



ORIGINAL

**Proposal to:
RFQ 7770095
State of West Virginia
Department of Administration
Purchasing Division
Building 15
2019 Washington Street East
Charleston, West Virginia 25305-0130**

Pavement Friction Tester

Opening September 12, 2007 at 1:30P.M.



Dynatest 1295 Pavement Skid Resistance Test System

**Proposal by
Dynatest Consulting Inc.
5950 East Executive Drive
Westland, Michigan 48185**



State of West Virginia
 Department of Administration
 Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER
7770095

PAGE
1

ADDRESS CORRESPONDENCE TO ATTENTION OF
MICHAEL AUSTIN
304-558-2316

***117135329 904-964-3777**
DYNATEST CONSULTING INC
PO BOX 337
STARKE FL 32091

DIVISION OF HIGHWAYS
MATERIALS, CONTROL, SOILS,
& TESTING
190 DRY BRANCH DRIVE
CHARLESTON, WV
25306 304-558-8984

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B	FREIGHT TERMS
08/19/2007				

BID OPENING DATE: **09/12/2007** BID OPENING TIME **01:30PM**

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
0001	1	EA		845-63	\$154,861.00	\$154,861.00
PAVEMENT FRICTION TESTER TO PROVIDE A PAVEMENT SKID FRICTION TEST SYSTEM PER THE ATTACHED SPECIFICATION. VENDOR PREFERENCE CERTIFICATE CERTIFICATION AND APPLICATION* IS HEREBY MADE FOR PREFERENCE IN ACCORDANCE WITH WEST VIRGINIA CODE, 5A-3-37 (DOES NOT APPLY TO CONSTRUCTION CONTRACTS). A. APPLICATION IS MADE FOR 2.5% PREFERENCE FOR THE REASON CHECKED: <input type="checkbox"/> BIDDER IS AN INDIVIDUAL RESIDENT VENDOR AND HAS RESIDED CONTINUOUSLY IN WEST VIRGINIA FOR FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION; OR <input type="checkbox"/> BIDDER IS A PARTNERSHIP, ASSOCIATION OR CORPORATION RESIDENT VENDOR AND HAS MAINTAINED ITS HEAD-QUARTERS OR PRINCIPAL PLACE OF BUSINESS CONTINUOUSLY IN WEST VIRGINIA FOR FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION; OR 80% OF THE OWNERSHIP INTEREST OF BIDDER IS HELD BY ANOTHER INDIVIDUAL, PARTNERSHIP, ASSOCIATION OR CORPORATION RESIDENT VENDOR WHO HAS MAINTAINED ITS HEADQUARTERS OR PRINCIPAL PLACE OF BUSINESS CONTINUOUSLY IN WEST VIRGINIA FOR FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION; OR						

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE: *[Signature]* TELEPHONE: **1-734-729-0400** DATE: **Sept 11, 2007**

TITLE: **V.P.** FEIN: **95-33-23707** ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

