APPENDIX E. EVALUATION OF SENSOR-ROADWAY DYNAMICS TEST PLAN

E.1 OVERVIEW

The tests that will be executed in accordance with this plan are part of a Discretionary Cooperative Agreement with the National Highway Traffic Safety Administration (NHTSA Grant DTNH22-94-Y-17016), "Characterization and Evaluation of a Forward-Looking Automotive Radar Sensor." TRW is providing a prototype forward-looking automotive radar that is intended for Intelligent Cruise Control applications, and is the focus of these tests. TRW is also supporting the test and evaluation efforts. The tests range from very controlled laboratory settings to the evaluation of the FLAR in actual driving situations that can not be controlled in the classical laboratory manner. In the following sections, the tests are defined in terms of the setting, the data that will be collected and the analyses to be performed.

E.1.1 Purpose

This document serves two purposes. First, it presents a plan for testing a TRW prototype Forward-Looking Automotive Radar (FLAR) intended for ICC applications. The tests will be executed at two levels of evaluation: (1) as a radar sensor (i.e., as a remote sensing measurement device that can provide range, range rate and azimuth measurements of objects within the sensor's measurement field of regard); and (2) as an FLAR for ICC. Second, this plan provides the basis for developing detailed test procedures.

E.1.2 Products

Within the restrictions of time, funding and the capabilities of the physical resources, these tests will produce quantitative measures of performance that will characterize the FLAR under a variety of test scenarios, both synthetic and representative of actual driving conditions. The most quantitatively accurate results will be obtained under controlled test conditions, such as those found at test tracks. Test tracks, however, do not fully capture the real-world setting offered by freeways with varying levels of traffic. Within the limits imposed by safety and practicality, the tests conducted under test track conditions will be duplicated on freeways. The freeway tests can not be controlled to produce highly accurate measurements of vehicle positions, orientations and velocities, but these conditions will test the FLAR's ability to accommodate complex background and traffic conditions when functioning as an ICC sensor. Quantitative results will be presented in either tabular or graphical form, whichever is most appropriate. The freeway test results will be more descriptive in nature. For each test there will be a qualitative discussion and interpretation of the results with a concluding statement about the findings.

E.1.3 Limitations

These tests are being conducted with a forward-looking automotive radar (FLAR) that is a prototype-production radar for Intelligent Cruise Control (ICC). As such, it imposes certain limitations on what can be learned from these tests. It is intended as a commercial product, not a scientific instrument. TRW has, however, provided ERIM with access to low-level radar data that can be used to assess the performance of the radar prior to the implementation of the ICC-related functions. With this understanding, useful data and information can be acquired through carefully designed and executed tests.

There is a second limitation that must be addressed. Not all possible combinations of the test parameters will be examined as part of the testing performed under the current Cooperative Agreement. The goal will be to sample a wide range of conditions that will test the FLAR in such a manner that the maximum variation in performance is measured. For example, not all combinations of road type (e.g., straight, curved), surface material (concrete, asphalt) and backgrounds (e.g., bridges, guard rails) need to be explored to determine the range of performance. Many combinations will produce very similar results, or won't be of any interest for the ICC application. To limit the testing to a manageable size, such judgments have been applied in the development of this plan.

E.2 TEST DEFINITIONS

There will be five (5) types of tests that are briefly described below. Each Test Type will generally be composed of several sub-tests. For each test, the plan will define the test's purpose, Setting, Measurements and Data Analysis Products. The Setting will define the test location, all the test elements (e.g., vehicles, background objects) and their initial geometrical arrangement. Measurements will define the data to be collected and vehicle paths when appropriate. Data Analysis Products will define how the data will be reduced and presented.

Static

The Static tests are intended to characterize the FLAR in a stand-alone, non-ICC setting. These tests will verify that the FLAR is basically functioning by measuring key parameters such as radiated power, antenna beam pattern, system timing and outputs (e.g., range, range rate). These tests will also verify that the FLAR is ready for higher-level testing. The test site will be restricted to a controlled, non-roadway setting.

Environment and Materials

The Environment tests will be limited to three conditions: dry, wet (raining) and contamination of the radome. Various levels of rain must be considered. Two parameters associated with precipitation are of interest. First, precipitation density is somewhat proportional to rate of precipitation, which is easier to measure. Any degradation in sensor performance will be directly related to precipitation density. The second parameter is particle (i.e., rain drop) size. As the size of the particle approaches the wavelength of the radiated energy, approximately 3 mm for the FLAR, appreciable reflection can be expected. Dirt, sludge and salt residue will be tested for their effects on sensor performance, particularly as contaminants on the radome. The tests will be conducted in a static, off-roadway setting because the primary affect of the environment is to reduce the quality of the received signal. Typical materials found in a roadway setting will be evaluated in terms of their RF reflection, absorption and transmission.

