U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY
ADMINISTRATION

PROCEDURES FOR TIRE TRACTION TESTING

CONSUMER INFORMATION REGULATIONS
PART 575.104

UNIFORM TIRE QUALITY GRADING

ENFORCEMENT

OFFICE OF VEHICLE SAFETY COMPLIANCE
WASHINGTON, D.C.

TP-UTQG-T-01 Issued October 28, 1979

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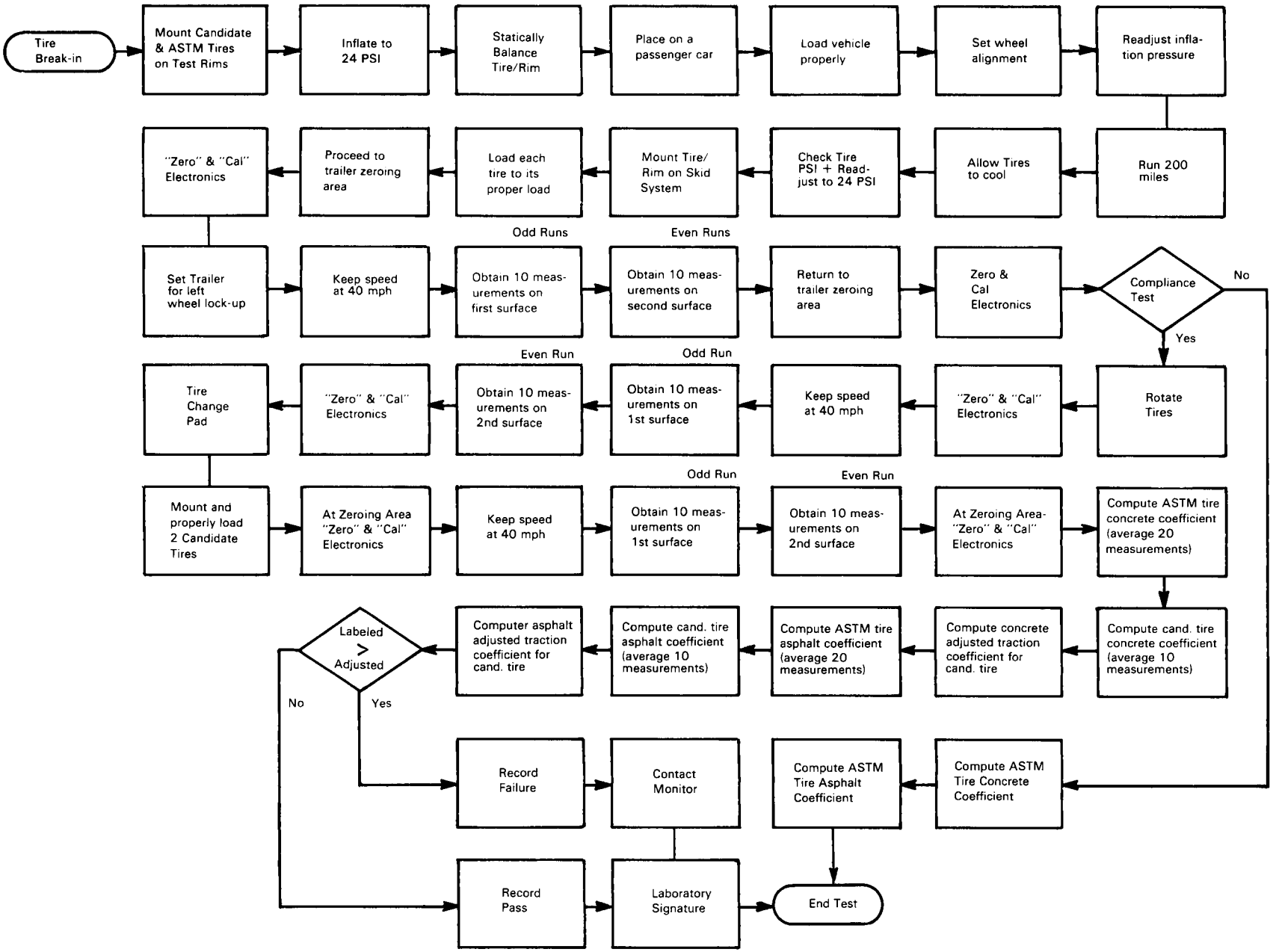


Figure 1. Traction Test Procedure Flow

SECTION I. INTRODUCTION

1-1. RESPONSIBILITIES FOR PROGRAM ADMINISTRATION AND PROCUREMENT

1-2. The Department of Transportation (DOT) National Highway Traffic Safety Administration (NHTSA), Enforcement, Office of Vehicle Safety Compliance (OVSC) is responsible for administering the tire testing program. The procurement of test items is a NHTSA Office of Contracts and Procurement responsibility. No information concerning the standards enforcement testing program, will be transmitted to anyone except the NHTSA Contract Technical Manager (CTM) unless specifically authorized by the NHTSA CTM or his superiors. No individuals, other than contractor personnel directly involved in the test program, shall be allowed to have access to test results unless specifically authorized by the NHTSA CTM or his superiors.

1-3. PURPOSE AND SCOPE

1-4. This manual describes the standardized tire test and reporting procedure for independent testing organizations in conformance with Part 575.104 Consumer Information Regulations-Uniform Tire Quality Grading-Traction Testing effective April 1, 1979 for Bias Ply tires, October 1, 1979 for Bias Belted tires and April 1, 1980 for Radial tires. As amendments become effective, this procedure will be modified accordingly. Instructions for test preparation, test performance, recording tire data, and reporting test results are presented in detail, in this manual. It should be noted that these procedures are specifically designed to maintain flexibility with respect to which organization will conduct the tests. The procedures presented in Sections I through VI are general in nature while the detailed calibration and test procedures presently being used by NHTSA personnel at San Angelo, Texas are included as Appendices B, C and D. This is to provide an example of procedures utilized on one particular type of skid system and what type of precision is expected by OVSC. Contractors utilizing different types of skid systems are expected to develop calibration/operational procedures for their system equivalent to those found in Appendices B, C and D for the NHTSA system utilized at San Angelo.

1-5. The procedure is not intended to conflict with the requirements set forth in the Uniform Tire Quality Grading Requlation (UTQG) or any amendments thereto. Any contractor interpreting any part of this procedure to be in conflict with UTQG or noting any deficiency in it is required to advise the NHTSA CTM for a resolution of the discrepancy prior to testing.

NOTE

The testing organization is responsible for testing tires to all applicable requirements of this regulation and procedure. The testing organization is responsible for the correctness of all data sheets.

1-6. The UTQG Test Facility in San Angelo, Texas has been established by the DOT, NHTSA as the test facility for UTQG compliance testing. The test facility is centered at the Goodfellow Air Force Base and utilizes the public roadways in the vicinity of San Angelo, Texas for the 200 mile tire break in procedure. The UTQG Test Facility is operated by the Vehicle Research and Test Center (VRTC) of Research and Development (R&D), NHSTA. The UTQG Test Facility Chief has overall responsibility for all operations of the Test Facility.

1-7. DEFINITIONS OF TERMS

1-8. Definitions for all specific technical words and phrases will be found in the Glossary of Terms at the end of this manual. Should any questions arise as to the interpretation of these definitions, contact the CTM.

1-9. TIRE TEST PROGRAM AUTOMATIC DATA PROCESSING SYSTEM

1-10. The tire compliance test program will use automated data processing techniques. The system is designed to more accurately qualify test results in conformance with UTQG, establish a common language for all program participants, minimize invalid tests, eliminate redundance of effort, and provide the NHTSA Office of Vehicle Safety Compliance (OVSC) with timely test results and laboratory status information.

SECTION II. GENERAL PROCEDURES

2-1. GENERAL

2-2. This section presents general procedures that are either contractually required prior to commencement of testing, or general procedures to be followed in addition to specific test procedures.

2-3. CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

2-4. Before starting the test program the contractor shall implement and maintain a measurement and test equipment calibration system in accordance with established calibration practices. Guidelines for setting up and maintaining such systems are described in MIL-C-45662A, "Calibration System Requirements."

NOTE

In the event of an indicated failure to the performance requirements of the standard being tested, a post-test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration will be at the CTM's discretion and will be performed without additional costs.

The calibration system shall be set up and maintained as follows:

1. Standards for calibrating the measuring and test equipment shall be stored and used under appropriate environmental conditions to assure their accuracy and stability.

2. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding 6 months. Records, showing the calibration traceability to the National Bureau of Standards, shall be maintained for all measuring and test equipment.

3. All measuring equipment, test equipment and measuring standards shall be labeled with the following information:

   a. Date of calibration.

   b. Date of next scheduled calibration.

   c. Name of person and organization who calibrated the equipment.

4. A written calibration procedure shall be provided by the contractor which includes, as a minimum, the following information for all measuring and test equipment:

   a. Type of equipment, manufacturer, model number, etc.

   b. Measurement range.

   c. Accuracy.

   d. Calibration interval.

   e. Type of standard used to calibrate the equipment. (Calibration traceability of the standard must be evident.)

5. Records of calibrations for all measuring and test equipment shall be kept by the contractor in a manner which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when authorized by the NHTSA CTM. The calibration system will need the acceptance of the NHTSA CTM before testing commences.

6. As a minimum, the measurement and test equipment calibration system will encompass:

   a. Vehicle speed measuring device.

   b. Vehicle distance measuring device (fifth wheel calibration).

   c. Traction trailer calibration equipment.

   d. Vehicle front end alignment equipment (break-in vehicles only).

   e. Tire pressure gage.

   f. Clinometer.

   g. Ambient temperature gage.

   h. Pavement surface thermometer (at the CTM's discretion).

   i. Scales for trailer wheel loading.

   j. Humidity gage.

   k. Anemometer.

2-5. OPERATING TEST PROCEDURE

2-6. Before starting the test program, the contractor shall provide a written operating test procedure which includes a step-by-step description of the test methodology used in the program. Where appropriate, the test procedure will include such items as check-off lists and individual worksheets for each testing phase. The operating test procedure must be approved by the NHTSA CTM before testing commences. The contractor will be responsible for keeping data on atmospheric conditions during testing.

2-7. GOOD HOUSEKEEPING

2-8. NHTSA contractors will maintain the test vehicles, test fixtures, and instrumentation in a neat and clean condition with test instruments set up in an orderly manner consistent with good test laboratory housekeeping practices.

2-9. TEST SECURITY

2-10. All test specimens shall be protected from grease, oil, solvents, and any other substance that would contaminate the tire and thus adversely influence the results of the test program. The NHTSA contractor shall provide appropriate security measures to protect the NHTSA test tires from contact with unauthorized personnel during the entire test program, as well as to protect and segregate the data that evolves from testing each tire. The test security plan will be coordinated between the NHTSA contractor and San Angelo Facility personnel and must be approved by the CTM.