**GENERAL TERMS & CONDITIONS
REQUEST FOR QUOTATION (RFQ) AND REQUEST FOR PROPOSAL (RFP)**

1. Awards will be made in the best interest of the State of West Virginia.
2. The State may accept or reject in part, or in whole, any bid.
3. All quotations are governed by the *West Virginia Code* and the *Legislative Rules* of the Purchasing Division.
4. Prior to any award, the apparent successful vendor must be properly registered with the Purchasing Division and have paid the required \$125.00 registration fee.
5. All services performed or goods delivered under State Purchase Orders/Contracts are to be continued for the term of the Purchase Order/Contract, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise available for these services or goods, this Purchase Order/Contract becomes void and of no effect after June 30.
6. Payment may only be made after the delivery and acceptance of goods or services.
7. Interest may be paid for late payment in accordance with the *West Virginia Code*.
8. Vendor preference will be granted upon written request in accordance with the *West Virginia Code*.
9. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.
10. The Director of Purchasing may cancel any Purchase Order/Contract upon 30 days written notice to the seller.
11. The laws of the State of West Virginia and the *Legislative Rules* of the Purchasing Division shall govern all rights and duties under the Contract, including without limitation the validity of this Purchase Order/Contract.
12. Any reference to automatic renewal is hereby deleted. The Contract may be renewed only upon mutual written agreement of the parties.
13. **BANKRUPTCY:** In the event the vendor/contractor files for bankruptcy protection, this contract is automatically null and void, and is terminated without further order.
14. **HIPAA Business Associate Addendum** - The West Virginia State Government HIPAA Business Associate Addendum (BAA), approved by the Attorney General, and available online at the Purchasing Division's web site (<http://www.state.wv.us/admin/purchase/vrc/hipaa.htm>) is hereby made part of the agreement. Provided that, the Agency meets the definition of a Covered Entity (45 CFR §160.103) and will be disclosing Protected Health Information (45 CFR §160.103) to the vendor.

INSTRUCTIONS TO BIDDERS

1. Use the quotation forms provided by the Purchasing Division.
2. **SPECIFICATIONS:** Items offered must be in compliance with the specifications. Any deviation from the specifications must be clearly indicated by the bidder. Alternates offered by the bidder as **EQUAL** to the specifications must be clearly defined. A bidder offering an alternate should attach complete specifications and literature to the bid. The Purchasing Division may waive minor deviations to specifications.
3. Complete all sections of the quotation form.
4. Unit prices shall prevail in cases of discrepancy.
5. All quotations are considered F.O.B. destination unless alternate shipping terms are clearly identified in the quotation.
6. **BID SUBMISSION:** All quotations must be delivered by the bidder to the office listed below prior to the date and time of the bid opening. Failure of the bidder to deliver the quotations on time will result in bid disqualifications.

SIGNED BID TO:

Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

RECEIVED

2007 SEP 11 A 9:19

PURCHASING DIVISION
STATE OF WV



State of West Virginia
 Department of Administration
 Purchasing Division
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VENDOR

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 STARKE FL 32091

SHIP TO

DIVISION OF HIGHWAYS
 MATERIALS, CONTROL, SOILS,
 & TESTING
 190 DRY BRANCH DRIVE
 CHARLESTON, WV
 25306 304-558-8984

DATE PRINTED 08/19/2007	TERMS OF SALE	SHIP VIA	FOB	FREIGHT TERMS
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BID OPENING DATE: 09/12/2007 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
<p>() BIDDER IS A CORPORATION NONRESIDENT VENDOR WHICH HAS AN AFFILIATE OR SUBSIDIARY WHICH EMPLOYS A MINIMUM OF ONE HUNDRED STATE RESIDENTS AND WHICH HAS MAINTAINED ITS HEADQUARTERS OR PRINCIPAL PLACE OF BUSINESS WITHIN WEST VIRGINIA CONTINUOUSLY FOR THE FOUR (4) YEARS IMMEDIATELY PRECEDING THE DATE OF THIS CERTIFICATION.</p> <p>B. APPLICATION IS MADE FOR 2.5% PREFERENCE FOR THE REASON CHECKED:</p> <p>() BIDDER IS A RESIDENT VENDOR WHO CERTIFIES THAT, DURING THE LIFE OF THE CONTRACT, ON AVERAGE AT LEAST 75% OF THE EMPLOYEES WORKING ON THE PROJECT BEING BID ARE RESIDENTS OF WEST VIRGINIA WHO HAVE RESIDED IN THE STATE CONTINUOUSLY FOR THE TWO YEARS IMMEDIATELY PRECEDING SUBMISSION OF THIS BID;</p> <p>OR</p> <p>() BIDDER IS A NONRESIDENT VENDOR EMPLOYING A MINIMUM OF ONE HUNDRED STATE RESIDENTS OR IS A NONRESIDENT VENDOR WITH AN AFFILIATE OR SUBSIDIARY WHICH MAINTAINS ITS HEADQUARTERS OR PRINCIPAL PLACE OF BUSINESS WITHIN WEST VIRGINIA EMPLOYING A MINIMUM OF ONE HUNDRED STATE RESIDENTS WHO CERTIFIES THAT, DURING THE LIFE OF THE CONTRACT, ON AVERAGE AT LEAST 75% OF THE EMPLOYEES OR BIDDERS' AFFILIATE'S OR SUBSIDIARY'S EMPLOYEES ARE RESIDENTS OF WEST VIRGINIA WHO HAVE RESIDED IN THE STATE CONTINUOUSLY FOR THE TWO YEARS IMMEDIATELY PRECEDING SUBMISSION OF THIS BID.</p> <p>BIDDER UNDERSTANDS IF THE SECRETARY OF TAX & REVENUE DETERMINES THAT A BIDDER RECEIVING PREFERENCE HAS FAILED TO CONTINUE TO MEET THE REQUIREMENTS FOR SUCH PREFERENCE, THE SECRETARY MAY ORDER THE DIRECTOR OF PURCHASING TO: (A) RESCIND THE CONTRACT OR PURCHASE ORDER ISSUED; OR (B) ASSESS A PENALTY AGAINST SUCH</p>						