Background

The Background tests will be conducted on local freeways, but during times without any traffic. The intent is to characterize the non-traffic component in the radar return from typical roadway objects that will appear in any forward-looking radar's field-of-view. Signs, bridges, tunnels, Jersey barriers, guard rails and the like will be included in these tests. Both the unprocessed and processed returns will be captured for the purpose of characterizing the background and false-alarm rates, respectively.

Test Track

As the title implies, this will be the collection of all tests that will be performed in a Test Track setting. Most of the scenarios will be repeated as part of the Freeway Tests, but Test Track tests will be more controlled in terms of vehicle geometries, and thus provide the more quantitative accurate measurements. The road surface materials and background will be varied as appropriate for a specific Test Scenario, but these parameters will not be exhaustively examined. The number of vehicles will also be limited. This removes an element of reality, but again permits more accurate measurements of the FLAR's basic performance.

Freeway

The Freeway tests will fall into two (2) major sub-categories, orchestrated and non-orchestrated. The Orchestrated tests will be performed only when ERIM can significantly control the prevailing traffic (i.e., all other vehicles will be provided by ERIM and they will follow a prescribed scenario). These tests will, for the most part, be a repeat of the Test-Track tests, but with realistic roadway backgrounds. The Non-orchestrated tests will be performed with whatever traffic is available, although ERIM will select the time of day, and thus the prevailing traffic density. The intent is to determine how well the FLAR performs in acquiring the vehicle to be tracked and maintaining track in a varying clutter environment. The host vehicle will be driven on the local freeways in such a manner to test the FLAR's ability to acquire an appropriate secondary vehicle and maintain track for the same scenarios used for the Orchestrated tests.

E.3 STATIC TESTS: RADAR-SENSOR EVALUATION

These tests will be restricted to a single off-roadway setting in which all objects, the FLAR and targets, are stationary. These tests are intended to characterize the FLAR in a stand-alone, non-ICC setting. These tests will verify that the FLAR is basically functioning by measuring key sensor parameters. Baseband, time-domain data (i.e., before any TRW signal processing such as the FFT), will be collected and stored for off-line analysis. Using the sensor calibration data from Task 2, FLAR Sensor Characterization, the raw data will be processed to produce measures of the parameters discussed in the following sections. These results will be compared with the actual values for the parameters, such as range from the FLAR to the corner reflector. The actual values will be obtained by independently measuring the target positions relative to the FLAR. This can be easily accomplished because the entire test setting is static. The comparisons will be presented in either a graphical or tabular form, whichever is most suitable.

E.3.1 Range Accuracy

The FLAR's range accuracy will be determined by placing corner reflectors, with different radar cross-sections (RCS), along the antenna boresight at several ranges between the specified limits of performance. This test will compare the measured ranges with known ranges and obtain the deviations, and also determine the minimum and maximum detectable ranges.

E.3.2 Range Resolution

The FLAR's range resolution will be determined by measuring its ability to resolve two stationary scatterers at different ranges. Two reflectors (corner reflectors, vehicles, and background objects), of approximately equal RCS, will be placed back-to-back along the antenna boresight. We will move one reflector further (closer), in small steps of approximately 0.5 meter until two distinct returns can be observed in the return and perform this measurement at several ranges between the specified limits of performance and in both directions along the antenna boresight.

E.3.3 Field of View

The FLAR's angular extent as a function of range for each of the three beams will be determined by placing a single corner reflector, with an RCS of approximately 10 dBsm, along each beam's boresight and moving the reflector off-boresight in fractional degree increments until the reflector response is negligible. This measurement will be obtained at several ranges between the specified limits of performance

E.3.4 Step Response

The FLAR's new target acquisition time will be determined by unveiling a corner reflector within the FLAR's field-of-view and measuring the time if taken for the target to appear in the output. This measurement requires time synchronization between the input event and the measurement.

E.4 ENVIRONMENT AND MATERIALS TESTS

These tests are essentially a continuation of the Static Tests, in that they will be performed in a controlled, off-roadway setting in which all the test objects are stationary. The intent of these tests is to quantitatively assess the effect of the environment in which the systems will be deployed and of typical materials used in cars and roadway construction on the quality of the received signal. Baseband, time-domain data (i.e., before any TRW signal processing), will be collected and stored for off-line analysis. These tests have been grouped into the following categories: Materials, Target Contamination, and Precipitation.

E.4.1 Materials: Reflection, Absorption and Transmission

The following materials will be evaluated: glass, plastic composite, Plexiglas, cardboard and rubber. The material under test will be placed approximately 3 meters from the FLAR and corner reflector will be placed at approximately 20 meters. The measured values will be compared with handbook values and correlated with the di-electric constant for the material.

