distance to and direction of an upcoming turn.
11. Verify that as you approach the first turn on the suggested route, the IVN unit provides an audible prompt, warning the driver of the upcoming turn.
12. Make the suggested turn.
13. Verify that another audible prompt occurs, indicating the appropriate time to turn.
14. Safely park the vehicle.
15. Press CANCEL and then select CANCEL GUIDANCE from the menu that appears. Verify that the destination input menu appears.
16. Choose INTERSECTION from the destination menu.
17. In the intersection input screens, enter San Antonio for the city name, Culebra Road for the first street name, and Callaghan for the cross street name.
18. Once the destination is input, choose the SHORTEST TIME ROUTE from the route criteria menu.
19. Allow some time for the IVN unit to compute a route then choose PROCEED in the ETA screen that follows. Verify that the map display reappears and a route from the current vehicle location to the intersection of Culebra and Callaghan is highlighted.
20. Press CANCEL and then select CANCEL GUIDANCE from the menu that appears. Verify that the destination input menu appears.
21. Choose POINT OF INTEREST from the destination menu and AIRPORT in the point of interest type menu.
22. In the point of interest input screens, enter NEAREST for the search criteria and select San Antonio International Airport for the point of interest name.
23. Once the destination is input, choose the SHORTEST TIME ROUTE from the route criteria menu.
24. Allow some time for the IVN unit to compute a route then choose PROCEED in the ETA screen that follows. Verify that the map display reappears and a route from the current vehicle location to San Antonio International Airport is highlighted.

25. Press CANCEL and then select CANCEL GUIDANCE from the menu that appears. Verify that the destination input menu appears.
26. Choose DESTINATION MEMORY from the destination menu.
27. Select 6220 Culebra, San Antonio from the list of addresses that appears.
28. Once the destination is input, choose the SHORTEST TIME ROUTE from the route criteria menu.
29. Allow some time for the IVN unit to compute a route then choose PROCEED in the ETA screen that follows. Verify that the map display reappears and a route from the current vehicle location to 6220 Culebra Road, San Antonio, Texas is highlighted.
30. Turn off the vehicle.
31. Review the specifications and printed information that accompany the IVN unit, and verify that the unit uses the South Central map database provided by Navigation Technologies.

2.2.2.4.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.2.2.5 IVN-NU-5

This test verifies that the IVN system communicates real-time traffic data to the Zexel navigation unit, the Zexel unit displays the information correctly, and the Zexel unit uses the information in route calculations.

~~1.1.1.1.1~~2.2.2.5.1 Requirements Addressed

IVN-1 The system shall communicate the following types of real-time traffic information to moving vehicles:
- link speed data,
- incident information.

IVN-4.2 The IVN unit shall accept real-time traffic data input from the STIC receiver.

IVN-4.4 The IVN unit shall calculate the shortest time route, based on the real-time information from the STIC receiver, from the current location of the vehicle to the traveler entered destination.

~~1.1.1.1.2~~2.2.2.5.2 Prerequisite Conditions

1. The Data Server processes must be running on the Data Server master computer.
2. The test version of the Realtime Receive process must be running on the IVN master computer.
3. Simulated real-time data as defined in Appendices E, F, and G must be input to the test version of the Realtime Receive process.
4. The STIC message encoder installed in the radio station transmission room must be operating normally.
5. The initial values of the parameters in the IVN MCS configuration file shall be as defined in Appendix B.

2.2.2.5.3 Test Inputs

The test inputs are the simulated TransGuide link and incident data as defined in Appendices E, F, and G.

~~1.1.1.1.4~~2.2.2.5.4 Test Results Evaluation

This test will be considered successful if each step in the procedure is completed successfully and the IVN unit behaves as described.

~~1.1.1.1.5~~2.2.2.5.5 Test Procedure

1. Start the vehicle and verify that the IVN unit starts up and displays the disclaimer screen.
2. Press ENTER to leave the disclaimer screen and then press the ROUTE/MAP key. Verify that the map display appears with the vehicle icon.
3. Using the test version of the Realtime Receive process, initiate a simulation using the data described in Appendix E. This data simulates a traffic condition in which the speeds on several road segments in San Antonio have the same value. The speed value cycles through five different speeds.
4. Verify that the traffic data icon on the IVN unit display indicates that traffic data is being received.