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE TELEPHONE 1-734-729-0400 DATE Sept 11, 2007

TITLE V.P. FEIN 95-33-23707 ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'



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LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
<p>BIDDER IN AN AMOUNT NOT TO EXCEED 5% OF THE BID AMOUNT AND THAT SUCH PENALTY WILL BE PAID TO THE CONTRACTING AGENCY OR DEDUCTED FROM ANY UNPAID BALANCE ON THE CONTRACT OR PURCHASE ORDER.</p> <p>BY SUBMISSION OF THIS CERTIFICATE, BIDDER AGREES TO DISCLOSE ANY REASONABLY REQUESTED INFORMATION TO THE PURCHASING DIVISION AND AUTHORIZES THE DEPARTMENT OF TAX AND REVENUE TO DISCLOSE TO THE DIRECTOR OF PURCHASING APPROPRIATE INFORMATION VERIFYING THAT BIDDER HAS PAID THE REQUIRED BUSINESS TAXES, PROVIDED THAT SUCH INFORMATION DOES NOT CONTAIN THE AMOUNTS OF TAXES PAID NOR ANY OTHER INFORMATION DEEMED BY THE TAX COMMISSIONER TO BE CONFIDENTIAL.</p> <p>UNDER PENALTY OF LAW FOR FALSE SWEARING (WEST VIRGINIA CODE 61-5-3), BIDDER HEREBY CERTIFIES THAT THIS CERTIFICATE IS TRUE AND ACCURATE IN ALL RESPECTS; AND THAT IF A CONTRACT IS ISSUED TO BIDDER AND IF ANYTHING CONTAINED WITHIN THIS CERTIFICATE CHANGES DURING THE TERM OF THE CONTRACT, BIDDER WILL NOTIFY THE PURCHASING DIVISION IN WRITING IMMEDIATELY.</p> <p>BIDDER: <u>DYNATEST CONSULTING INC</u></p> <p>DATE: _____</p> <p>SIGNED: <u>[Signature]</u></p> <p>TITLE: <u>V.P.</u></p> <p>* CHECK ANY COMBINATION OF PREFERENCE CONSIDERATION(S)</p>						

SEE REVERSE SIDE FOR TERMS AND CONDITIONS			
SIGNATURE	TELEPHONE	DATE	
<u>[Signature]</u>	1-734-729-0400	5 Sept. 2007	
TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE	
V.P.	95-33-23707		