E.4.2 Target Contamination

The following contaminants will be evaluated: wet mud, dry dirt, water droplets, snow (on target), ice, and salt residue. A Plexiglas substrate will be used to "hold" the contaminant. The design will take into consideration the fact that reflections can occur whenever a di-electric difference exists between two materials. The tests and data analysis will then the follow the same procedures as described in Section E.4.1.

E.4.3 Precipitation

Varying levels of density, or rate, will be considered for fog, rain, and snow. The two-way attenuation will be determined using a corner reflector placed approximately 20 meters from the FLAR.

E.5 BACKGROUND TESTS

The Background tests will be conducted on local freeways, but during times without any traffic. The intent is to characterize the non-traffic component in the radar return from typical roadway objects that will appear in any forward-looking radar's field-of-view. The tests will be conducted by driving the Testbed Vehicle on freeways in the greater Ann Arbor area on routes selected for their variety of backgrounds. The freeway route between ERIM in Ann Arbor facilities and GM's in Warren provides a side range of backgrounds varying from grassy medians to urban canyons. Baseband, time-domain data (i.e., before any TRW signal processing) and the standard FLAR outputs will be collected and stored for off-line analysis.

The baseband data will be analyzed for characterizing the background returns and diagnosing any false alarms in FLAR outputs. Under these test conditions, the FLAR should not attempt to track any objects in the roadway scene. Any attempt to measure range, or range-rate, will be considered a false alarm. The background returns will be plotted as a function of distance along the freeway. The plots will be annotated with roadway features of interest (e.g., bridge abutment, guard rail).

E.6 TEST-TRACK TESTS

The following series of tests have been designed to evaluate the FLAR's performance in a number of roadway settings that are typical of every day driving. The primary variables are: (1) roadway geometry (straight and curved); (2) background clutter (e.g., stationary vehicles, Jersey barriers); and vehicles on the roadway. An independent measurement technique(s) will be used to determine vehicle positions as a function of time. The measurements based on FLAR data, and tracking data produced by the FLAR will be compared with the independent measurements to provide a measure of the FLAR's performance. Because the Measurements and Data Analysis Products are very common across all the tests, they are described once at the end of this Section.

Throughout the following descriptions, the Primary vehicle is the one equipped with the FLAR and data acquisition electronics. The Secondary vehicle(s) is an unequipped vehicle that is being tracked, or represents vehicle clutter. All Secondary vehicles will all be of a similar type, medium-sized sedans, unless stated otherwise.

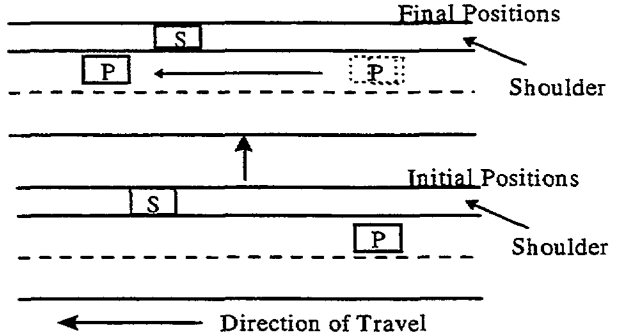
F.6.1 Vehicle Induced False Alarms—Straight Roadway

The purpose of the following two tests is to determine the Primary vehicle's ability to ignore an out-of-lane Secondary vehicle on a straight section of roadway. In one case the vehicle is parked on the roadside shoulder and in the second case it is traveling in an adjacent lane in front of the Primary vehicle. Only the Primary and Secondary vehicles will be present on the roadway.

<u>**Vehicle on Shoulder**</u>

The Secondary vehicle will be parked on the roadside shoulder approximately 1/4 of a mile in front of the Primary vehicle. The Primary vehicle will accelerate to freeway speeds and pass the Secondary vehicle, completing the test.

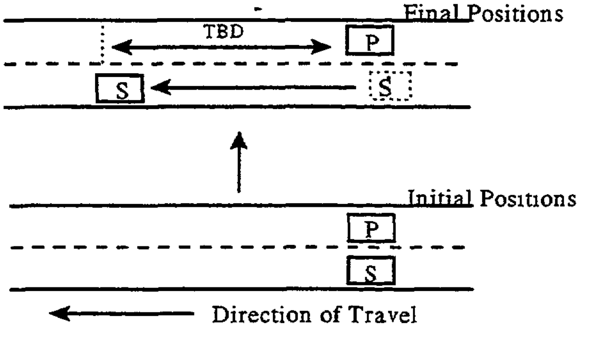
Plan View of Test Setting



Vehicle in Adjacent Lane

The Primary and Secondary vehicles will be traveling at freeway speeds in adjacent lanes and in approximately the same positions at the start of the test. The Primary vehicle will maintain a constant speed and the Secondary vehicle will accelerate for a short period of time until it has reached a specifiedistance in front of the Primary vehicle. At this time, the Secondary vehicle will reduce its speed to that of the Primary vehicle and both vehicles will maintain this headway for a specified time. The test will terminate after the two vehicles have traveled at the constant headway for the required time.