5. Using the map zoom keys, inspect the map display and verify that road segments on the map that correlate with those in the simulation data change colors in conjunction with the changes in speeds in the simulation data.
6. Using the map zoom keys, inspect the map display and verify that icons appear on the map in locations that correlate with those in the simulation data.
7. Drive the vehicle to the parking lot of the TxDOT San Antonio District Office at the intersection of Callaghan and I-410.
8. Using the test version of the real-time receive process, initiate a simulation using the data described in Appendix F. This data simulates a traffic condition in which the speeds on several adjacent road segments of I-37 east of downtown is 5 mph.
9. Verify that the traffic data icon on the IVN unit display indicates that traffic data is being received and that the map display shows colored road segments on I-37 in the appropriate location.
10. Press ROUTE/MAP to display the destination menu.
11. Choose INTERSECTION from the destination menu.
12. In the intersection input screens, enter San Antonio for the city name, New Braunfels for the street name, and I-10/US-90 for the cross street name.
13. Once the destination is input, choose the SHORTEST TIME ROUTE from the route criteria menu.
14. Allow some time for the IVN unit to compute a route then choose PROCEED in the ETA screen that follows. Verify that the map display reappears and a route from the current vehicle location to the intersection of I-10 and New Braunfels is highlighted. Also, verify that the route avoids I-37 on the east side of downtown.
15. Press CANCEL and then select CANCEL GUIDANCE from the menu that appears. Verify that the destination input menu appears.
16. Using the test version of the real-time receive process, initiate a simulation using the data described in Appendix G. This data simulates a traffic condition in which the speeds on several adjacent road segments of I-10 south of downtown is 5 mph.
17. Verify that the traffic data icon on the IVN unit display indicates that traffic data is being received and that the map display shows colored road segments on I-10 in the appropriate location.
18. Press ROUTE/MAP to display the destination menu.
19. Choose INTERSECTION from the destination menu.
20. In the intersection input screens, enter San Antonio for the city name, New Braunfels for the street name, and I-10/US-90 for the cross street name.
21. Once the destination is input, choose the SHORTEST TIME ROUTE from the route criteria menu.
22. Allow some time for the IVN unit to compute a route then choose PROCEED in the ETA screen that follows. Verify that the map display reappears and a route from the current vehicle location to the intersection of I-10 and New Braunfels is highlighted. Also, verify that the route avoids I-10 on the south side of downtown.

2.2.2.5.6 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____
TxDOT: _____ Date: _____

2.3 IVN-SYS

This test verifies that the high-level system requirements are met.

~~1.1.1~~2.3.1 Test Preparation

None.

~~1.1.2~~2.3.2 Requirements Addressed

IVN-3 The system shall communicate the real-time traffic information using the Subcarrier Traffic Information Channel (STIC) system which consists of a message encoder/FM subcarrier generator and FM subcarrier receivers.

IVN-4 The system shall utilize commercially available IVN units to display the real-time traffic information to travelers.

IVN-5 The system shall utilize the IVN units of at least two manufacturers.

~~1.1.3~~2.3.3 Prerequisite Conditions

The IVN-MC and IVN-NU series of tests have been completed successfully.

~~1.1.4~~2.3.4 Test Inputs

None.

~~1.1.5~~2.3.5 Test Results Evaluation

This test will be considered successful if the IVN-MC and IVN-NU series of tests were completed successfully.

~~1.1.6~~2.3.6 Test Procedure

Note the results of the IVN-MC and IVN-NU series of tests.

~~1.1.7~~2.3.7 Test Results

☐ Pass ☐ Fail SwRI: _____ Date: _____

TxDOT: _____ Date: _____

2.4 IVN-INSTALL

The IVN-INSTALL tests are designed to be performed after installation of in-vehicle equipment is complete. These tests will verify that the installation was performed properly and that the installed navigation unit and STIC receiver are fully functional.

~~1.1.1~~2.4.1 Test Preparation

The navigation unit and STIC receiver must be installed in the vehicle in accordance with the installation procedures described in the documentation accompanying the components. In addtion, the IVN MCS and STIC data transmission system must be operating and continuously broadcasting traffic data.