2-11. TEST FORMS

2-12. All report items and test results shall be entered in black ink, or indelible pen on the forms by the testing organization. A sample set of UTQG Traction Test forms appear in Figures 4, 5 and 6.

2-13. TEST PROGRAM OVERVIEW

2-14. The NHTSA contractor will receive standard tires (ASTM tires) and candidate tires (test tires) from the UTQG test facility in San Angelo, Texas. The tires will then be labeled, mounted onto rims, balanced and placed onto a passenger vehicle. The tires will be driven over the southern circuit of the treadwear course for a 200 mile break-in.

Upon completion of the tire break-in, the standard tires will be placed onto the skid trailer and each tested on both the asphalt and concrete skid pads. At the completion of the standard tire tests their traction coefficient will be calculated.

The two candidate tires will then be placed onto the skid trailer and one tire will be tested on both the asphalt and concrete skid pads. The candidate tire's traction coefficient will be calculated, and adjusted utilizing the standard tire's traction coefficient to compensate for changes in the skid pads. The candidate tire will then be graded, and the resultant grade will be compared with the published grade of the tire manufacturer to determine the accuracy of the UTQG traction grade.

SECTION III. TIRE PREPARATION

3-1. GENERAL

3-2. In addition to the candidate tires, standard (ASTM) tires will be received.

3-3. TIRE RECEIPT AND HANDLING

3-4. Inventory and log-in procedures as detailed in the UTQG Data Management System will be accomplished by the facility personnel prior to release of the tires to the test contractor.

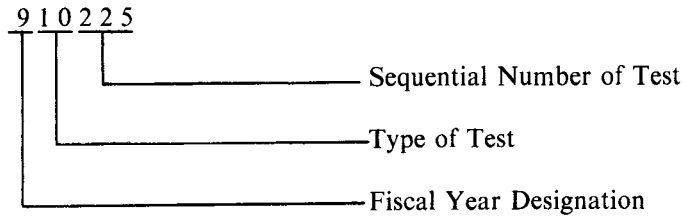
3-5. The candidate tires and the standard tires will be transferred from NHTSA to the contracted testing organization by the Traction Manager (TRM). The TRM will inspect the tires to ascertain that they are acceptable for use when received. The testing organizations will insure that the tires will be handled with care to avoid cuts, tears, or any condition that may adversely affect test validity.

3-6. TIRE IDENTIFICATION AND MARKING

3-7. The tires will have been marked with the fiscal year and an inventory number when they arrive from NHTSA storage.

3-8. A test number will be written onto the outboard sidewall of the candidate tires utilizing tire paint or tire paint stick and kept legible at all times.

3-9. The test number consists of six digits. The first is the last number of the fiscal year (9=1979). The second and third digits are numbers identifying the type of test. The next three digits are assigned sequentially from a block of numbers provided each contractor by the NHTSA, OVSC. These numbers account, by individual tire, for all tires received by the contractor, and further identify the contractor by a different number series assigned to each contractor. If two different candidate tires are rated by the same two ASTM tires, then the ASTM tires will have two test numbers. See Figure 2 for the tire marking requirements.



Test Type Codes

10 = Monitoring Test
20 = Compliance Test, Standard Matrix
24 = Compliance Test, Retest
25 = Compliance Test, Responsive
30 = Special Test
90 = Break-in

NOTE

Each group of three (two standard and one candidate) tires will carry the same test number.

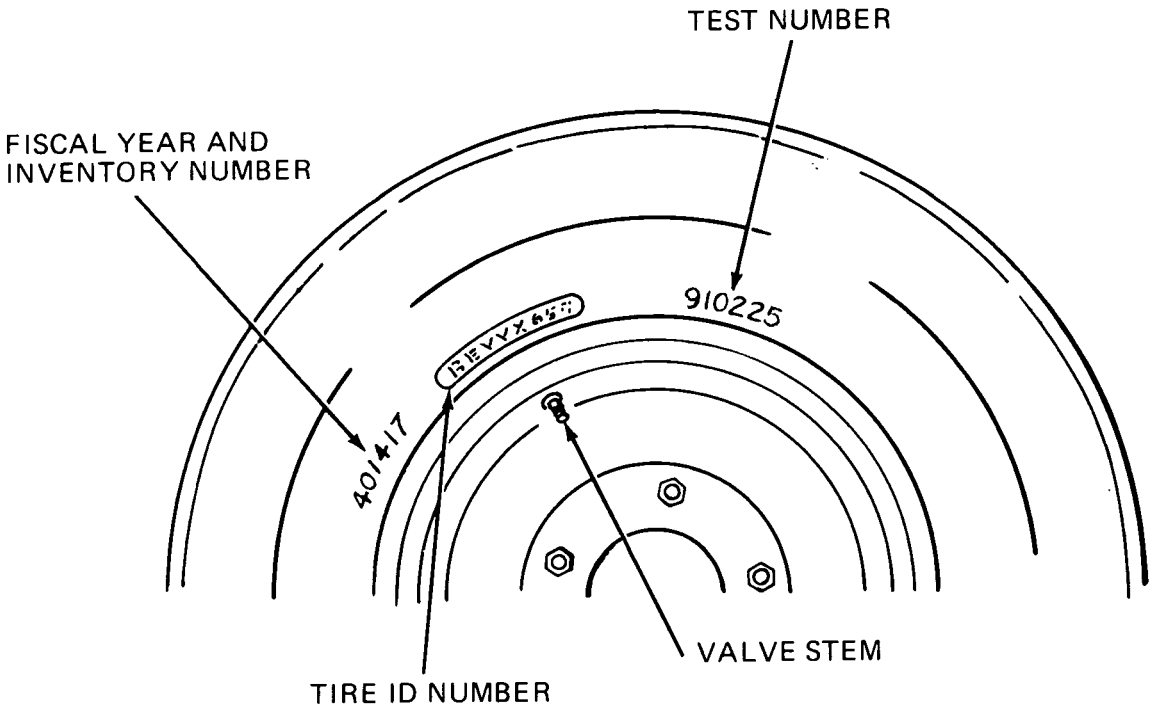


Figure 2. Tire Marking.

3-10. TIRE PRE-TEST INSPECTION

3-11. Prior to mounting the tires, the contractor shall conduct a detailed pre-test inspection. Special attention is required in looking for bead scuffs, radial or lateral mold flow cracks, splice breaks, wire breaks, cavities in bead covering, over-flow of rubber into mold vents which could prevent proper tire seating on the test rim. A visual inspection should also be made of the tire's sidewalls, treads, and innerliner for repair work or any abnormalities. All tire defects noted shall be brought to the attention of the CTM and recorded in the remarks section of the test report form. Tires with defects can only be tested with the approval of the CTM.

3-12. TEST RIMS

3-13. All physical dimensions of the test rim shall conform with published dimensions of a standard production rim commercially available. Tires tested in accordance with UTQG must be mounted on a rim with any configuration as shown appropriate for that tire size and designation in an associative table found in publications referenced in the standard, or alternatively in a publication issued by the tire manufacturer and distributed to dealers and to the public on request. In case of conflict, the latter type of publication would prevail over an associative table. Applicable publications are: The Tire and Rim Association, The European Tyre and Rim Technical Organization, Japanese Industrial Standards, Deutsche Industrie Norm, The Society of Motor Manufacturers and Traders, Ltd., British Standards Institution, and Scandinavian Tire and Rim Organization. Test conformance of each test rim will be verified by physical measurement and visual inspection. The physical measurements taken shall include diameter and width.

3-14. Diameter and width measurements shall be made in accordance with procedures defined in the current TRA Year Book. The diameter will be verified using a mandrel calibrated disk tape or equivalent. The width shall be verified using a TRA Sliding Gage or equivalent. Tolerances as to diameter or width are as published in the current TRA Year Book for the particular rim involved. The test rim should have a width within +0.50, -0 inches of the

width listed. Prior to making measurements, the wheel shall be visually examined for paint runs or any other abnormalities that would cause errors in any reading. All abnormalities shall be removed by light filing, sanding, or by the use of steel wool.

3-15. The measurements shall be recorded and perpetual records shall be kept and made available to the CTM. The frequency of wheel measurements shall be initial measurement, measurement immediately following tire failure on that rim, and measurement at least every 25th mounting, or when deemed necessary by the CTM.

3-16. The test rims furnished by the contractor are to be identified by a contractor assigned serial number which is compatible to the recording requirements as established by these procedures. The serially numbered rims are to be assigned specifically to each tire so that it can be documented that a tire was tested on a specific rim. Prior to mounting of the test tire on the test rim the wheel shall be visually checked for obvious deformation of the pilot hole, bolt holes, contours, safety locks, cracks, etc. The rim markings may be stamped, spray painted, stick painted, stenciled or any other method which is permanent.

3-17. TIRE MOUNTING

3-18. The test tire shall be mounted on a serially numbered test rim. The rim shall be visually inspected for any apparent characteristics which may effect the test validity. This includes cracks or deformations of the bolt hole, hub, and flange. Those rims which may be in question are not to be saved for UTQG testing. The wheel must be free from any foreign substance, rust, oxidized rubber, or adhesives.

3-19. The tire shall be mounted so that all tire markings are to the outside of the rim and so that the tire identification number is located above the valve stem as shown in Figure 2. Mount the tire in such a manner that the beads do not bind against the rim ledge and bend improperly on the rim flange. Do not allow the air pressure to exceed the manufacturer's prescribed maximum inflation pressure. A thin solution of Bead Lubricant shall be applied to each bead to aid in the proper positioning and seating of the beads. If the beads have not seated by the time the pressure has reached maximum inflation, deflate the assembly, reposition the tire and reinflate.

The pressure gauges shall be accurate within ±1 PSI at the prescribed inflation pressure.

3-20. The tires shall be inflated to 24 PSI. The tire/wheel assemblies shall then be dynamically balanced. A record of weights used and their location on each test tire shall be kept.

NOTE

Inflation Pressure Tolerance for Candidate Tires: +0, -2 PSI.

Inflation Pressure Tolerance for ASTM Tires: +2, -0 PSI.

3-21. The tires will be mounted onto the break-in vehicle for the 200 mile break-in run. The break-in vehicle shall be a rear wheel drive passenger vehicle which will not subject the tires to a load greater than their maximum load rating.

3-22. At the completion of the tire break-in, the traction test will be conducted.

SECTION IV. VEHICLE PREPARATION

4-1. GENERAL

4-2. The vehicles for traction testing will be of two types. One being the vehicle utilized for the 200 mile break-in, and the other being the skid trailer/tow vehicle combination.

4-3. BREAK-IN VEHICLE IDENTIFICATION

4-4. All break-in vehicles shall be marked (at least 3" high) "TEST VEHICLE" on both doors along with the name of the testing organization.