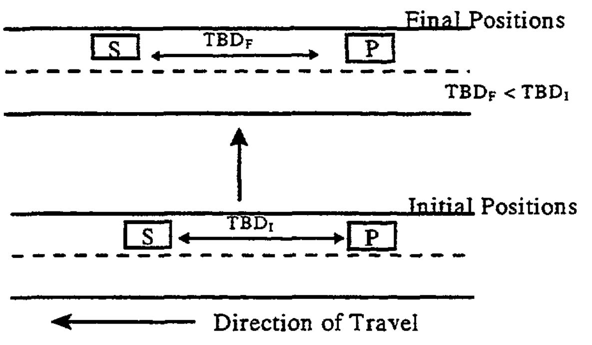
Plan View of Test Setting



E.6.2 Braking Secondary Vehicle—Straight Roadway

The purpose of this test is to determine the Primary vehicle's response to a Secondary vehicle braking after the Primary vehicle had been tracking the Secondary vehicle. The test begins after the Primary and Secondary vehicles are maintaining a constant headway and speed. The Secondary vehicle will then brake moderately. The test will terminate after the Primary vehicle has reduced headway by a predetermined amount.

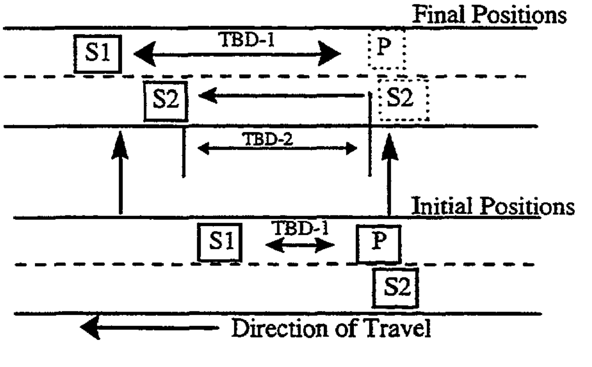
Plan View of Test Setting



E.6.3 Out-of-Lane Vehicle Clutter—Straight Roadway

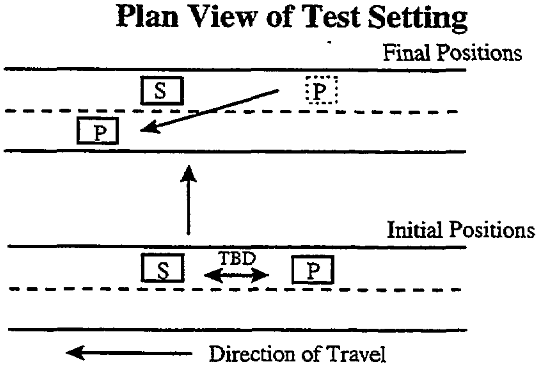
The purpose of this test is to determine the Primary vehicle's ability to track the in-lane Secondary vehicle when there is an out-of-lane Secondary vehicle that should be ignored. The test begins with the Primary vehicle maintaining a constant headway from the in-lane Secondary vehicle, and an out-of-lane Secondary vehicle next to the Primary vehicle. The Primary and Secondary vehicles maintain their lane positions throughout the test. The Primary and in-lane Secondary vehicles maintain their initial headway. The out-of-lane Secondary vehicle then accelerates to a position in front of the Primary vehicle and then maintains this position for the remainder of the test. The test will terminate after the out-of-lane Secondary vehicle has maintained a stable headway.

Plan View of Test Setting



E.6.4 Intentional Lane Changes—Straight Roadway

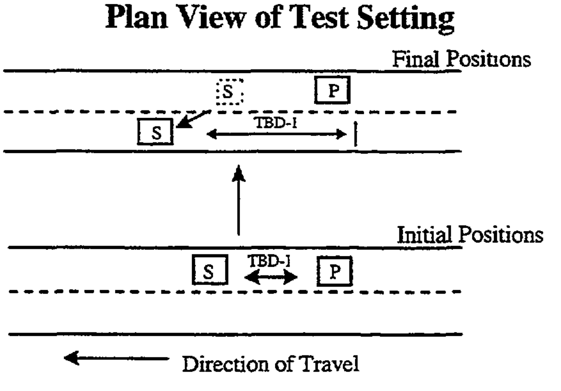
The purpose of this test is to determine the Primary vehicle's ability to detect changes introduced by vehicle lane changes. Response time is also an important performance parameter that will be monitored. Only the Primary and Secondary vehicles will be present on the freeway. In the first test, the Primary vehicle changes its lane to pass the Secondary vehicle. In the second test, the Secondary vehicle moves out of the Primary vehicle's lane.