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LINE	QUANTITY	UOP	CAT NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
<p>IN EITHER "A" OR "B", OR BOTH "A" AND "B" WHICH YOU ARE ENTITLED TO RECEIVE. YOU MAY REQUEST UP TO THE MAXIMUM 5% PREFERENCE FOR BOTH "A" AND "B". (REV. 12/00)</p> <p style="text-align: center;">NOTICE</p> <p>A SIGNED BID MUST BE SUBMITTED TO:</p> <p style="text-align: center;">DEPARTMENT OF ADMINISTRATION PURCHASING DIVISION BUILDING 15 2019 WASHINGTON STREET, EAST CHARLESTON, WV 25305-0130</p> <p>THE BID SHOULD CONTAIN THIS INFORMATION ON THE FACE OF THE ENVELOPE OR THE BID MAY NOT BE CONSIDERED:</p> <p>SEALED BID</p> <p>BUYER: 43</p> <p>RFQ. NO.: 7770054</p> <p>BID OPENING DATE: 09/12/2007</p> <p>BID OPENING TIME: 1:30 PM</p> <p>PLEASE PROVIDE A FAX NUMBER IN CASE IT IS NECESSARY TO CONTACT YOU REGARDING YOUR BID: ----- 1-734-729-0401 -----</p>						

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE <i>[Signature]</i>	TELEPHONE 1-734-729-0400	DATE Sept 11, 2007
TITLE V.P.	FEIN 95-33-23707	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'



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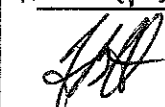
*117135329 904-964-3777
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BID OPENING DATE: **09/12/2007** BID OPENING TIME **01:30PM**

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
CONTACT PERSON (PLEASE PRINT CLEARLY): <i>FRANK B. HOLT</i>						
***** THIS IS THE END OF RFQ 7770095 ***** TOTAL:						<i>\$154,861.00</i> 

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE 	TELEPHONE 1-734-729-0400	DATE Sept 12, 2007
TITLE U.P.	FEIN 93-33-73707	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

1.0 SYSTEM DESCRIPTION

The Pavement Skid Friction Test System measures the coefficient of friction of pavements using a Locked Wheel in accordance with ASTM standard E274.

The system consists of a specially equipped vehicle and a specially equipped towed two-wheeled trailer.

The trailer uses an ASTM standard ribbed or blank test tire, which can be pulled over a paved surface by the truck at a constant velocity while a nozzle dispenses water in front of the tire to simulate wet conditions. The test wheel of the trailer is coupled by a disc brake assembly to a calibrated force transducer, which measures the traction force and load on the wheel under braking. The electrical/mechanical devices in the trailer are controlled by the computer system electronics in the pickup truck in combination with switches on an operator's control console.

The truck cab contains an on-board computer system that controls all skid friction testing operations and performs all necessary data logging functions. The computer system, herein referenced as the Mobile Data Recorder (MDR), in conjunction with the remaining components of Pavement Skid Friction Test System is capable of:

- (1) Interfacing with the operator
- (2) Controlling the tests
- (3) Measuring and digitizing the necessary resultant test signal data
- (4) Recording the resultant test data on IBM-PC compatible media
- (5) Calculating and storing the friction values
- (6) Displaying the stored digitized friction data
- (7) Printing the stored data upon operator request

when conducting tests to measure the friction characteristics of paved surfaces using a full-scale tire in accordance with ASTM E274, Standard Test Method for Skid Resistance of Paved Surfaces Using a full-scale Tire.

The vehicle contains a water system which supplies water to the test trailer, an air system to provide control assistance, electronics to control the test operations, electrical equipment to supply the required DC power to the test system, and a computer system to activate tests and record the measured data.

In typical testing, the driver of the truck maintains the desired test speed then activates a test where the equipment (1) dispenses water at the trailer wheel, (2) actuates the trailer braking system to lock up the wheel, (3) detects the resultant wheel traction force, wheel load, and vehicle speed and (4) uses the resulting force time information to determine the friction of pavement for the standard test tire. The friction value detected can be recorded with the milepost where the test was activated.

The ASTM specification requires only single wheel testing and the equipment users only test with one wheel.