4-5. BREAK-IN AND VEHICLE PREVENTIVE MAINTENANCE SCHEDULE

4-6. The testing organization shall establish a preventive maintenance schedule to maximize vehicle reliability. The contractor shall present his maintenance schedule to the TRM before the start of each test. This schedule must ensure that the skid system (tow vehicle and trailer) will be properly maintained and clean with no fluid and/or oil leaks. Leaks of this type will damage the skid surfaces and change the traction levels.

4-7. SAFETY EQUIPMENT

4-8. Each test vehicle shall comply with all applicable Federal Motor Vehicle Safety Standards. Standard safety equipment shall be kept operational at all times. Additional safety equipment shall include flares, fire extinguishers and first aid kits.

4-9. TIRE BREAK-IN VEHICLE REQUIREMENTS

4-10. The vehicle utilized to conduct the 200 mile break-in procedure shall be a standard, rear wheel drive passenger vehicle. The selection of this vehicle shall be such that the tires will not be loaded in excess of their maximum load rating. The size of tires to be tested must be standard equipment or approved alternate as specified by that vehicle's manufacturer.

4-11. SKID TRAILER

4-12. The skid trailer shall be built in conformity with ASTM Method E274-70 paragraph 3. The instrumentation utilized in conjunction with the skid trailer shall be as stipulated in paragraph 3.3.2 of ASTM Method E274-70.

4-13. SKID TRAILER CALIBRATION

4-14. The skid trailer shall be calibrated to verify the accuracy of all its measurement parameters at least every 6 months. Due to the nature of the operation, it may be necessary to spot check, or recalibrate the trailer at greater frequency to assure the accuracy of its operation through the test program.

4-15. The skid trailer calibration will be conducted in accordance with ASTM F377-74 (Calibration of Braking Force for Testing of Pneumatic Tires). Each contractor shall establish detailed procedures for his particular type of equipment. Appendix B contains an example of Skid Trailer Calibration details presently in use at the San Angelo test facility.

SECTION V. TEST PROCEDURES

5-1. GENERAL

5-2. This section describes the test course, driving procedures and all other procedures which are required for the successful completion of a UTQG traction test, regardless of the type of skid system employed.

5-3. It should be noted that these procedures are specifically designed to maintain flexibility with respect to which organization will conduct the tests. The procedures presented in this section are general in nature while the detailed calibration and test procedures presently being used by NHTSA personnel at San Angelo are included in Appendices B and C. This is to provide an example of procedures utilized on one particular type of skid system and what type of precision is expected by OVSC. Contractors utilizing different types of skid systems are expected to develop equivalent calibration/operational procedures for their system as found in Appendices B, C and D for the NHTSA system utilized at San Angelo. Appendix A contains all applicable codes for the Test program. Cross references are provided from the general to the specific procedures.

5-4. VEHICLE STORAGE

5-5. During any non-working hours for any test the tires and vehicle shall be stored within the area supplied each test organization at the Goodfellow Air Force Base.

5-6. TIRE BREAK-IN PROCEDURES

5-7. The 200 mile break-in procedure will be conducted with the two candidate tires and the two standard tires mounted on standard rear wheel drive vehicles. For this procedure the first 50 miles of the southern loop of the UTQG treadwear course will be utilized for two round trips.

5-8. DRIVING INSTRUCTIONS FOR TIRE BREAK-IN

The drivers shall strictly adhere to the following procedures:

1. **Vehicle Speed**

   The speed to be maintained throughout the course shall be the posted speed limit unless unsafe conditions arise. Under such circumstances, the speed should be reduced to a maximum safe operating speed.

5-9. At the completion of the tire break-in, the tire and rim assemblies will be removed from the vehicle and prepared for the traction test.

5-10. BREAK-IN TEST DATA

5-11. The tire mounting and break-in data will be recorded on the tire break-in form Figure 5.

5-12. TRACTION TEST PROCEDURE - GENERAL

5-13. The traction test is divided into two segments. One segment consists of testing both of the standard tires. The other segment consists of testing one of the candidate tires.

NOTE

Pavement surface temperatures will be taken at the discretion of the CTM in accordance with Appendix D, page D-7 or an equivalent procedure.

5-14. TRACTION SKID PADS

5-15. Two skid pads have been laid on an unused runway and taxi strip of Goodfellow AFB. Their location is shown in Figure 3.

The asphalt skid pad is 600 ft. x 60 ft. and is shown in black on the runway in Figure 3. The pad is approached from either end by a 75 ft. ramp followed by 100 ft. of level pavement. This arrangement permits the skid trailers to stabilize before reaching the test area. The approaches are shown on the figure by the hash-marked area.

The concrete pad is 600 ft. x 48 ft. and is on the taxi strip. The approaches to the concrete pad are of the same design as those for the asphalt pads.

A two lane asphalt road has been built to connect the runway and taxi strip. The road is parallel to the northeast-southwest runway at a distance of 100 ft. The curves have super-elevation to permit safe exit from the runway at operating speeds.

5-16. BEGINNING OF TEST PROCEDURE

5-17. All data collection equipment shall be activated and final checks made prior to entering the assigned test area as specified in Appendix C, page C-1 to C-4 or an equivalent procedure.

5-18. WARM-UP PROCEDURE

5-19. Prior to warm-up at least one test with water only (no lock-up) and then one test with water and lock-up shall be run to ensure proper system operation.

5-20. The skid system shall be warmed up by running for 5 miles at 40 mph prior to any skid testing.

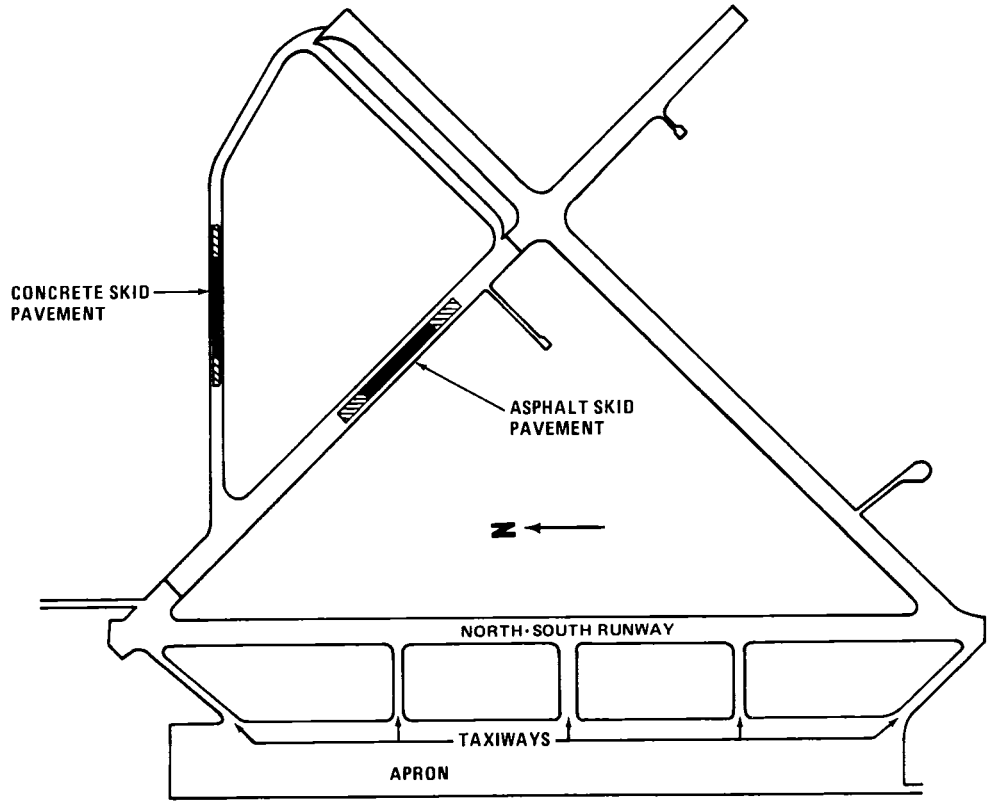


Figure 3. Traction Test Course.

5-21. Pre-wet the assigned pad on the last warm-up lap.

5-22. Drive to Zero Pad located near the ready line, park vehicle with engine running, open vehicle hood and initiate Zero Pad procedures.

5-23. ZERO PAD PROCEDURE

5-24. Prior to starting test, the instrumentation shall be checked on the Zero Pad as specified in Appendix C, pages C-4 to C-5 or an equivalent procedure.

5-25. TRACTION TEST - STANDARD TIRES

1. Allow the tires to cool and adjust the pressure to 24 +2, -0 psi. Mount the tires onto the skid trailer and adjust the tire load to 1085 pounds, +40, -0 pounds.

2. Stop at assigned area on ready line before entering test area.

3. Circle traction course in the specified direction maintaining a speed of 40 mph where safe.

4. Tow the traction trailer onto the asphalt test surface at a speed of 40 +1, -0 mph. Lock one wheel and record the locked wheel traction coefficient between 0.5 and 1.5 seconds after lockup. Enter SN on Flight Plan and Data Sheet after each skid.

5. Within 2 minutes, utilizing the same procedure, the same tire will be skidded on the concrete test surface.

NOTE

The skidding sequence may be reversed at the discretion of the TRM.

6. The above testing will be repeated for a total of 10 measurements on each skid surface.

7. Remove the unskidded tire and wheel assembly from the non-test side and install it on the test side.

8. The above procedure will be repeated on the second ASTM tire for a total of 10 measurements on each test surface.

9. The twenty measurements from each skid surface will be averaged to find the standard tire traction coefficient for each surface.

5-26. In the event of an aborted run enter into the data recording instrumentation the conditions as given in the Codes List. The abort procedure (Abort Rerun Profile), also shown in the Codes List, is pre-determined and is given on the Schedule Sheet and Test Matrix Sheet. The Abort Codes specified in Appendix A, page A-5 or an equivalent system shall be used.

5-27. In the event of test malfunctions, i.e., dry skid, power failure, etc., immediately stop all test functions. The skid system utilized must have provision for instantaneous response in this areas as specified in Appendix C, page C-6 or an equivalent procedure.

5-28. TRACTION TEST - CANDIDATE TIRES

1. Allow the tires to cool and adjust the pressure to 24 +0, -2 psi. Mount the tires onto the skid trailer and adjust the tire load to 85 percent +0, -4% of the load specified at 24 psi for the tires size designation in Appendix A of FMVSS 109.

2. Only one of the two candidate tires will be tested.

3. Stop at assigned area on ready line before entering test area.

4. Circle traction course in the specified direction maintaining a speed of 40 mph where safe.

5. Tow the traction trailer onto the asphalt test surface at a speed of 40 +0, -1 mph. Lock the wheel and record the locked wheel traction coefficient between 0.5 and 1.5 seconds after lockup. Enter SN on Flight Plan and Data Sheet after each skid.