Primary Passes Secondary

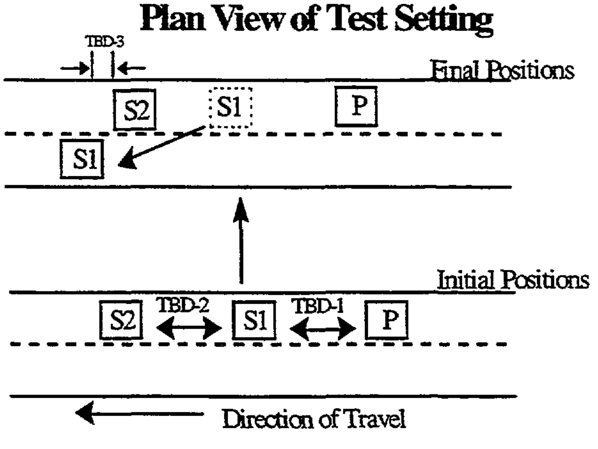
The test begins with the Primary vehicle maintaining a constant headway from the in-lane Secondary vehicle. The Primary vehicle then accelerates moderately and changes its lane to pass the Secondary vehicle. The test will terminate after the Primary vehicle passes the Secondary vehicle.

Secondary Leaves Lane



The test begins with the Primary vehicle maintaining a constant headway from the in-lane Secondary vehicle. The Secondary vehicle accelerates moderately and changes its lane, then decelerates so that its final headway in the adjacent lane is the same as before. The test will terminate after the Secondary vehicle has achieved and maintained the original headway.

E.6.5 Tracking New Secondary—Straight Roadway

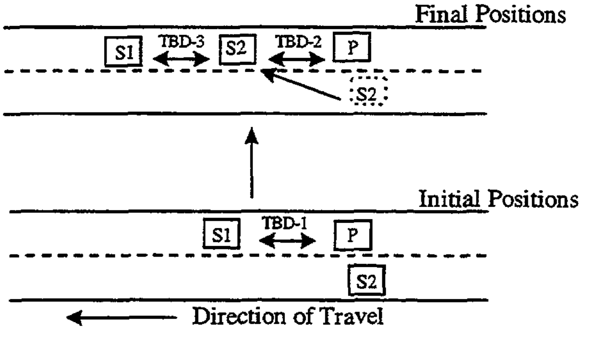


The purpose of this test is to determine the Primary vehicle's ability to detect changes produced by a vehicle leaving its path and exposing a new vehicle in the Primary vehicle's path. The test begins with the Primary vehicle maintaining a constant headway from the first Secondary vehicle, and the first Secondary vehicle maintaining a constant headway from the second Secondary vehicle. The headways will be selected so that their sum is well within the maximum range performance of the FLAR. The Primary and second Secondary vehicles maintain a constant speed throughout the test. The first Secondary then accelerates, changes its lane and assumes its final position in the adjacent lane, in front of the second Secondary vehicle. The test will terminate when the first Secondary vehicle has achieved its final position.

E.6.6 Tracking With a Cut-in-Straight Roadway

The purpose of this test is to determine the Primary vehicle's ability to detect changes produced by a vehicle entering its path. The test begins with the Primary vehicle maintaining a constant headway from the first Secondary vehicle, with the second Secondary vehicle adjacent to the Primary vehicle and traveling at the same speed. The headway will be selected that is within the FLAR's maximum operating range, large enough that a third vehicle can safely enter and operate in it. The Primary and first Secondary vehicles will maintain their relative positions throughout the test. The second Secondary vehicle will accelerate and move into the right-hand lane between the other two vehicles. The final headways will be selected for safe operation within the FLAR's minimum operating range. The test will terminate when the three vehicles have achieved the designated headways.