~~1.1.2~~2.4.2 Test Descriptions

The individual test methods are described in the following sections.

~~1.1.1.1~~2.4.2.1 IVN-INSTALL-1

This test verifies that the Alpine navigation system and STIC receiver are properly installed in a vehicle.

~~1.1.1.1.1~~2.4.2.1.1 Requirements Addressed

None.

~~1.1.1.1.2~~2.4.2.1.2 Prerequisite Conditions

Valid traffic data must be continuously broadcast by the IVN MCS and STIC data transmission system during this test.

~~1.1.1.1.3~~2.4.2.1.3 Test Inputs

The Alpine "TransGuide Diagnostic" CD-ROM is required for testing the installation of the STIC receiver.

~~1.1.1.1.4~~2.4.2.1.4 Test Results Evaluation

The installed components will pass the test if every step of the test procedure is completed successfully and events are verified as described.

~~1.1.1.1.5~~2.4.2.1.5 Test Procedure

1. Park the vehicle outside in an area where the GPS and FM antennas have good reception.
2. Turn the ignition to the "On" postion.
3. Verify that the unit "wakes up" and the disclaimer screen appears.
4. Press ENTER.
5. Allow 10 to 30 minutes for the IVN unit to receive GPS data and approximate the vehicle position. During this time, verify that the GPS icon turns light blue then yellow.
6. Verify that the vehicle icon appears in approximately the correct position on the map.
7. Drive the vehicle a short distance.

8. Verify that the vehicle icon moves smoothly on the map and not in large steps.
9. Turn the vehicle while driving.
10. Verify that the vehicle icon rotates as the vehicle turns.
11. Drive the vehicle in reverse.
12. Verify that the vehicle icon moves backward when the vehicle is moving in reverse.
13. Eject the Alpine "Smart Map Pro" CD-ROM and insert the Alpine "TransGuide Diagnostic" CD-ROM.
14. Allow 3 minutes for the STIC receiver to receive traffic data.
15. Verify that the diagnostic screen displays a confirmation message.
16. Eject the Alpine "TransGuide Diagnostic" CD-ROM and re-insert the Alpine "Smart Map Pro" CD-ROM.

2.4.2.1.6 Test Results

☐ Pass ☐ Fail Custom Sounds/SwRI: _____ Date: _____
TxDOT: _____ Date: _____

~~1.1.1.2~~2.4.2.2 IVN-INSTALL-2

This test verifies that the Zexel navigation system and STIC receiver are properly installed in a vehicle.

~~1.1.1.1.1~~2.4.2.2.1 Requirements Addressed

None.

~~1.1.1.1.2~~2.4.2.2.2 Prerequisite Conditions

Valid traffic data must be continuously broadcast by the IVN MCS and STIC data transmission system during this test.

~~1.1.1.1.3~~2.4.2.2.3 Test Inputs

The Zexel "MDI Diagnostic" PCMCIA data cartridge is required for testing the installation of the STIC receiver.

~~1.1.1.1.4~~2.4.2.2.4 Test Results Evaluation

The installed components will pass the test if every step of the test procedure is completed successfully and events are verified as described.

~~1.1.1.1.5~~2.4.2.2.5 Test Procedure

1. Park the vehicle outside in an area where the GPS and FM antennas have good reception.
2. Install the database cartridge labeled "MDI Diagnostic."
3. Turn the ignition to the "On" position.
4. Verify that navigation system software updates and system restarts correctly.
5. Enter diagnostic menu by pressing the OPTION key.
6. Select SYS CALIB from the option menu. Selecting SYS CALIB will cause the diagnostic menu to appear.
7. Select REVERSE SIGNAL from the diagnostic menu.
8. Move the vehicle shift lever in and out of reverse.
9. Verify that the reverse signal test display changes to "ON" only when the vehicle shift lever is in reverse.
10. Select VOICE AND SOUND from the diagnostic menu.
11. Verify that the system voice prompt operates correctly.
12. Press CANCEL to exit the diagnostic menu.
13. Press ROUTE/MAP key to go to the map screen.
14. Allow 3 minutes for the STIC receiver to receive traffic data.
15. Verify that the traffic information (TI) symbol in the lower left corner is green in color.
16. Turn the ignition to the "Off" position.