6. Within 2 minutes, utilizing the same procedure, the same tire will be skidded on the concrete test surface.

NOTE

The skidding sequence may be reversed at the discretion of the TRM.

7. The above testing will be repeated for a total of 10 measurements on each skid surface.

8. Average the 10 measurements taken on the asphalt surface to find the candidate tire traction coefficient for that surface.

9. Average the 10 measurements taken on the concrete surface to find the candidate tire traction coefficient for that surface.

10. Compute the candidate tires adjusted traction coefficient for both the asphalt and concrete test surfaces utilizing the standard tire data for adjustment to compensate for changes of the skid surfaces.

5-29. In the event of an aborted run, enter into the recording instrumentation the conditions as given in the Codes List. The abort procedure (Abort Rerun Profile), also shown in the Codes List, is pre-determined and is given on the Schedule Sheet and Test Matrix Sheet. The Abort Codes specified in Appendix A, page A-5 or an equivalent system shall be used.

5-30. In the event of test malfunctions, i.e., dry skid, power failure, etc., immediately stop all test functions. The skid system utilized must have provision for instantaneous response in this areas as specified in Appendix C, page C-6 or an equivalent procedure.

5-31. END OF TEST PROCEDURE

1. Upon completion of designated number of skids, obtain ambient temperature and test surface temperatures (if required), also air pressure in trailer skids. Enter on Flight Plan and Data Sheet.

2. Return to Zero Pad, recheck calibration and record all final test data as specified in Appendix C, page C-6 or an equivalent procedure.

5-32. DATA RECORDING

1. Record data on UTQG Flight Plan and Data Sheet.

2. Collect data in accordance with Appendix C, page C-6 or an equivalent procedure.

3. The data will be analyzed by the TRM and entered into the Data Management System.

5-33. TEST DATA

5-34. In addition to the UTQG test forms the test contractor is responsible for maintaining additional logs and data sheets which will be required to support the test data. As a minimum these will include Vehicle Maintenance Records; Raw Data Sheets to support Calibration Test Records; Schedule and Test Matrix Sheets; recorded instrumentation data such as strip charts or printed tapes; reports relating to mechanical malfunctions; accidents, tire damage and replacement, etc.; receipts for test tires and/or GFE; and any raw data or calculations relevant to the test program.

5-35. ABNORMAL CONDITIONS

5-36. Abnormal conditions encountered while driving the test course such as tire replacement, mechanical malfunctions and accidents shall be reported on a case-by-case basis to the TRM.

5-37. TIRE DISMOUNTING

5-38. The contractor must exercise care by using proper equipment and procedures during dismounting to avoid damage to the test tires.

5-39. TIRE DISPOSITION

5-40. Upon completion of each test, the contractor representative will return the tested tires to the TRM.

SECTION VI. REPORT PROCEDURES

6-1. GENERAL

6-2. This section relates to the Traction Test Forms, function of the forms and the supportive data required to be submitted by the contractor to corroborate entries on the test forms.

6-3. RECEIPT OF FORMS

6-4. Upon receipt of each tire set (2 standard and 2 candidate tires) from the UTQG test facility, the testing organization will receive a 7 page traction test package. This package is received with portions of the information completed. It is the test contractor's responsibility to complete the remaining portions of the forms neatly and accurately.

6-5. The traction data package will consist of three traction break-in summary sheets (2 ASTM, 1 candidate) (form UT041), three traction break-in daily run sheet forms (UT042) (2 ASTM, 1 candidate) and one compliance test pre-test sheet (form SC-2). See Figures 4, 5 and 6.

6-6. DISPOSITION OF FORMS

6-7. Upon completion of all forms for a test they will be returned to the TRM.

6-8. ADDITIONAL DATA AND FORMS

6-9. It is the test organization's responsibility to supply as much additional data and information as required to back up and substantiate the test data for the traction test package sheets. Refer to paragraph 5-32.

6-10. TRACTION TEST PACKAGE PROCEDURES

6-11. Completing the UTQG Traction Break-in Summary Sheet (Figure 4).

6-12. The summary sheet will be received with most of the information completed. Prior to mounting the test tire onto the rim the test organization technician shall compare the information on the summary sheet with the information actually on the tire. If the information agrees, the technician will then sign the sheet, enter the Julian date and his identification code.

6-13. If a discrepancy of information is noted, the TRM shall resolve the problem.

6-14. Upon completion of the tire inspection, the traction summary sheet will be returned to the TRM.

6-15. Completing the UTQG Traction Break-in Daily Run Sheet (Figure 5).

6-16. Break-in daily run sheet information.

1. **Test Number:** Enter the assigned tire test number.
2. **Test Vehicle I.D.:** As assigned by the UTQG test facility.
3. **Break-in Date:** Julian date of test.
4. **Test Load:** Enter the tire maximum load rating.
5. **Test PSI:** Enter the required test pressure.

6. **Position in Convoy:** Not applicable for traction testing.

7. **Test ORG:** Enter the test organization I.D. Code.

8. **Driver I.D.:** Enter the drivers I.D. Code.

9. **Inv. No.:** Enter assigned tire inventory number of each tire.

10. **Actual Load:** Not applicable for traction testing.

11. **Tire Pressure (Cold):** Enter start, start adjusted to and final tire pressure.

12. **Mileage End:** Enter vehicle odometer reading at the completion of the break-in.

13. **Time End:** Enter local 24 hour time at completion.

14. **Mileage Start:** Enter vehicle odometer reading at the start of the break-in.

15. **Time Start:** Enter local 24 hour time at start.

16. **Total Miles:** Deduct mileage start from mileage end and enter completed circuit mileage.

17. **Wet Miles:** Enter wet miles test tires received in this circuit.

18. **Tire Failure Code:** See UTQG tire failure code listing (Appendix A).

19. **Inventory Number:** Inventory number of failed tire.

20. **Mileage at Failure:** Enter vehicle's mileage at time of failure.

21. **Mechanical Failure Code:** See UTQG vehicle failure code listing (Appendix A).

22. **Mileage at Failure:** Enter vehicle's mileage at time of mechanical failure.

23. **Wheel Alignment:**

    Mileage: Enter cumulative mileage on test tires when vehicle aligned.

    Date: Enter Julian date vehicle aligned.

24. **Signature:** Enter Test Organization's Supervisor's signature if an entry is made for tire failure, mechanical failure and wheel alignment lines of this form.

    Remarks: Enter remarks pertinent to the test circuit such as,

    a. Tire replacement numbers in case of tire failure and wheel position.

    b. Mechanical problems and which test convoy vehicle.

    Signature: Vehicle driver's signature.

    Date: Julian date of circuit's completion.

6-17. Completing the UTQG Compliance Test Pre-test Sheet (Figure 6)

6-18. Pre-test Sheet Information.

1. **Date:** Enter Julian date that form is filled out.
2. **Schedule Test Date:** Enter Julian date that test is scheduled.
3. **Test Wheel:** Enter the test wheel position code.
4. **Test Number:** Enter the assigned tire test number of the candidate tire.
5. **ASTM Tire Inv. No.:** Enter the assigned inventory number of each of the standard tires.
6. **Rim I.D.:** Enter the rim identification number for the item 5 tires.
7. **Load:** Enter the required test load for the item 5 tires.
8. **Inflation:** Enter the required cold inflation pressure of the item 5 tires.
9. **Shore A. Hardness:** Tire hardness measurement.
10. **ASTM Idler Tire Inv. No.:** Enter the assigned tire inventory number of the spare ASTM tire.
11. **Candidate Test Tire Inv. No.:** Enter the assigned tire inventory number of the candidate tire which is to be tested.
12. **Candidate Idler Tire Inv. No.:** Enter the assigned tire inventory number of the candidate tire which is not tested.
13. **Order of Testing Tires:** Assigned by the UTQG Traction Manager.
14. **Flt. No's.:** The assigned flight number for each tire.
15. **System ID:** The assigned ID number of the skid trailer.
16. **Shore Hardness Gage I.D.:** The assigned I.D. number of the hardness tester.
17. **Driver I.D.:** The assigned driver I.D. number.
18. **Operator I.D.:** The assigned operator I.D. number.
19. **Special Instructions:** As required.

U.T.Q.G. TRACTION BREAK-IN SUMMARY SHEET

TEST START DATE:_ _ _ _ _

TEST END DATE:_ _ _ _ _ _

TEST NUMBER:_ _ _ _ _ _

TESTING ORG._ _ _ _

SPEC. I.D.	INVENTORY NO.	TIRE I.D. NO.
_ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _ _
_ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _ _
_ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _ _
_ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _ _

MANUFACTURER:_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

BRAND:_ _

TIRE LINE NAME:_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

TIRE SIZE:_ _

CONSTRUCTION:_,_,_,_

MAX PSI:_ _

MAX LOAD:_ _ _ _

LOAD RANGE:_ _

CORD MATERIAL: CAR._ _ _

BLT._ _ _

NO. OF PLIES: SW. _ _ _

TREAD _ _ _

NO. OF BELTS: _ _ _

NO. OF MEASR. GROOVES:_ _ _

RECOMMENDED RIM SIZE: _ _ _

ALTERNATE RIM SIZE: _ _ _ _ _ _,_ _ _ _ _ _,_ _ _ _ _ _

TRACTION GRADE: _ _ _

SIGNATURE:_____ UTQG REP. SIGNATURE_____

CODE:_ _ _ DATE:_ _ _ _ _ CODE:_ _ _ _ DATE:_ _ _ _ _ _

TESTING ORGANIZATION REP SIGNATURE:_____

CODE:_ _ _ _ _ DATE:_ _ _ _ _ _ _

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Figure 4.

U.T.Q.G. TRACTION BREAK-IN DAILY RUN SHEET

TEST NO.:_ _ _ _ _ _

TEST VEHICLE I.D.:_ _ _ POSITION IN CONVOY:_ _ _ _

BREAK-IN DATE:_ _ _ _ _ TEST ORG.:_ _ _ _ _ _ _ _

TEST LOAD:_ _ _ DRIVER I.D.:_ _ _ _

TEST PSI:_ _ _ _

TIRE POS.	INV. NO.	ACTUAL LOAD	--START PSI-- MEASURED	ADJ. TO	END PSI
1	_ _ _ _ _ _	_ _ _	_ _ _	_ _	_ _
2	_ _ _ _ _ _	_ _ _	_ _ _	_ _	_ _
3	_ _ _ _ _ _	_ _ _	_ _ _	_ _	_ _
4	_ _ _ _ _ _	_ _ _	_ _ _	_ _	_ _

MILEAGE END:_ _ _ _

TIME END:_ _ _ _

MILEAGE START:_ _ _ _

TIME START:_ _ _

TOTAL TIME:_ _ _ TOTAL MILES:_ _ _ _ WET MILES:_ _ _

TIRE FAILURE CODE:_ _ _ _ TIRE FAILURE CODE:_ _ _ _

INVENTORY NO.:_ _ _ _ INVENTORY NO.:_ _ _ _ _ _

MILEAGE AT FAILURE:_ _ _ MILEAGE AT FAILURE:_ _ _ _

MECHANICAL FAILURE CODE:_ _ MECHANICAL FAILURE CODE:_ _ _

MILEAGE AT FAILURE:_ _ _ _ MILEAGE AT FAILURE:_ _ _ _ _

WHEEL ALIGNMENT: MILEAGE:_ _ _ _ DATE:_ _ _ _ _ _

SIGNATURE:_____

REMARKS:_____

_____

_____

SIGNATURE:_____

UT042

DATE:_ _ _ _ _

VERSION 1

Figure 5.