All connections between the vehicle and the trailer are quick disconnect to allow easy and complete separation of the vehicle from the trailer. The static download at the hitch point is designed to be 100 to 200 pounds. The static download at each test wheel is designed to be 1,085 +/- 15 pounds. A third adjustable height support wheel is located on the trailer near the tongue to support the front of the trailer when disconnected from the truck.

2.0 TRAILER DESCRIPTION

The trailer completely disconnects from the truck. This is easily accomplished via quick disconnects and hand tight screw fittings. The trailer has a front compartment which houses a spare tire and electrical components plus a rear compartment which contains the air and hydraulic brake control equipment. Gas shocks are used to assist the opening and closing of the aluminum covers over each compartment. The covers provide easy access while creating environmental protection. Four flashing lights are provided on the trailer rear cover. Two flexible antennas are mounted on the rear bumper to indicate the rear position of the trailer. Corvette type disk brakes are used to provide quick lockups during testing.

2.1 TRAILER CONSTRUCTION

The trailer has a perimeter type frame constructed of two by four inch rectangular box sectional steel tubing. The tongue is a four-inch box section with a two-inch ball coupler. The construction gives solid rigidity with low weight for minimum wheel load. Weights are added to bring the trailer load at the wheels into ASTM specifications. A third adjustable height support wheel is located on the trailer tongue area to support the front of the trailer when disconnected from the truck.

2.2 TRAILER SUSPENSION

The trailer suspension is a parallelogram trailing arm design, with adjustable upper control arms and fixed lower control arms on each side. Pivot points are hard spherical bushing or universal joints to minimize rotation of the axle and provide free motion. Coil springs, air adjustable shocks, and an adjustable anti-sway bar complete the suspension components. The suspension system shall allow any transducer cross-talk to be removed without touching the transducer's mounting hardware.

2.3 TRAILER TRANSDUCERS

The trailer contains transducers to measure wheel speed, traction, load, and provides control for braking and optional water flow in a two-wheel system.

2.3.1 TRAILER WHEEL SPEED TRANSDUCERS

The speed of each trailer wheel is measured by a special digital pulse generator located on the outside of each rotor. The DMI reads pulses created by precisely machined notches in the rotor. The DMI is fully contained outside the axle/spindle assembly. The DMI is capable of being fully serviced without removing the spindle assemblies from the trailer. The speed resolution

and accuracy is +/- 0.1% per mile. The speed signals are routed to the electronics in the vehicle cab and viewable on both the computer screen and a dash mounted digital voltmeter. The speed of both wheels is simultaneously recorded at the time of rest.

2.3.2 TRAILER FORCE/LOAD TRANSDUCERS

The transducers that measure force and load at each wheel are strain gage bridges mounted on a single stainless steel assembly. The transducer is mounted between the spindle and the wheel assemblies and an instrumentation connector is used to connect to the trailer wiring. The bridge requires that voltage be applied across it during operation and that its output be amplified from microvolt levels to that required by the data acquisition equipment. The trailer wiring routes the signals to the truck connectors and forward to the computer/electronics which provides all voltages and signals conditioning. Transducer/Bridges may be present at either or both wheels as required but only one shall be selected at a time.

The transducer measures force in two orthogonal directions and must be oriented so these directions are along the road surface and perpendicular to the road surface. The orientation is accomplished by slotted hole with four locking bolts to insure alignment with the trailer tongue. After alignment the force transducers are protected by means of a stone shield, straps, and tape.

The calibrated transducer is designed to meet the requirements ASTM E274. It will have less than 1% non-linearity and hysteresis when subjected to torsion load only, and less than 1% cross-talk under 1,000 lbs. load in bending. Calibration shunt resistors are contained in the computer system for monitoring the signal calibration.

2.4 TRAILER BRAKING SYSTEM

The braking system is air over hydraulics and provides two pressures. A lower safety brake pressure is applied to both brakes for normal stopping which a separate high pressure can be applied to the wheel during testing. Corvette disk brakes are used to provide quick lockups.