17. Remove the database cartridge labeled "MDI Diagnostic" and reinstall the standard database cartridge.
18. Turn the ignition to the "On" position.
19. Enter the diagnostic menu from the CAUTION screen using the sequence: UP ARROW, UP ARROW, RIGHT ARROW, OPTION.
20. Select GPS from the diagnostic menu. Select GPS INITIALIZATION. Confirm your choice when prompted.
21. Allow approximately 15 minutes for the GPS system to initialize.
22. Verify that the GPS initializes and the display returns to the diagnostic menu.
23. Drive the vehicle a short distance.
24. Verify that the vehicle icon moves smoothly on the map and not in large steps.
25. Turn the vehicle while driving.
26. Verify that the vehicle icon rotates as the vehicle turns.

2.4.2.2.6 Test Results

☐ Pass ☐ Fail Custom Sounds/SwRI: _____ Date: _____
TxDOT: _____ Date: _____

3.0 Requirements Traceability

NUMBER	REQUIREMENT	SOURCE	DESIGN ELEMENT ALLOCATED TO
IVN-1	The system shall communicate the following types of real-time traffic information to moving vehicles: • link speed data • incident information	RFO-33.3.3	MCS/STIC system
IVN-2	The real-time traffic information shall be derived from the Data Server.	P-2.6.2.3.4	MCS
IVN-2.1	Software running on an IVN master computer shall be used to extract real-time information from the Data Server.	P-2.6.2.3.4	MCS
IVN-2.1.1	The IVN MCS shall transmit IVN process status information to the Data Server every 60 seconds.	derived	MCS
IVN-2.1.2	The IVN MCS shall extract link ID information from the Data Server Realtime Subsystem.	derived	MCS
IVN-2.1.3	The IVN MCS shall extract link location information from the Data Server Realtime Subsystem.	derived	MCS
IVN-2.1.4	The IVN MCS shall extract link speed information from the Data Server Realtime Subsystem.	derived	MCS
IVN-2.1.5	The IVN MCS shall extract incident information from the Data Server Realtime Subsystem.	derived	MCS
IVN-2.1.6	The IVN MCS shall transmit link speed information to the STIC message encoder every 60 seconds.	derived	MCS
IVN-2.1.7	The IVN MCS shall transmit incident information to the STIC message encoder every 60 seconds.	derived	MCS
IVN-2.1.8	The IVN MCS shall transmit locally referenced link speed information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.	derived	MCS
IVN-2.1.9	The IVN MCS shall transmit globally referenced link speed information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.	derived	MCS
IVN-2.1.10	The IVN MCS shall transmit locally referenced incident information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.	derived	MCS
IVN-2.1.11	The IVN MCS shall transmit globally referenced incident information to the STIC message encoder in accordance with the messaging protocol defined in the *TransGuide In-Vehicle Navigation System High Speed FM Subcarrier Communications Protocol*.	derived	MCS
IVN-2.1.12	The IVN MCS shall generate a table of TransGuide link information that includes	derived	MCS

NUMBER	REQUIREMENT	SOURCE	DESIGN ELEMENT ALLOCATED TO
	link ID, starting coordinate, ending coordinate, and street name		
IVN-2.1.13	The IVN MCS shall provide a display of the process status which shall be updated every 60 seconds.	derived	MCS
IVN-2.1.14	The IVN MCS shall be capable of being started and stopped through the IVN process status GUI.	derived	MCS
IVN-2.1.15	The IVN MCS shall provide a display of the status of communication to peripheral systems with which it exchanges data.	derived	MCS
IVN-2.1.16	The IVN MCS shall log informational messages, warning messages and error messages to a status log file.	derived	MCS
IVN-2.2	The IVN master computer shall be a Sun Microsystems Ultra SPARCStation with the following components: • 167 MHz SPARC (RISC) CPU • 128 MB RAM • GB hard disk space • Floppy disk drive • Sun CD-ROM drive • Turbo GX+ graphics • 20" color monitor • 8 port modem server (SCSI attached) • Dual ethernet interfaces • Dual SCSI channels	P-2.3.2.4.1	IVN master computer
IVN-2.3	The master computer shall be located in the TransGuide Operations Center.	P-2.6.2.3.4	IVN master computer
IVN-3	The system shall communicate the real-time traffic information using the Subcarrier Traffic Information Channel (STIC) system which consists of a message encoder/FM subcarrier generator and FM subcarrier receivers.	P-2.6.1	STIC encoder/STIC receiver
IVN-4	The system shall utilize commercially available IVN units to display the real-time traffic information to travelers.	RFO-33.4.1	Alpine/Zexel navigation units
IVN-4.1	The IVN unit shall be composed of the following components: • microprocessor • reconfigurable LCD color display • removable media for data storage • gyroscopic sensor • GPS receiver	P-2.6.2.3.5	Alpine/Zexel navigation units
IVN-4.2	The IVN unit shall accept real-time traffic data input from the STIC receiver.	P-2.6.2.3.5	Alpine/Zexel navigation units
IVN-4.3	The IVN unit shall provide a means for the traveler to enter a destination of the following types:	P-2.6.2.3.5	Alpine/Zexel navigation units