Compliance Test

Pre-Test Sheet

Date: _____

Schedule Test Date: _____ Test Wheel: _____

Test Number: _____

ASTM Tire Inv. No.: _____ Rim I.D.: _____

Load: _____ Inflation: _____ Shore A. Hardness: _____

ASTM Tire Inv. No.: _____ Rim I.D.: _____

Load: _____ Inflation: _____ Shore A. Hardness: _____

ASTM Idler Tire Inv. No.: _____ Rim I.D.: _____

Load: _____ Inflation: _____ Shore A. Hardness: _____

Candidate Test Tire Inv. No.: _____ Rim I.D.: _____

Load: _____ Inflation: _____ Shore A. Hardness: _____

Candidate Idler Tire Inv. No.: _____ Rim I.D.: _____

Load: _____ Inflation: _____ Shore A. Hardness: _____

	Inventory No.	Flt. No's
Order of Testing Tires:	_____	_____
	_____	_____
	_____	_____

System I.D.: _____ Shore Hardness Gauge I.D.: _____

Driver: _____ Operator I.D.: _____

Special Instructions: #1. Set hitch angle to the selected value obtained during calibration before starting and after each trailer load change.

SC-2

Figure 6.

APPENDIX A. CODES

TIRE CHARACTERISTIC CODES

Tread	
street	S
ASTM	A
Construction	
tube type	T
tubeless	L
bias	B
belted bias	E
radial	R
Appearance	
blackwall	B
other	O

(other: whitewall, white raised letters, red stripe, etc.)

Cord Materials	
nylon	N
rayon	R
polyester	P
fiberglass	F
steel	S
nygen	G
aramid	A
*fortiflex	A
*DP01	A

*Additional produce names for Aramid

TIRE FAILURE CODES

01A	Labeling		
01B	Tread Separation		
01C	Bead Separation		
01D	Linear Separation		
01E	Chipping or Chunking		
01F	Splice Separation		
01G	Flat Spot		
01H	Mold fold - row edges, sometimes strip off		
01J	Flash - mold misalignment		
01N	Splice opening		
01P	Groove cracking	=	Externally produced (by small stone in groove which induces a small cut which propagates. Not product defect.)
01R		=	Internally produced. (Due to shallow rubber underbase at groove bottom, compounding of rubber, extreme carcuss growth. Usually grows in length and depth).
		=	Always 6-B in a product defect. Tire fails test. Can be isolated to a single tire but usually all specimens do it.
01S	Porosity	=	Rubber compound aireated due to bag pressure loss during curing. Fast wearing tire. Single product defect.
01T		=	Bent or damaged beads. = Tire will not inflate or hold air.
01U		=	Workmanship = irregularities that occur in tire production line whereby tire gets damaged.

EXTERNAL, ENVIRONMENTAL TIRE FAILURE CODES

02A	Run FLAT
02B	Puncture
02C	Valve Problems
02D	Cuts Produced by Foreign Object
02E	Patch Lockup
02F	Accident
02G	Other

VEHICLE SYSTEMS FAILURE CODES

Steering Assembly	62A
Suspension	62B
Brakes	62C
Emergency Brakes	62D
Engine	62E
Fuel, Carburation, Exhaust	62F
Power Train	62G
Electrical System	62H
Lighting and Communication System	62J
Visual System	62K
Heat, Defroster, Air Conditioner	62L
Vehicle Instrumentation	62M
Structure	62N
Electronic System	62P
Rim	62R
Speedometer or Tachograph	62S

UTQG FACILITY CODES

Skid Surface	
Asphalt	1
Concrete	2
Skid Pads	
Asphalt	1 through 10
Concrete	1 through 8
Skid Lanes	
Asphalt	1 through 10
Concrete	1 through 10
Direction of Travel - Skid Loop	
Counter Clockwise	1
Clockwise	2
Tire Categories	
ASTM	A
CMT	C
Candidate	X
Special	S
Equipment	E
Skid Trailer	
Left Wheel	1
Right Wheel	2

EQUIPMENT I.D.'s ASSIGNED

Calibrator ID:

AIR Bearing Force Plates

1. First UTQG System, set up in 1975, Model 1275A.
2. Second UTQG System, set up in 1978, Model 1275A.

Shore Hardness Durometer ID

1. Durometer Serial No. 55070-A.
2. Durometer Serial No. 43930-A.

Skid System

1. First UTQG System, purchased from K. J. Law, delivered in July 1975, Model 969B-1.5.

Surface Thermometer

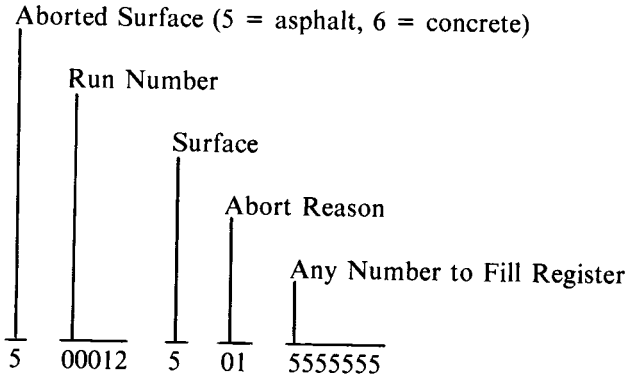
1. Wahl Infrared Thermometer Serial No. 1588A.

TRACTION ABORT PROFILES

NON-PAIRED TESTING

1. Skip the next surface, replace aborted run immediately.
2. Do not skip the next surface, replace aborted run immediately with next run on the same surface.
3. Skip the next surface, replace aborted run later.
4. Do not skip the next surface, replace aborted run later.

TRACTION ABORT CODES



ABORT REASONS

01	=	Speed
02	=	Lateral Position
03	=	Longitudinal Position
04	=	Weather
05	=	Mechanical Problem
06	=	Electronic Problem
07	=	Tire Problem
08	=	Outside Interference
09	=	Human Element
10	=	Water Flow Rate
11	=	To Be Assigned
99	=	Other

PAIRED TESTING

5. Do not skip the next surface, replace aborted pair immediately.

6. Do not skip the next surface, replace aborted pair later.

TEST ORGANIZATION CODES

A. If a testing organization is a tire manufacturer, use his brand or manufacturer code.

A	ARA	Automotive Research Associates
P	APG	Automotive Providing Grounds
C	CTI	Compliance Testing Inc.
K	KJL	K. J. Law (PATTCO)
N	NAT	Nevada Automotive Test Center
M	SMI	Smithers Scientific Services
S	SRI	Southwest Research Inc.
E	STX	South Texas Testing
T	TTI	Transportation Testing Inc. of Texas
R	TRC	Transportation Research Center of Ohio

APPENDIX B. SKID TRAILER CALIBRATION DETAIL

(PROCEDURES CURRENTLY UTILIZED AT SAN ANGELO)

FORCE PLATE

1. Wash truck and trailer. Wash the trailer inside and out to remove loose debris.
2. Fill vehicle with fuel and water.
3. Drive the truck into building lining up the wheels on painted guide stripes. Stop when the force plate pit is between the truck and trailer.
4. Remove the grates from force plate pit.
5. Remove the protective covering from epoxy surface.
6. Use a vacuum cleaner and clean cloth to clean the epoxy surface.
7. Install force plate with airbearing platform in pit with the tongue of force plate pointed rearward.
8. Place the thin traction plate on top of force plate with lip hooked over rear of force plate.
9. Place the steel transition bridge onto rear of force plate with the ears protruding into nearest grate.
10. Drive truck slowly forward until the test wheel is centered on force plate.
11. Set truck emergency brake and transmission in park.
12. Remove transition bridge.
13. Remove remaining grates behind test wheel.
14. Clean debris from the neck of the pit using vacuum cleaner.
15. Make electrical connections as follows:

    a. Observe the identification labels on the force plate cables (traction and load) and connect them to the proper receptacles in the force plate and force plate calibrator box.

    b. Connect the output of force plate calibrator box to the correct force plate amplifiers, load and traction.

    c. Connect the output of load and traction force plate amps to two places:

        (1) The output that will be used first should be hooked to the X axis on X-Y Y' plotter.

        (2) Both outputs should be connected to their respective digital readout meters, load to veritical and traction to traction.

16. Apply power to X-Y Y' plotter, force amplifiers and digital readouts.
17. Connect a battery charger to main vehicle battery. Check water level in battery, leave caps off.

CAUTION

Be sure to observe proper battery polarity.

18. Remove banana plugs from the receptacle on battery positive lead and plug special shorting plug, attached to the positive battery charger lead, into receptacle.

NOTE

This will connect the battery charger to the instrumentation battery in rear of tow vehicle.

19. Disconnect the 117 volt plug from the inverter in bed of vehicle and plug it into 117 volt commercial power.

20. Apply power to console in the following steps and allow at least 30 minutes for warmup.

    a. 12 volt DC.

    b. 117 volt AC.

    c. Strip chart recorder on.

    d. Digital printer on.

    e. Datalogger on.

    f. Arm left brake.

21. Connect a long banana cable between console monitoring receptical and Y axis of the X-Y Y' plotter.

22. Place an unskidded, broken-in ASTM E501 tire on each trailer wheel position.

23. Adjust trailer tire pressures to 24 psi.

24. Install force cylinder in end of pit with pull rod pointing toward force plate.

25. Use a chain to anchor cylinder to end of pit and another chain to connect pull rod and tongue of force plate.

26. Drain water trap at main manifold air supply.

27. Turn off air supply to manifold.

28. Connect small air hose between manifold and inlet to force cylinder regulator.

29. Connect small air hose between force cylinder regulator output and force cylinder input.

30. Connect large air hose between manifold and air bearing.

NOTE

Be sure air valve is closed at bearing end.

31. Connect small air hose between manifold and inlet to trailer air system regulator.

NOTE

Regulator should be adjusted to 80 psi and locked in that position.