3.0 TOW VEHICLE DESCRIPTION

The tow vehicle is a one ton dual rear-wheel extended cab pickup truck. The vehicle supports up to a 300-gallon water tank fully loaded and has enough power to perform testing fully loaded at speeds up to the maximum speed limit allowed by law on a level terrain.

The tow vehicle supplies all the mechanical and electrical power required to perform testing and contains several support systems. The support systems include the electrical system, the watering system, the air compressor/storage system, and the Computer/Electronics System.

Standard WVDOT vehicle paint color is white. The vehicle also contains a spare truck tire and a fiberglass bed cover.

Training – 2 days of on-site training of operators and maintenance crews will be included. (Training to be conducted at WVDOT facilities in Charleston, West Virginia)

Include a GPS system so test locations can be mapped and entered in the Departments GIS system.

System will be delivered to the following address:

WVDOT
190 Dry Branch Road
Charleston, West Virginia 25306

3.1 ELECTRICAL SYSTEM

The electrical system consists of a System Control Panel, a trailer mounted digital capture system, an aux. battery, a cab roof mounted warning light, a speaker system, a connector panel at the rear bumper and a main wiring harness.

3.1.1 SYSTEM CONTROL PANEL

The system control panel is located to the right of the driver under the monitor easily accessible to the driver/operator. The control panel houses components including the operator switches, control relays, terminal blocks, fuses, etc., which provide the most basic power control functions. The main control functions are provided by the computer system via the control panel wiring. The floppy disk drives are also conveniently located on the system control panel.

Switches and indicators which the operator can use are mounted on the front of the control panel. The switches and indicator are as follows:

- (1) **Power Switch** – Turns on the power to the computer system and electronic power supplies.
- (2) **Air Pump/Aux Power Switch** – Applies DC power to the air compressor, and DC components in the truck and trailer. Must be on to maintain air in reservoir (tank) for brake application for both manual and computer operation.
- (3) **Air On Light** – Indicates air compressor is on.
- (4) **Safety Brake Switch** – Manually applies safety brakes to the trailer.
- (5) **Cycle Start** – An automatic cycle may be initiated by depressing push button.
- (6) **Remote Cycle Start** – External jack on side of control panel where cord with hand held push button may be plugged in to allow cycle start.
- (7) **Cycle Kill/Stop Push-Button** – Actuation stops the automatic cycle when desired.
- (8) **Beacon and Flashers On/Off** – turns on truck beacon and trailer flashers.

(9) **Jacks Power** – Supply power so trailer jacks may be used.

(10) **Water Level** – Indicator lights that display the amount of water located in the water tank. (Top, Mid, Bottom)

3.1.2 WARNING LIGHT

A warning light powered from the standard vehicle batter is mounted on the truck cab roof, which may be turned on via the control panel.

3.1.3 REAR BUMPER CONNECTOR PANEL

Screw type waterproof connectors are provided at the rear bumper to allow the truck and trailer to easily be disconnected. One connector is provided for control signals and lighting which the second is provided for data signals.

3.1.4 MAIN WIRING HARNESS

The main wiring harness is contained in conduit and connects the truck cab area to the truck bed and rear bumper connector panel. Spare wires are provided which all used wires are terminated in connectors or terminals.

3.2 WATERING SYSTEM

The watering system consists of a water tank mounted in the vehicle, water-pumping unit mounted under the vehicle, and plumbing under the vehicle.

3.2.1 WATER TANK

The water tank is either a 250-350 gallon tank constructed of welding aluminum. The tank contains baffles and an overflow for proper water handling. The tank top is screwed down to the side panels and sealed with a silicon sealer to prevent leaks. The top may be removed for complete access to the tank. An optional water level indicator provides a minimum of three water level indications.