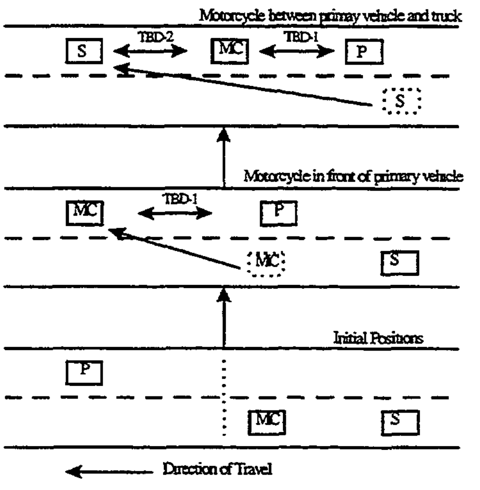
Plan View of Test Setting



E.6.7 Strong Vehicle Clutter in Range—Straight Roadway

The purpose of this test is to determine the Primary vehicle's ability to acquire and maintain track on a fixed Secondary vehicle (i.e., the in-lane vehicle) in the presence of another in-lane Secondary vehicle, but at a greater range. This tests the FLAR's ability to discriminate vehicles in the same lane, but with varying RCS and range. The closer Secondary vehicle will be a motorcycle. The clutter vehicle will have a radar cross-section significantly greater than that of the motorcycle. The FLAR should detect and maintain track on the motorcycle and ignore the presence of the clutter vehicle. The test begins with the motorcycle and clutter Secondary vehicle in the adjacent lane to the Primary, with all the vehicles traveling at the same speed. The motorcycle then accelerates and moves into the Primary vehicle's lane in front of the Primary vehicle. The clutter Secondary vehicle then accelerates, moves into the same lane in front of the motorcycle. The headways will be selected for safe operation the maximum operating range of the FLAR. The test will terminate after the three vehicles have maintained the indicated positions for a specified time.

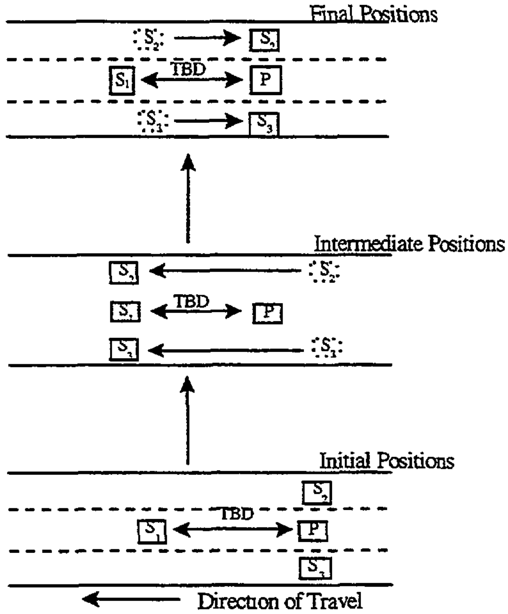
Plan View of Test Setting



E.6.8 Vehicle Clutter in Azimuth—Straight Roadway

The purpose of this test is to determine the Primary vehicle's ability to maintain track on a fixed Secondary vehicle in its lane within a vehicle-cluttered environment (i.e., vehicles in adjacent lanes). This tests the FLAR's ability to discriminate between in-lane and out-of-lane vehicles. The two out-of-lane Secondary vehicles will be selected to have radar cross-sections slightly greater than that of the in-lane Secondary vehicle. The test begins with the Primary vehicle maintaining a constant headway from the in-lane Secondary vehicle, out-of-lane Secondary vehicles adjacent to the Primary vehicle and traveling at the same speed. The out-of-lane Secondary vehicles then accelerate until they are adjacent to the in-lane Secondary vehicle. They maintain this position, and then decelerate until they are again adjacent to the Primary vehicle. The test will terminate when the initial, relative vehicle positions have been achieved.

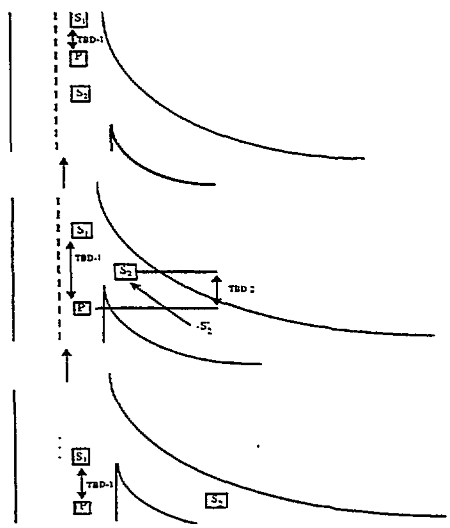
Plan View of Test Setting



E.6.9 Merging Traffic—Straight Roadway

The purpose of this test is to determine the FLAR's response to merging traffic from a freeway entrance lane. The test begins with the Primary vehicle maintaining a constant headway from the in-lane Secondary vehicle, while the merging Secondary vehicle is on the entrance ramp. The merging Secondary vehicle accelerates so that it is between the Primary and Secondary vehicles, but still in the merging lane. The merging Secondary vehicle will stop accelerating when it is in front of the Primary vehicle; the Primary and Secondary vehicles will maintain a constant speed and headway, then the merging Secondary vehicle will decelerate and merge behind the Primary vehicle. At this point the test is complete.