32. Connect air system regulator to external air inlet connection on trailer.

    a. Turn manifold air on.

    b. Lower fifth wheel.

33. Inflate and level the air bearing using three valves mounted on bearing base and bi-directional level attached to bearing base.

34. Adjust hitch angle and bumper height to the values established during previous calibration.

    a. Place pendulum clinometer in designated spot on trailer tongue to measure hitch angle.

    b. Turn the vertical bolt on hitch that raises and lowers ball to adjust hitch angle.

    c. Adjust air pressure in air suspension bags to set bumper height. These air valves are located on the inside of the rear bumper brackets.

NOTE

These last two steps interact with each other. Repeat both steps until the desired measurements are achieved.

35. Check vertical to traction cross-talk.

    a. After 30 minute warmup deflate air bearing.

    b. Use a floor jack under trailer bumper to raise test wheel clear of force plate.

    c. Using balance and gain controls on force plate vertical amplifier, calibrate the vertical force plate amp.

NOTE

Use the 1000 pound switch setting on the calibration box to set gain to proper scale.

    d. Place the system DVM selector switch to read vertical load on DVM and adjust balance and gain controls to calibration value established for system calibration resistor in previous calibration.

    e. Lower test wheel and inflate air bearing.

    f. Record vertical force plate value.

        (1) If necessary adjust wheel weight to 1085 pounds.

    g. If system vertical readout does not indicate 1085 pounds, adjust balance to read 1085 pounds.

        (1) Place calibration switch in calibration position to determine if deflection is equal to established calibrated value.

    h. Turn DVM selector switch to traction position and adjust the balance and gain controls until established calibration value is achieved.

i. Check hitch angle to assure it is still correct.

(1) Suspension system of trailer is manually activated by depressing and releasing rear bumper. This is to allow the suspension components to come to a mechanical equilibrium.

j. Load both trailer fenders with 200 pounds using 25 pound shot bags.

NOTE

Be sure to place them on each fender one at a time, but simultaneously, to maintain trailer balance.

(1) Read and record the values of system traction and force plate vertical outputs.

(2) If the system traction value is less than 2% of the applied load shown on the force plate vertical readout, then cross-talk in this axis is within tolerance.

(a) If necessary, adjust hitch angle, maintaining bumper height until cross-talk is less than 2% of applied load.

(3) Repeat steps j, (1) and (2) three times to assure accuracy of setting.

36. Check for traction to vertical transducer cross-talk.

a. Be sure system vertical, forceplate vertical and traction amplifiers are balanced and gains are set to established calibration values.

b. Leave hitch angle at the final reading used in vertical to traction cross-talk check.

c. Lock test wheel brake.

d. With DVM selector switch in vertical load position, use the force cylinder regulator to apply 800 pounds force to the test wheel three times. This will set the tire on the friction plate.

e. Apply 500 pounds force on the test wheel using force plate readout - read system vertical load and force plate vertical load. Record these values.

f. If the difference between system vertical and force plate vertical is less than 2% of the 500 pound applied force, then cross-talk is within tolerance.

(1) If necessary, adjust hitch angle, maintaining bumper height until cross-talk is within 2% tolerance.

(2) Repeat steps e. and f. three times to assure setting is correct.

(3) If adjustments were necessary in this check, recheck vertical to traction cross-talk to make sure it is still within tolerance.

NOTE

These two procedures may need to be repeated several times to reach a hitch angle that will allow cross-talk to be in tolerance on both axis.

37. Calibration of vertical transducer.

    a. Deflate air bearing and left test wheel.

    b. Set balance and gain control on both system and force plate vertical amplifiers to their respective calibrated values.

        (1) Use the 1000 pound calibrated position on force plate calibration box to scale force plate vertical amplifier.

    c. Lower test wheel onto force plate and inflate air bearing.

    d. Adjust system balance to read the same static load shown on the force plate.

    e. Using 25 pound shot bags load both fenders simultaneously until you have 200 pounds on each fender.

    f. Read both vertical load displays.

    g. If these readings aren't the same, adjust the gain of the system amp by the amount of difference.

        (1) Do this by turning the system balance control to zero and increasing or decreasing the calibrated value by the same amount as the difference found between the two transducers.

    h. Repeat steps e. and f. three times to assure that the new value is correct.

    i. After the correct value is attained and the trailer is unloaded, the difference between static and calibrated values will be the new calibrated value. Record the new value on the vehicle operator's calibration card.

38. Linearity check between system and forceplate vertical transducer procedure.

    a. Inflate air bearing.

    b. Check both systems to be sure gains are correct.

    c. Install clean graph paper on plotter.

    d. Check vehicle hitch angle and adjust to proper setting.

    e. Scale plotter using the system internal vertical calibration switch and the force plate vertical calibration box.

        (1) Connect force plate to X axis and system to Y axis of the plotter.

    f. Place load on the fenders in 50 pound increments, loading both sides simultaneously, put the plotter pen down momentarily at each 50 pound increment, until load changes of approximately 350 pounds each side of the static load value has been attained.

        (1) Record the load indicated on both vertical readouts at each load increment on UTQG Traction Transducer Calibration Data (Vertical) Form, Figure 7.

UTQG TRACTION

TRANSDUCER CALIBRATION DATA (VERTICAL)

Date: _____

System I.D. _____

Calibrator I.D. _____

Wheel: ___

Tire I.D. No. _____

ES = External Stimulus (Pounds)

SR = System Response (Pounds)

VERTICAL LOAD

	Run		Run		Run	
	ES	SR	ES	SR	ES	SR
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

OPERATOR: _____

SIGNATURE: _____

Figure 7.

g. Unload the trailer and use a floor jack at the trailer bumper to lift the load from the test wheel in approximately 50 pound increments, starting at approximately 1050 pounds and down to approximately 750 pounds.

(1) Mark each step on plotter and record each reading.

h. Repeat this procedure two more times (total of 3).

39. Calibration of system force transducer.

a. Inflate air bearing.

b. Lock brake.

c. Use the balance control on force plate amplifier to adjust readout to zero.

d. Switch calibrator switch to 800 pounds and adjust gain to read 800 pounds force on readout.

e. Set vehicle DVM selector switch to read traction force.

f. Use traction balance to adjust DVM to zero and gain to set DVM to calibrated value when calibration switch is turned to calibrate position.

g. Use force cylinder regulator to apply 500 pounds force on force plate.

h. Record system DVM display. If reading is not 500 pounds ±2 pounds, proceed as follows:

(1) Adjust vehicle traction gain until reading 500 pound force with 500 pound force applied.

(2) Release force.

(3) Switch system calibration switch to calibrate position and read the value on DVM.

(a) This will be the new calibration value.

(4) Repeat steps g. and h. three times to be assured that the new calibrated value is correct. Record the new value on the vehicle operator's calibration card.

40. Procedure for linearity check between system and force plate traction transducers.

a. Inflate and level air bearing.

b. Lock brake on test wheel.

c. Using force cylinder regulator apply approximately 800 pounds force to test wheel three times to firmly set the tire on the friction plate.

d. Connect traction amplifier output to X axis on plotter.

e. Install clean graph paper on plotter.

f. Check vehicle hitch angle, adjust if necessary.

g. Scale plotter using the system traction calibration switch and the force plate traction calibration box.

h. Use the force cylinder regulator to apply 800 pounds traction force to test wheel in 100 pound increments.

(1) Allow the force to stabilize at each setting, record the system and force plate readings and put the plotter pen down momentarily, record these readings on UTQG Traction Transducer Calibration Data (Horizontal) Form, Figure 8.

i. Release force and repeat steps e., f., g. and h. two more times (3 total).

j. Assemble all data and deliver to Traction Manager. Data from graphs will be recorded on forms C1 and C2 as were the digital meter readings.

WATER QUANTITY CALIBRATION PROCEDURE (Q-TEST)

1. Jack up rear wheels of skid truck and install jack stands.
2. Raise trailer and remove test wheel.
3. Run truck in second gear (or regular operating gear) and set throttle at RPM reading recorded for 40 mph.
4. Turn on water and run for 10 seconds at correct RPM.
5. Slip plastic bag over water nozzle and catch all water for a timed 10 second period avoiding any spillage.
6. After 10 seconds quickly remove plastic bag and shut off water.
7. Weigh the bag of water to the nearest 1/2 pound.
8. Complete the flow rate using weight and time.
9. Repeat steps 3 through 8 three times to obtain average.

SPEED CALIBRATION PROCEDURE

1. Clamp "Tracktest" fifth wheel to right rear bumper of tow vehicle.
2. Install Labeco D D-1 and D D-2 in vehicle cab and distance sensor on fifth wheel.
   a. Inflate system fifth wheel to pressure determined at last calibration.
   b. Inflate trailer cold tire pressure to 24 ± psi, and two vehicle tire pressures to manufacturers specifications.
3. Lower "Tracktest" fifth wheel and inflate to approximately 30 psi.
4. Run system for five miles at 40 mph to warm up tires (four loops around traction course).
5. Enter measured mile, located on runway, and stop at beginning mile marker.
6. Reset distance meter to zero and accelerate smoothly to 40 mph. Maintain a straight line course for one mile. Stop smoothly, at end of one mile, on the mile marker.

7. Read distance meter. If it reads 5280 ± 4' then the fifth wheel shall be considered properly calibrated.

   a. If it does not read 5280 ± 4' then adjust air pressure in tire and repeat test until correct reading is achieved.

      (1) If reading is high, increase fifth wheel tire pressure, if low decrease pressure.

NOTE

Electronics are pre-adjusted at factory and need no adjustment at this time.

   b. The fifth wheel is now calibrated and will read speed correctly.

   c. Drive vehicle in a straight line at 40 mph and driver reads speed in vehicle speed readout.

      (1) Each time the driver reads 40 mph the operator will record the speed displayed on the digital system. If the two systems agree within 0.1 mph then no adjustments are necessary. Record this data on UTQG Traction Speed Calibration Data Form Figure 10.

      (2) If the two systems do not agree, adjust card J 108 in console until both systems do agree.

   d. If necessary, adjust amplifier on strip chart recorder until correct speed is indicated on strip chart.

   e. Remove external speed calibration equipment.

NOTE

These procedures are equal to or exceeding specifications laid out in ASTM F457-76.

UTQG TRACTION

TRANSDUCER CALIBRATION DATA (HORIZONTAL)

Date: _____

System I.D.: _____

Calibrator I.D.: _____

Wheel:

Tire I.D. No.: _____

ES = External Stimulus (Pounds)

SR = System Response (Pounds)

Calc. SN = Force/Vert. Load

TRACTION

RUN	ES	SR	SN READOUT	VERT. LOAD	CALC. SN
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

OPERATOR: _____

SIGNATURE: _____

Figure 8.