NUMBER	REQUIREMENT	SOURCE	DESIGN ELEMENT ALLOCATED TO
	• address • intersection • place or point of interest • previous destination		
IVN-4.4	The IVN unit shall calculate the shortest time route, based on the real-time information from the STIC receiver, from the current location of the vehicle to the traveler entered destination.	RFO-33.4.2	Alpine/Zexel navigation units
IVN-4.5	The IVN unit shall communicate the route information using a map display, guide display, and audible prompting.	P-2.6.2.3.5	Alpine/Zexel navigation units
IVN-4.6	The IVN unit guide display shall present the following information: • distance to an upcoming turn • direction of an upcoming turn	P-2.6.2.3.5	Alpine/Zexel navigation units
IVN-4.7	The IVN unit shall provide the following audible prompts: • warning of an upcoming turn • indication to make a turn	RFO-33.4.2	Alpine/Zexel navigation units
IVN-4.8	The IVN unit map display shall show the current location of the vehicle and the calculated route on an annotated map of the surroundings.	P-2.6.2.3.5	Alpine/Zexel navigation units
IVN-4.9	The information used to generate the map display shall be derived from the San Antonio, Texas Metropolitan Area database supplied by Navigation Technologies.	P-2.6.2.3.5	Alpine/Zexel navigation units
IVN-5	The system shall utilize the IVN units of at least two manufacturers.	RFO-33.4.1	Alpine/Zexel navigation units

Appendix A – Simulated Real-Time Data

Appendix A – Simulated Real-Time Data

Section 1 – Link Speed Data

Link 1 (locally referenced)

Link ID	IE1604L-0035I-POINT
Start longitude	-9833556
Start latitude	2957028
Start altitude	-2
End longitude	-9833333
End latitude	2956833
End altitude	-2
Street name	LP 1604
Street flag	1
Link speed	10

Link 2 (locally referenced)

LinkID	IE1604L-BITTE-TRADE
Start longitude	-9858222
Start latitude	2959222
Start altitude	-1
End longitude	-9853417
End latitude	2960292
End altitude	-1
Street name	LP 1604
Street flag	0
Link speed	20

Link 3 (locally referenced)

LinkID	IN0035I-0410I-FISCH
Start longitude	-9861569
Start latitude	2930944
Start altitude	0
End longitude	-9860792
End latitude	2931639
End altitude	0
Street name	IH 35
Street flag	0
Link speed	30

Link 4 (locally referenced)

LinkID	IN0035I-1604L-TOEPP
Start longitude	-9834833
Start latitude	2955542
Start altitude	1
End longitude	-9833306
End latitude	2956847
End altitude	1
Street name	IH 35
Street flag	0
Link speed	40

Link 5 (locally referenced)

LinkID	IN0281U-AIRPO-BASSE
Start longitude	-9848264
Start latitude	2948750
Start altitude	2
End longitude	-9847778
End latitude	2951597
End altitude	2
Street name	US 281
Street flag	0
Link speed	50

Link 6 (globally referenced)

LinkID IN0281U-DONEL-OAKSH
Start longitude -9047861
Start latitude 2957583
Start altitude 3
End longitude -9046889
End latitude 2960903
End altitude 3
Street name US 281
Street flag 1
Link speed 10