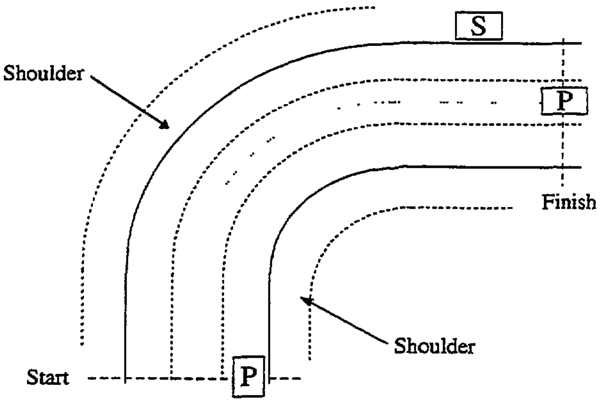
Plan View of Test Setting



E.6.10 Vehicle Induced False Alarms—Curved Roadway

The purpose of the following two tests is to determine the Primary vehicle's ability to ignore an out-of-lane Secondary vehicle on a curved section of roadway. In one case the vehicle is parked on the roadside shoulder and in the second case the Secondary vehicle is traveling in an adjacent lane in front of the Primary vehicle. Only the Primary and Secondary vehicles will be present on the roadway.

Plan View of Test Setting *



* Curve accentuated for illustratrative purposes

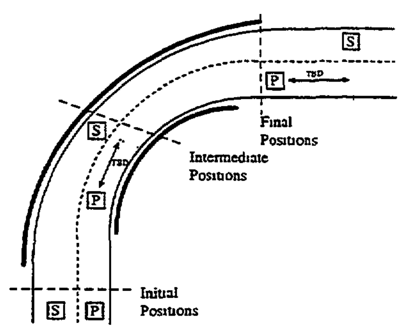
Vehicle on Shoulder

The Secondary vehicle will be parked on the roadside shoulder approximately 1/4 of a mile in front of the Primary vehicle. The Primary vehicle will accelerate to freeway speeds and pass the Secondary vehicle completing the test.

Vehicle in Adjacent Lane

The Primary and Secondary vehicles will be traveling at freeway speeds in adjacent lanes and in approximately the same positions at the start of the test. The Primary vehicle will maintain a constant speed and the Secondary vehicle will accelerate for a short period of time until a predetermined distance ahead of the Primary vehicle. At this time, the Secondary vehicle will reduce its speed to that of the Primary vehicle and both vehicles will maintain this headway. The test will terminate after the two vehicles have traveled at the constant headway for the specified time.

Plan View of Test Setting *



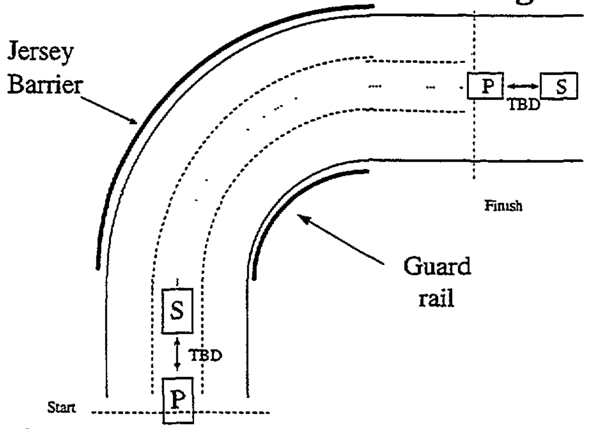
* Curve accentuated for illustratative purposes

E.6.11 Tracking Through a Curve

The purpose of this test is to determine the Primary vehicle's ability to track a Secondary vehicle through a standard freeway curve on a dry, flat section of roadway. The test will be performed under good driving conditions. Roadway will be selected so that guard rails, Jersey Barriers and signs are in the scene, but tested separately.

The test will commence when the Primary is tracking the Secondary vehicle in a straight section of roadway prior to entering a curve. Both vehicles will be traveling at the posted speed limit and attempt to maintain those speeds and the initial separation distance throughout the test maneuver. The test will terminate when both vehicles are again on a straight section of roadway. The test will be performed at several radius of curvatures that are intended to encompass those found in typical freeway settings.