UTQG TRACTION

Q-TEST

(Note: All Times and Dimensions in Decimals)

Nozzle Number: _____ Date: _____

Wheel Position: _____

(Wetted) Trace Width at Ground Contact _____ Inches

Nozzle Angle ____ Deg

Distance, Trailing Edge of Nozzle to Ground _____ Inches

Distance, Trailing Edge of Nozzle to Center Line of Axle _____ Inches

Vehicle Tachometer _____ Sim. Speed _____

Sample Period _____ Min.

Quantity In Gallons

Run 1	Run 2	Run 3
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Avg. _____	Avg. _____	Avg. _____

Grand Avg. Gallons

Calculated Average Flow Rate: GPM

(Note: Required Output = 3.6 GPM/Wetted Inch ± 10%)

Figure 9.

SPEED CALIBRATION DATA

Date _____

Reference System Error: _____ Ft. Per Mile _____

Reference Wheel Inflation: _____

System Wheel Inflation: _____

Tire I.D. No: Left, _____ Right, _____

	Reference Speed Readout		System Speed Readout	
Avg.		Avg.		Diff.
Avg.		Avg.		Diff.
Avg.		Avg.		Diff.

Figure 10.

APPENDIX C. TEST EQUIPMENT OPERATING PROCEDURES

(PROCEDURES CURRENTLY UTILIZED AT SAN ANGELO)

VEHICLE OPERATIONS CHECK LIST

WARNING

Vehicle cannot be moved until 12 Volt DC power and air pump is turned on.

1. Lift truck bed cover and check the following:
   a. Battery water level.
   b. Inverter connections.
   c. Compressor air lines and connections.
   d. Air filtering system.
   e. Cover turnbuckles for proper tension.
   f. Air gauges and valves.
   g. Bleed condensation from air tanks.
2. Remove OUT-PUT connector at power inverter and attach vehicle instrumentation system to 115 Volt AC commercial power. Add 80 pounds PSI of air to system air tanks.
3. Move to vehicle cab and check printer and analog recorder paper supply. Refer to Appendix D for detailed instrumentation operating procedures. Turn on the following instrumentation:
   a. Analog Recorder (Appendix D, Page D-1).
   b. Printer (Appendix D, page D-3).
   c. Date Logger (Appendix D, page D-3).

NOTE

Warm-up time for vehicle instrumentation is thirty (30) minutes.

4. Open vehicle hood and check the following:
   a. All belts and hoses.
   b. Coolant level.
   c. Engine, transmission and power steering oil levels.

d. Battery water level.

e. Check for frayed wiring and loose connections.

f. General appearance of engine accessories.

g. Close vehicle hood.

5. Make a visual inspection of vehicle and trailer external surfaces.

6. Raise trailer front cover and check for the following:

a. Trailer hitch connection.

b. Safety chains.

c. Trailer brake valve in armed position.

d. Hitch dolly fully retracted.

e. Water hose connections and clamps.

f. Air connections.

g. Electrical connections between vehicle and trailer.

h. Fifth wheel actuator, nozzle and water solenoids.

i. Fifth wheel assembly and safety latch.

j. Nozzle assembly, hoses, clamps and mounts.

k. Weight tie-downs.

l. Actuate fifth wheel and nozzles, several times.

7. Make a visual check of trailer brakes.

8. Inspect all tires and set tire pressures as follows:

a. Vehicle - inflate to 60 PSI.

b. Fifth wheel - inflate to 44 PSI.

c. Trailer - Set inflation as specified for load and tire size.

9. Lower trailer front cover and lock safety latches.

10. Open trailer rear cover and check the following:

a. General appearance of wiring and junction box.

b. Weight tie-downs.

c. Hydraulic fluid level in tubing.

d. Hydraulic and air gauges.

e. Air tank drain, lines and pressure relief valve.

11. Close trailer rear cover, lock safety latches and check light lenses.

12. Move to vehicle cab and turn off the following:

a. Data logger.

b. Printer.

c. Analog recorder.

13. Move to rear of truck and remove power OUT-PUT connector from 115 Volt AC commercial power. Connect vehicle instrumentation to power inverter. Place extension cord in truck bed cover.

14. Move to vehicle - all instrumentation and vehicle accessories must be OFF. Start engine and set manual throttle for 1200 RPM. Check vehicle gauges and close windows and doors. Attach Handie-Talkie FM radio to vehicle antenna, adjust volume and squelch.

15. Turn on vehicle accessories and instrumentation in the following order:

a. Vehicle air conditioner or heater.

b. 12 Volt DC power.

c. Air pump.

d. 117 Volt AC power.

e. Analog recorder.

f. Printer - POWER ON - STAND-BY OFF.

NOTE

Printer must be in stand-by position when turning printer power ON or OFF.

g. Data logger - power ON.

h. Select proper brake, water and lock-up switches.

i. Insure that the Auto DROP-OUT Light is ON.

j. Turn on flasher.

16. Drive vehicle to fuel and water supply area and fill fuel and water tanks as needed.

NOTE

Connect ground cable to vehicle bumper before fueling. All power switches must be turned OFF in the following order prior to fueling:

a. Flasher.

b. Data logger.

c. Printer.

d. Analog recorder.

e. 117 Volt AC power.

f. Air pump.

g. 12 Volt DC power.

h. Vehicle air conditioner or heater.

i. Engine.

NOTE

Power switches must be turned ON in reverse of the above after starting engine.

17. Drive vehicle to ready line. Check -

a. Printer - Power ON - Standby ENGAGED.

b. Analog Recorder - Power ON - Drive OFF.

c. Data Logger - ON - Program 4-0-0-0-0-1-1 into system.

d. Proper brake, water and LOCK-UP Switch positions.

e. Automatic drop-out light ON.

f. Fifth wheel DOWN.

g. Bridge function switch - ON.

18. The skid system shall be warmed up by running for 5 miles at 40 mph prior to any skid testing. Prior to warm-up at least one test with water only (no lock-up) and then one test with water and lock-up shall be run to ensure proper system operation. DO NOT DRIVE ON TESTING PADS. Insure Data Logger updates Test Number, Speed, Skid Number, Peak SN and that Printer is printing properly.

19. Pre-wet the assigned pad on the last warm-up lap.

20. Drive to Zero Pad located near the ready line, park vehicle with the engine running, open vehicle hood and initiate Zero Pad procedures.

ZERO PAD PROCEDURE

1. Depress hydraulic pump and arm jack switches on console. Using switches on trailer tongue, raise and lower trailer. Release hydraulic pump and arm jack switches on console.

2. Set hitch angle and rear bumper height to settings obtained at last system calibration as specified in Appendix D, page D-6.

3. Check fifth wheel and trailer tire pressures. Adjust if necessary.

4. Turn on Analog recorder drive and disengage Printer standby switch.

5. Program the console through and including line six (address group 85) as shown on the Data Logger Code Sheet. Line one - a row of sixteen number eights - designates beginning of test. Refer to Appendix D, page D-3.

6. Use gain values obtained at last calibration - set vertical load and traction for test wheel.

7. Set function switch in calibration position, depress both automatic operation and test enable switches. This records the calibration settings at beginning of test.

8. Program line eight from Data Logger Code Sheet into Data Logger (4-0-0-0-0-1-1).

9. Final check before testing:

   a. DVM Selector - in position one (1).

   b. Air Pump - on.

   c. Hydraulic Pump - off.

   d. 12 Volt DC - on.

   e. 117 Volt AC - on.

   f. Fifth wheel - down.

   g. Proper brake and water switches engaged.

   h. Proper lock up switch position.

   i. Arm jacks switch - off.

   j. Automatic drop out switch - on.

   k. Flasher - on.

   l. Manual chart, water and brake switches - off.

   m. Bridge Function - on position.

10. Drive to ready line and enter traffic pattern.

11. Initiate driving and testing procedures.

DRIVING AND TESTING PROCEDURE

1. Stop at assigned area on ready line before entering test area.

2. Circle traction course in the specified direction maintaining a speed of 40 mph where safe.

3. Lock the test wheel on the asphalt and concrete pads while maintaining a speed of 40 mph.

NOTE

Vehicle speed tolerances for candidate tires: +0, -1 mph.

Vehicle speed tolerances for ASTM tires: +1, -0 mph.

4. Enter SN on Flight Plan and Data Sheet after each skid.

5. In the event of an aborted run, enter into data logger the conditions as given in the Codes List. The abort procedure (Abort Rerun Profile), also shown in the Codes List, is pre-determined and is given on the Schedule Sheet and Test Matrix Sheet.

6. In the event of test malfunctions, i.e., dry skid, power failure etc., immediately press red emergency button on console to stop all test functions.

END OF TEST PROCEDURE

1. Upon completion of designated number of skids, obtain ambient temperature and test surface temperatures (if required) also air pressure in skid trailer tires. Enter on Flight Plan and Data Sheet.

2. Return to Zero Pad, program address groups 93 and 94 as shown on Data Logger Code Sheet into data logger.

3. Set function switch in calibration position, depress automatic operation and test enable switches. This records end of test calibration values.

4. Program a row (16) of nines into data logger. This designates end of test.

DATA RECORDING

1. Record console digital read-out on UTQG Flight Plan and Data Sheet.

2. Remove printed tape from printer.

3. Remove strip chart from Analog recorder.

4. Remove and replace cassette at designated intervals.

5. Above data will be analyzed by the TRM and entered into Data Management System.

APPENDIX D. INSTRUMENTATION OPERATING PROCEDURES

(PROCEDURES CURRENTLY UTILIZED AT SAN ANGELO)

ANALOG RECORDER

This section provides general operating procedures for the Model 1858 CRT Visicorder.

1. Paper loading.

   a. Open the paper door and remove the take-up spindle.

   b. Release the cradle latch.

   c. Remove supply spindle and insert into paper roll.

   d. Place loaded supply spindle in slots of supply cradle with paper unwinding forward from top of roll. Spindle ends are positioned in the vertical slots, flat sides to the rear.

   e. Unroll enough paper to fold over cradle door, close cradle door, pull paper keeping it smooth and straight.

   f. Place take-up spindle in its slots with the recording paper down behind the spindle. Pull paper snug and straight.

   g. Press and lock in Power and Drive pushbuttons.

   h. Hold paper against take-up spindle, push blue chart button on console and allow paper to roll around spindle evenly.

   i. Close door.