Link 7 (globally referenced)
LinkID IN0410I-0010I-HOUST
Start longitude -9038861
Start latitude 2942347
Start altitude 4
End longitude -9038944
End latitude 2943611
End altitude 4
Street name IH 410
Street flag 0
Link speed 20

Link 8 (globally referenced)
LinkID IN0410I-0090U-PEARS
Start longitude -9062347
Start latitude 2933889
Start altitude 5
End longitude -9064903
End latitude 2939667
End altitude 5
Street name IH 410
Street flag 0
Link speed 30

Link 9 (globally referenced)
LinkID SECT-0010E-555.360
Start longitude -9860292
Start latitude 2060708
Start altitude 6
End longitude -9860167
End latitude 2060319
End altitude 6
Street name IH 10
Street flag 0
Link speed 40

Link 10 (globally referenced)
LinkID SECT-0010E-555.845
Start longitude -9860167
Start latitude 2060319
Start altitude 7
End longitude -9859958
End latitude 2059625
End altitude 7
Street name IH 10
Street flag 0
Link speed 50

Section 2 – Incident Data

Incident 1 (local link)
Incident ID 1
Link ID IE1604L-0035I-POINT
Incident source 1 (ATMS)
Incident type 0 (Major accident)

Incident longitude 0
Incident latitude 0
Incident altitude 0
Incident start time (current time)
Incident status 3 (Executing scenario)

Incident 2 (local point)
Incident ID 2
Link ID (null)
Incident source 2 (LANECLOSURE)
Incident type 8 (LANECLOSURE)
Incident longitude -9833555
Incident latitude 2957027
Incident altitude -2
Incident start time (current time - 5 minutes)
Incident status 3 (Executing scenario)

Incident 3 (global link)
Incident ID 3
Link ID IN0281U-DONEL-OAKSH
Incident source 1 (ATMS)
Incident type 1 (Minor accident)
Incident longitude 0
Incident latitude 0
Incident altitude 0
Incident start time (current time - 10 minutes)
Incident status 3 (Executing scenario)

Incident 4 (global point)
Incident ID 4
Link ID (null)
Incident source 3 (POLICE)
Incident type 9 (POLICE)
Incident longitude -9638860
Incident latitude 2142347
Incident altitude 4
Incident start time (current time - 15 minutes)
Incident status 3 (Executing scenario)

Incident 5 (not yet active)
Incident ID 5
Link ID IN0035I-0410I-FISCH
Incident source 1 (ATMS)
Incident type 2 (CONGESTION)
Incident longitude 0
Incident latitude 0
Incident altitude 0
Incident start time (current time - 20 minutes)
Incident status 0 (Unassigned)

Appendix B – IVN MCS Configuration File

Appendix B – IVN MCS Configuration File

```
# TG link data file path/name
TgLinkFile                  (File name to be determined)

# Data server host name, IVN process name
DataServerHost              dataserver
IvnProcessName              ivn_main

# Status log file path, name
LogFilePath                 $ATMS/log/
LogFileName                 ivn_status

# Dataserver heartbeat interval in seconds
HeartBeatInterval           60

# Serial I/O attributes
# - read timeout in 0.1 seconds
# - read min bytes timeout in seconds
# - write min bytes timeout in seconds
# - EINTR error retry limit
SerialAttr.readtimeout      10
SerialAttr.readmintimeout   5.0
SerialAttr.writemintimeout  5.0
SerialAttr.eintrretry       5

# Modem control attributes
# - command timeout in seconds
# - connection timeout in seconds
# - attention command delay in seconds
# - command retry limit
# - connection retry limit
ModemAttr.commandtimeout    5.0
ModemAttr.connecttimeout    60.0
ModemAttr.attentiondelay    2.0
ModemAttr.commandretry      5
ModemAttr.connectretry      5

# STIC communication attributes
# - message send timeout in seconds
# - message reply timeout in seconds
# - message retry limit
SticAttr.msgsendtimeout     30.0
SticAttr.msgreplytimeout    60.0
SticAttr.msgretry           5

# Enable/disable messages to stdout
LogAttr.errormsgstostdout   1
LogAttr.warnmsgstostdout    1
LogAttr.infomsgstostdout    1
LogAttr.debugmsgstostdout   1
LogAttr.debugdatatostdout   0

# Enable/disable messages to log file
LogAttr.errormsgstologfile  1
LogAttr.warnmsgstologfile   1
LogAttr.infomsgstologfile   1
LogAttr.debugmsgstologfile  0
LogAttr.debugdatatologfile  0

# Origin info for local referencing
# - longitude in half degree units
# - latitude in half degree units
# - ID (not currently used)
Origin.longitude            -197
Origin.latitude             59
```

```
Origin.id                   0

# IVN message protocol parameters
# - threshold for speed change updates in MPS
# - maximum number of incidents reported
# - STM sequence number data file
SpeedDeltaThreshold         3
MaxIncidents                100
SeqNumDataFile              $ATMS/data/ivn_stmseq.dat

# IVN parameters for communication to STIC
# - serial/modem baudrate (9600 or 19200)
# - IVN modem tty device name
# - STIC modem phone number (KTFM)
BaudRate                    19200
ModemTty                    /dev/sts/ttyC50
SticPhoneNumber             4768783

# Maximum real-time data update interval (set to 0 to disable check)
MaxLinkUpdateInterval       60
MaxIncUpdateInterval        60
```