Plan View of Test Setting *

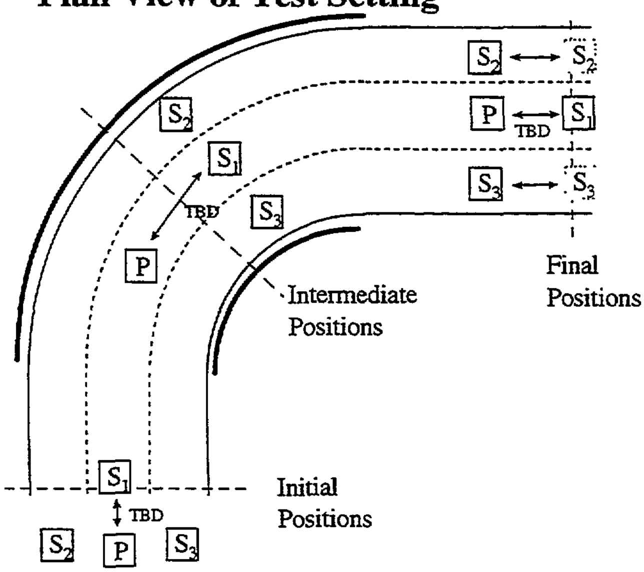


* Curve accentuated for illustratrative purposes

E.6.12 Vehicle Clutter in Azimuth—Curved Roadway

The purpose of this test is to determine the Primary vehicle's ability to track a fixed Secondary vehicle in its lane within a vehicle-cluttered environment (i.e., vehicles in adjacent lanes). This tests the FLAR's ability to discriminate between in-lane and out-of-lane vehicles on a curved section of roadway. The two out-of-lane Secondary vehicles will be selected to have radar cross-sections slightly greater than that of the in-lane Secondary vehicle. The test begins with the Primary vehicle maintaining a constant headway from the in-lane Secondary vehicle, with the out-of-lane Secondary vehicles adjacent to the Primary vehicle and traveling at the same speed. The out-of-lane Secondary vehicles then accelerate until they are adjacent to the in-lane Secondary vehicle. They maintain this position, then decelerate until they are again adjacent to the Primary vehicle. The test will terminate when the initial, relative vehicle positions have been achieved once the vehicles are on a straight section of roadway.

Plan View of Test Setting



* Curve accentuated for illustratrative purposes

E.6.13 Measurements

The same basic set of measurements will be made for all the above tests. The data acquired on the Testbed Vehicle will all be time tagged to support the reduction and analysis of the data. The data to be collected is:

1. Baseband, time-domain data (i.e., before any TRW signal processing such as the FFT);
2. FLAR processed data, range, range rate, and various sensor status information;
3. Video data of the forward scene; and
4. Site survey data of all marker locations used to define maneuver positions.

E.6.14 Data Analysis Products

The analyzed results from each test will be compared with the independent measurements for assessing the FLAR's performance. There are two basic types of tests: detections and (position, relative velocity) measurements. The detection tests will examine two cases: false positives (declaring that a vehicle is in-lane when it is not); and misses (not detecting a vehicle when it is in-lane). These tests will be repeated a number of times to provide some statistical data. The majority of the tests involve the evaluation of the FLAR as a measurement device to support ICC applications. For these tests, plots and tabularized data will be presented to compare actual measurements against the true values obtained through independent measurements.

E.7 FREEWAY TESTS

The Freeway tests will fall into two (2) major sub-categories, orchestrated and non-orchestrated. The Orchestrated tests will be performed only when ERIM can significantly control the prevailing traffic (i.e., all other vehicles will be provided by ERIM and they will follow a prescribed scenario). These tests will, for the most part, be a repeat of the Test-Track tests, but with realistic roadway backgrounds. The Non-orchestrated tests will be performed with whatever traffic is available, although ERIM will select the time of day, and thus the prevailing traffic density. The intent is to determine how well the FLAR performs in acquiring the vehicle to be tracked and maintaining track in a varying clutter environment. The Primary vehicle will be driven on the local Freeways in such a manner to test the FLAR's ability to acquire an appropriate Secondary vehicle and maintain track for the same scenarios used in the Orchestrated tests.

E.7.1 Orchestrated Tests

The following Test Track Tests should be repeated, but with the indicated modifications. Every reasonable attempt should be made to perform these tests at times when non-ERIM vehicles are not likely to be on the road. The primary intent is to determine the impact of actual freeway backgrounds on the FLAR's performance. Tests involving vehicle maneuvers will be avoided.

Vehicle Induced False Alarms—Straight Roadway

Background should include guard rails.

Out-of-Lane Vehicle Clutter—Straight Roadway

Down-range background should contain bridge abutments.

Intentional Lane Changes—Straight Roadway

Down-range background should contain bridge abutments.

Tracking New Secondary—Straight Roadway

Down-range background should contain bridge abutments.

Strong Vehicle Clutter in Range—Straight Roadway

Down-range background should contain bridge abutments.

Merging Traffic—Straight Roadway

Background should include guard rails, signs and any other typical roadway clutter.

Tracking Through a Curve

Background should contain a Jersey barrier, or other strong radar reflective objects.

E.7.2 Non-Orchestrated Tests

The above tests should be repeated, but conducted under three traffic conditions: (1) light—where there is an occasional non-ERIM vehicle in the adjacent lane; (2) medium—where there is always one adjacent lane occupied by a non-ERIM vehicle and an occasional passing vehicle; and (3) heavy—typical rush-hour traffic.