3.2.2 WATER PUMPING UNIT

The water-pumping unit is driven from the drive shaft of the vehicle using a gear belt pulley and electrical clutch. The output of the clutch drives a positive displacement pump, which provides water under computer control via the electric clutch activation. An adjustable driven balancing gear unit is used to eliminate vibration at the drive shaft. A petcock valve is provided at the pump to provide water pump drainage. All water delivery components are mounted to pillow blocks, which ride on a cradle assembly. The components are tied together with a special adjustment rod, which adjusts all components simultaneously.

3.2.3 PLUMBING

The plumbing consists of all rust free components of either brass, stainless steel, or rubber tubing. A strainer and dump valve are located at the tank output near the vehicle side for ease of use. A Hansen quick disconnect fitting is used at the rear bumper to allow for the easy separation of vehicle and trailer.

3.3 AIR COMPRESSOR/STORAGE SYSTEM

The air compressor/storage system consist of a compressor system mounted in the vehicle and two air storage tanks mounted under the vehicle in the rear providing 20 gallons of air storage. The system contains a filter, dryer, control valve, safety valve and oiler in the supply airline. A quick disconnect fitting is provided at the vehicle bumper for easy connection to the trailer. A drain is provided on each tank.

4.0 COMPUTER/ELECTRONICS SYSTEM GENERAL DESCRIPTION

The computer system is mounted between the seats in the tow vehicle cab while the analog to digital conversion electronics are mounted in a protective enclosure in the trailer. All signals from sensing devices in the skid trailer are converted into digital signals in the trailer and sent to the recording electronics in the vehicle cab. The trailer mounted digital conversion eliminates any potential signal loss or device error due to wiring harness length.

The distance measurement is accomplished using a pulse generator mounted in the transmission or the rear differential assembly of the vehicle. The system has a method of calibration to ensure accurate measurement of roadway distance. The accuracy of the system can be calibrated to $\pm 0.1\%$ per mile.

The system supplied for friction testing performs in a real-time, interactive, vehicle environment, which may include a two-way radio, flashing lights, speaker system, and other potential noise sources. The equipment when combined with the sensors on the trailer and transport vehicle tracks the location of the test vehicle, controls the friction tests being performed, displays the test results, and displays vehicle location on the system monitor. Collection and display of roadway feature data and friction test data shall occur in real-time.

4.1 GENERAL DESIGN PARAMETERS

The system is designed to meet the following general requirements:

- (a) The system operates satisfactorily in the rugged environment of the transport vehicle used for friction testing.
- (b) The system operates satisfactorily in all typical climatic conditions when installed in the transport vehicle.

- (c) The system allows testing to be safely performed in the field without hindrance to on-going traffic.
- (d) The system integrity or location measurement accuracy is not compromised and testing may be performed at vehicle speeds up to 65 MPH.
- (e) The system is capable of storing test results and measured feature locations in real-time.
- (f) The system measures data in feet, kilometers, or miles in an incrementing or decrementing mode from an arbitrary starting point.
- (g) Operating temperature range is 34 to 110 degrees F, non-operating temperature range shall be 32 to 140 degrees F.
- (h) Operating temperature range is 8% to 80% (non-condensing), non-operating humidity range is 5% to 95% (non-condensing) non-operating.
- (i) Operating power is +12VDC @ 30A supplied by test vehicle electrical system. Vehicle DC is converted to 110 VAC for required components.

4.2 COMPONENTS AND BLOCK DIAGRAM

All test activities are automated by and consolidated in the database management, vehicle location tracking, friction testing, data display.

The system utilizes an IBM-PC at compatible microcomputer with a SVGA controller for high resolution graphics, USB drive, a CDRW drive and a hard drive as the Processing Unit.