2. Set control switches on front panel in the following positions:

Timeline Switch	—	1
Gridline Switch	—	Continuous
Record Timer	—	Off
Power Pushbutton	—	Locked On
Drive Pushbutton	—	Locked On
Record Speed: in/sec.	—	1
Multiplier	—	1.0

Modules:			Sensitivity setting if ON
1 (Sens.)	—	On	.1
2 (Sens.)	—	Off	.2
6 (Sens.)	—	Off	—
7 (Sens.)	—	Off	—
9 (Sens.)	—	Off	—
10 (Sens.)	—	Off	—
15 (Sens.)	—	On	.1
16 (Sens.)	—	Off	.5

3. Channel Signal Connector/Function

FUNCTION	DVM POS.	MODULE	PLUG
Vehicle Speed	1	1	23
Left Wheel Speed	2	2	24
Right Wheel Speed	3	3	25
Left % Slip	4	4	26
Right % Slip	5	5	36
Left Force (Traction)	6	6	29
Left Load	7	7	31
Left Water Flow	8	8	37
Right Force (Traction)	9	9	30
Right Load	10	10	32
Right Water Flow	11	11	38
Cal	12	12	33
—	—	13	—
—	—	14	—
Left S.N.	—	15	27
Right S.N.	—	16	28
ERP	—	17	35
Monitor	—	18	34

PRINTER

A Model 2010A FLUKE Printer is used to provide paper tape print-out of skid trailer data.

1. Front Panel - Front panel contains push buttons for Paper Feed, Manual Print, Standby and Power.
2. Rear Panel - Rear panel contains fuse and receptacles for cable from console and power supply.
3. Paper installation:
   a. Push in and lock Power and Standby buttons on front panel.
   b. Open drawer.
   c. Lift hinged door containing slotted window.
   d. Place paper in drawer.
   e. Insert paper under spring tension clip.
   f. Push Paper Feed button until paper appears over top of feed roller. Release Paper Feed button.
   g. Manually insert paper through slot in window.
   h. Close hinged door.

DATA LOGGER

1. Program data logger as described in Data Logger Code Sheet (Figures 11 and 12) using numeric codes given in Codes List.
2. All additional codes i.e. manufacturer's codes, brand codes, tire size tables, etc. are found in the UTQG Data Management System Code Book.

Completing the Data Logger Code Sheet (Figures 11 and 12)

Data Logger Code Sheet Information.

1. **Julian Date:** Enter test date.
2. **Test Tire Inventory No.:** Enter the assigned tire I.D. number.
3. **Abort Rerun Profile:** Coded instructions for aborted test.
4. **A Pad:** Coded instructions for the assigned asphalt skid pad.
5. **A Lane:** Coded instructions for the assigned asphalt lane.
6. **C Pad:** Coded instructions for the assigned concrete skid pad.
7. **C Lane:** Coded instructions for the assigned concrete lane.
8. **Force Cal:** The prior force calibration value.
9. **Load Cal:** The prior load calibration value.

DATA LOGGER CODE SHEET

8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

8	1	Julian Date					Test Tire Inventory No.						Abort Rerun Profile		0

8	2	A-Pad		A-Lane		C-Pad		C-Lane		Force Cal			Load Cal		

8	3	Driver I.D.		Operator I.D.		First Suff.	Direct	Wheel	Start Time				Start Flight No.		

8	4	Idler Tire No.							Test Load			0	0	0	0

8	5	Test Tire Start Inflation								Idler Tire Start Inflation			Runs Per Lane		

Bridge selector switch in "CAL" position - Push "TEST ENABLE" button

1	Calibration Record - BOT														

4	Beginning Run No.				Count Inter.	Frequency of Count					—	—	—	—	—

Figure 11.

DATA LOGGER CODE SHEET (cont)

Automatic Entries														
		Ambient Temp.		Asphalt Wet		Asphalt Dry		Concrete Wet		Concrete Dry				
9	3										0	0	0	0
		Test Tire End Inflation			End Time									
9	4								0	0	0	0	0	0	0	0
Bridge selector switch in "CAL" position - Push "TEST ENABLE" button														
	Calibration Record - EOT													
1														
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

Figure 12.

10. **Driver I.D.:** The I.D. code of the driver.
11. **Operator I.D.:** The I.D. code of the operator.
12. **First Surf:** Code representing which skid surface is to be utilized first.
13. **Direct:** Code representing direction of travel.
14. **Wheel:** Code representing which wheel to be locked.
15. **Start Time:** Local time of test start.
16. **Start Flight No.:** Indicates which flight to begin sequence with.
17. **Idler Tire No.:** I.D. number of idler tire.
18. **Test Load:** Required test load.
19. **Test Number:** Assigned test number.
20. **Test Tire Start Inflation:** Measured inflation pressure of skidded tire.

21. **Idler Tire Start Inflation:** Measured inflation pressure of idler tire.

22. **Runs Per Lane:** Driving instruction.

23. **Calibration Record-Dot:** Previous calibration history.

24. **Beginning Run No:** The number of the first run.

25. **Count Incr.:** Count increment of records.

26. **Frequency of Count:** Time base of records.

27. **Ambient Temp:** Temperature at time of test.

28. **Asphalt Wet:** (If required).

29. **Asphalt Dry:** (If required).

30. **Concrete Wet:** (If required).

31. **Concrete Dry:** (If required).

32. **Test Tire End Inflation:** Measured tire pressure at completion of test

CLINOMETER

An Hilger and Watts Pendulum Clinometer Model TB108 is used to measure the angle of the trailer frame during calibration and to set this designated angle daily during the "Zero Pad" calibration procedure.

1. Before use:

   a. Free pendulum by turning the clamp knob clockwise.

   b. Hold instrument in both hands and rotate so that main scale (drum) is oscillating.

2. To make reading:

   a. Place instrument on white painted surface at front of trailer frame near jack operation switch buttons. Make sure this surface and base of instrument is clean.

   b. When the drum is stationary, clamp and carefully remove the clinometer from the surface.

   c. The vernier reading is that point where a vernier graduation is exactly in line with a degree graduation on the drum. If the main index mark is against the red half of the drum, use the red vernier scale; if the main index mark is against the black part of the drum, use the black vernier scale.

3. Adjustment:

   To check that the index mark and vernier scale is correctly positioned, carry out the following procedure:

   a. Set the drum oscillating to distribute the oil in the bearing and make sure the base is clean.

b. Place the clinometer on a flat surface which is approximately level. Place a straight edge against the instrument to act as a fence and take the reading.

c. Reverse the clinometer end for end against the straight edge and take another reading.

d. The two readings - one on the red scale and the other on the black scale - should be similar.

e. If they are not, loosen the three bolts on the side of the instrument, near the clamp knob. Unclamp the drum and move the vernier scale appropriately by sideways pressure on the bolts. Tighten the bolts and recheck, repeating the adjustments as necessary until the desired accuracy is attained. Make sure that the surfaces of the drum and vernier are in alignment.

PAVEMENT SURFACE THERMOMETER

A hand held Heat Spy Infrared Temperature Thermometer Model HSA-1G manufactured by William Wahl Corporation is used to measure the temperature of each surface upon which testing is conducted.

Operation:

1. **Battery Check:**

   Rotate selector switch to battery position. Squeeze trigger to full position. Pointer should indicate within green band on right of full scale. If pointer does not indicate properly, replace batteries with two 5.4 volt Mallory Battery TR-134 or equivalent.

2. **Emissivity Selector:**

   Set 0.9. The following is a practical procedure to obtain this setting. Paint a small area of the surface to be measured with dull black paint. This black surface has an emissivity (radiated heat energy of 1.0, measure this temperature with the Selector Switch set on 1.0. Take the temperature of an unpainted area and adjust the Selector Switch until the same temperature reading is obtained as on the painted area.

3. **Zero Adjustment:**

   Squeeze the trigger to half-way position until the first detent is felt. If the pointer needle does not read zero, rotate the zero adjustment knob until the meter is set at zero.

4. **Measure Temperature:**

   Point instrument at target to be measured. Look through the internal sights to establish desired spot. Squeeze trigger to full position and read the temperature on the meter. Recheck zero.

5. **Precautions:**

   Allow instrument to stabilize at using temperature for 1 hour. Never take temperature of sun or any target which might have temperature higher than the range on dial. Check zero before and after taking temperature. This adjustment is very sensitive and must be monitored closely.

GLOSSARY OF TERMS

Bead	That part of the tire made of steel wires, wrapped or reinforced by ply cords, that is shaped to fit the rim.
Belted-Bias	A type of pneumatic tire which features a bias tire construction reinforced with textile ply (belt) at an angle less than the carcass angle, located between the carcass and the tread.
Bias Tire	A type of pneumatic tire construction which features the ply cords that extend to the beads laid at alternate angles, substantially less than 90°, to the centerline of the tread.
Brand, Tire	The identifying name assigned by the seller of the tire.
Break-In	The running of a tire *prior to test*.
Candidate	A tire to be tested to the traction requirements.
Carcass	The tire structure, except tread and sidewall rubber.
Construction	The reference to the body structure of the tire; the type designator of the tires tested - R-radial; BB-belted bias; B-bias.
Contract Technical Manager (CTM)	The designated OVSC Official who is responsible for assuring laboratory compliance with contractual obligations.
DOT	Department of Transportation.
Flight Plan	Designated Order of Testing.
FMVSS	Federal Motor Vehicle Safety Standard.
GFE	Government Furnished Equipment.
NHTSA/OVSC	National Highway Traffic Safety Administration/Office of Vehicle Safety Compliance.
OVSC CC	Office of Vehicle Safety Compliance Computer Center.
Production Lot	An undesignated number of tires, all made of the same supply of raw materials with the same specification, in the same production facility, as nearly as possible during the same time (i.e., sequentially without interruption).
Radial Tire	A type of pneumatic tire in which the ply cords extend to the beads and are aligned substantially 90° to the centerline of the tread.
Rim	A metal support for a tire or a tire and tube assembly upon which the tire beads are seated.
Sidewall	That portion of a tire between the tread and the bead.

Skid Trailer	Test vehicle utilized for the traction testing as specified in ASTM Method E274-70 paragraph 3.
Standard Tire (ASTM Tire)	Tires utilized for checking the traction coefficient of the skid pads as specified in ASTM Method E501.
Test Number	A six digit number which denotes a particular test.
Test Period	The calendar time period during which a test is conducted.
Test Rim	The rim to be used for testing a tire as defined in paragraph S.3 of FMVSS No. 109.
Test Vehicle ID	An identification number assigned by the San Angelo Test Center Manager.
Tire Line (Tire Name)	The name of a series of tires of which there may be several within one brand name.
Tire Type	Referring to construction, i.e., radial, belted bias, or bias, designated R, BB, or B, respectively.
TRA	Tire and Rim Association.
Traction Manager (TRM)	The test facility official who is responsible for all day-to-day activities relative to traction testing.
Tread	That portion of a tire that comes into contact with the road.
Tread Groove	The space between two adjacent tread ribs.
Tread Rib	A tread section running circumferentially around a tire.
Tread Separation	Pulling away of the tread from the tire carcass.
UTQG	Uniform Tire Quality Grading.
Wheel	The combined rim and tire, not necessarily mounted on the vehicle hub or drum.
Zero Pad	Test area designated for pre-test and post-test calibration checks.