Appendix C – IVN Process Status GUI Configuration File

Appendix C – IVN Process Status GUI Configuration File

```
# The time in seconds between updates of the process status GUI.
UPDATE_RATE             5

# The name of the shared memory base constant associated with the project.
# The segment number of the process status shared memory segment.
SUBSYSTEM_SHM_BASE      IVN_SHM_BASE
PROCESS_STATUS_SEGMENT  0

# The name of the project.
PROJECT_NAME        In Vehicle Navigation

# The command-line string used to start the master process of the project.
PROJECT_STARTUP     $ATMS/bin/ivn_main

# The command-line string used to start the detailed status GUI.
# If not present then the view pulldown will not be available.
DETAILED_STARTUP    $ATMS/bin/ivn_equip_gui ivn_equip_gui.cfg

# If present in the configuration file this indicates the SIGHUP signal
# should be sent to the master process whenever the process state is changed
# by the process status GUI.
SEND_SIGNAL
```

Appendix D – IVN Equipment Status GUI Configuration File

Appendix D – IVN Equipment Status GUI Configuration File

```
# The time in seconds between updates of the equipment status GUI.
UPDATE_RATE                             5
```

Appendix E – Simulated Traffic Data

Appendix E – Simulated Traffic Data

Link 1

Link ID	SECT-0010E-573.654
Start longitude	-9850015
Start latitude	2939597
Start altitude	0
End longitude	-9849347
End latitude	2939597
End altitude	0
Street name	IH 10
Street flag	0
Link status	1

Time	Link speed
(current time)	5
(current time + 1 minute)	15
(current time + 2 minutes)	25
(current time + 3 minutes)	35
(current time + 4 minutes)	45
(current time + 5 minutes)	55
(current time + 6 minutes)	65

Link 2

Link ID	SECT-0037S-140.348
Start longitude	-9847957
Start latitude	2940750
Start altitude	0
End longitude	-9847972
End latitude	2940070
End altitude	0
Street name	IH 37
Street flag	0
Link status	1

Time	Link speed
(current time)	5
(current time + 1 minute)	15
(current time + 2 minutes)	25
(current time + 3 minutes)	35
(current time + 4 minutes)	45
(current time + 5 minutes)	55
(current time + 6 minutes)	65

Link 3

Link ID	SECT-0L35S-154.750
Start longitude	-9850417
Start latitude	2941445
Start altitude	0
End longitude	-9850972
End latitude	2940610
End altitude	0
Street name	IH 35
Street flag	0
Link status	1

Time	Link speed
(current time)	5
(current time + 1 minute)	15
(current time + 2 minutes)	25
(current time + 3 minutes)	35
(current time + 4 minutes)	45
(current time + 5 minutes)	55
(current time + 6 minutes)	65

Link 4

Link ID	SECT-0410N-011.941
Start longitude	-9861555
Start latitude	2946875

Start altitude	0
End longitude	-9861125
End latitude	2947332
End altitude	0
Street name	IH 410
Street flag	0
Link status	1

Time	Link speed
(current time)	5
(current time + 1 minute)	15
(current time + 2 minutes)	25
(current time + 3 minutes)	35
(current time + 4 minutes)	45
(current time + 5 minutes)	55
(current time + 6 minutes)	65

Incident 1

Incident ID	1
Link ID	SECT-0010E-573.654
Incident source	1 (ATMS)
Incident type	0 (Major accident)
Incident longitude	0
Incident latitude	0
Incident altitude	0
Incident start time	(current time)
Incident status	3 (Executing scenario)

Incident 2

Incident ID	2
Link ID	SECT-0037S-140.348
Incident source	2 (LANECLOSURE)
Incident type	8 (LANECLOSURE)
Incident longitude	0
Incident latitude	0
Incident altitude	0
Incident start time	(current time)
Incident status	3 (Executing scenario)

Incident 3

Incident ID	3
Link ID	SECT-0L35S-154.750
Incident source	1 (ATMS)
Incident type	1 (Minor accident)
Incident longitude	0
Incident latitude	0
Incident altitude	0
Incident start time	(current time)
Incident status	3 (Executing scenario)

Incident 4

Incident ID	4
Link ID	(null)
Incident source	3 (POLICE)
Incident type	9 (POLICE)
Incident longitude	-9861555
Incident latitude	2946875
Incident altitude	0
Incident start time	(current time)
Incident status	3 (Executing scenario)

Appendix F – Simulated Link Speed Data on I-37

Appendix F – Simulated Link Speed Data on I-37

Link 1

Link ID	SECT-0037S-140.007
Start longitude	-9847972
Start latitude	2940070
Start altitude	0
End longitude	-9847765
End latitude	2939527
End altitude	0
Street name	IH 37
Street flag	0
Link status	1
Link speed	5

Link 2

Link ID	SECT-0037S-140.348
Start longitude	-9847957
Start latitude	2940750
Start altitude	0
End longitude	-9847972
End latitude	2940070
End altitude	0
Street name	IH 37
Street flag	0
Link status	1
Link speed	5

Link 3

Link ID	SECT-0037S-140.919
Start longitude	-9847972
Start latitude	2941515
Start altitude	0
End longitude	-9847957
End latitude	2940750
End altitude	0
Street name	IH 37
Street flag	0
Link status	1
Link speed	5

Link 4

Link ID	SECT-0037S-141.399
Start longitude	-9848015
Start latitude	2942167
Start altitude	0
End longitude	-9847972
End latitude	2941515
End altitude	0
Street name	IH 37
Street flag	0
Link status	1
Link speed	5

Link 5

Link ID	SECT-0037S-141.837
Start longitude	-9848097
Start latitude	2942890
Start altitude	0
End longitude	-9848015
End latitude	2942180
End altitude	0
Street name	IH 37
Street flag	0
Link status	1
Link speed	5

Link 6

Link ID	SECT-0037S-142.314
Start longitude	-9847735
Start latitude	2943375
Start altitude	0
End longitude	-9848097
End latitude	2942875
End altitude	0
Street name	IH 37
Street flag	0
Link status	1
Link speed	5

Appendix G – Simulated Link Speed Data on I-10

Appendix G – Simulated Link Speed Data on I-10

Link 1

Link ID	SECT-0010E-572.973
Start longitude	-9851082
Start latitude	2939597
Start altitude	0
End longitude	-9850015
End latitude	2939597
End altitude	0
Street name	IH 10
Street flag	0
Link status	1
Link speed	5

Link 2

Link ID	SECT-0010E-573.654
Start longitude	-9850015
Start latitude	2939597
Start altitude	0
End longitude	-9849347
End latitude	2939597
End altitude	0
Street name	IH 10
Street flag	0
Link status	1
Link speed	5

Link 3

Link ID	SECT-0010E-574.117
Start longitude	-9849347
Start latitude	2939597
Start altitude	0
End longitude	-9848527
End latitude	2939430
End altitude	0
Street name	IH 10
Street flag	0
Link status	1
Link speed	5

Link 4

Link ID	SECT-0010E-574.623
Start longitude	-9848542
Start latitude	2939430
Start altitude	0
End longitude	-9847610
End latitude	2939610
End altitude	0
Street name	IH 10
Street flag	0
Link status	1
Link speed	5