4.2.1 COMPUTER SYSTEM

The computer system meets the following minimum specifications:

- (a) IBM-PC at compatible system – Pentium microprocessor based design using a single industrial hardened processor board with:
 - 1) 128 Mbytes of RAM memory
 - 2) Two RS-232C Serial Ports (One is dedicated to DAS)
 - 3) One IBM compatible Parallel Port
 - 4) One CDRW
 - 5) Battery-backed up real-time Clock
 - 6) USB Drive and Hard disk
- (b) Windows XP operating system
- (c) USB drive

- (d) A high resolution SVGA graphics controller
- (e) A 200 Gbyte minimum hard disk drive
- (f) Power requirements: 110 VAC

The configuration contains at least three (3) expansion slots free for future expansion.

4.2.2 DATA DISPLAY

A high-resolution color flat panel display provides the test operator with relevant displays for conducting test operations. Menus presented on the Data Display permit the operator to configure the system as required before a test run.

The following apply:

- (a) 15" (diagonally measured) active matrix color display
- (b) Power – 110 VAC

4.2.3 KEYBOARD

The system has a detached, IBM-PC at miniature microcomputer style keyboard with track-pad for operator control of the system. The keyboard is used by the test operator to configure the system for test activities and to edit the data as required. A subset of the Event Board keys is also implemented so that keyboard can be used for test activities.

4.2.4 DATA ACQUISITION SUBSYSTEM (DAS)

All real-time verification activities are coordinated by the Data Acquisition Subsystem (DAS) contained in the trailer. The DAS provides the interface between the processing unit and all other functions (including those on the trailer) controlled by the computer system. Signals are cabled to conditioning modules located in the test trailer and control panel then are then are passed to the computer I/O modules. The computer system derives distance, speed, traction, and load from transducers (including strain gage bridges) mounted in the trailer; activates the trailer water and brakes; interfaces to the control panel i.e. read switches, output to indicators; derives distance and location information from the transmission distance transducer, process operator inputs from the Event Keyboard and control panel signaling that the test vehicle has encountered a significant feature; and passes information on the feature and its location to the processing unit for display and logging.

The following are provided by the DAS subsystem:

- (a) Interface and control routines in Main Program

(b) IBM-PC compatible plug-in module(s) with

- 1) 12 Bit 8 Channel A/D Converter
- 2) DMA interface with host
- 3) 5 Counter-Timers for A/D Conversion and event timing
- 4) 8 Digital I&O for Control Panel Interface
- 5) One Event Board interface
- 6) One Distance Pulse Generator Interface

(c) Analog Conditioning Interface with channels for

- 1) Traction inputs
- 2) Two Load Inputs
- 3) Two Tachometer Speed Input
- 4) One internal event state signal for Test Verification

(d) Measured distance accurate to 0.1% per mile for transport vehicle speeds up to 65 MPH

(e) Output to control brakes, water, and signal selection

(f) System power control

(g) Power: +5VDC, +12VDC, -12VDC supplied by Processing Unit

The transmission distance transducer provides the computer system with a pulse for each unit of distance traveled by the vehicle on the roadway. The computer system processes these pulses to arrive at a meaningful indication of distance traveled and vehicle speed. The computer system also receives signals from the friction trailer tachometers(s) for wheel speed. These are checked against vehicle speed calculated from the vehicle distance pulses in calibration and checkout. The system processes the signals and records the data from the unit(s) selected by the operator.

4.2.5 PRINTER

An ink-jet printer is used to produce hardcopy of various data during test operations.

The printer provides the following minimum requirements:

- (a) HP Laser or Ink Jet Printer
- (b) IBM-PC compatible Centronics parallel interface
- (c) IBM-PC compatible dot-addressable graphics
- (d) Power: 110VAC

4.2.5.1 EVENT BOARDS

The Event Board can be the primary user interface for test control and roadway feature entry as the vehicle travels along the roadway. Specific Event Board keys can be associated with each of the possible eventing modes and monitored by the DAS. Operator actuation of a key signals the DAS that the test vehicle has encountered a roadway feature or a test event takes place which requires actions appropriate to the type of function associated with the key. A 56 key two-hand event board or a smaller one-hand event board can be provided for operator(s) use.

4.2.5.2 TWO HAND 56 KEY EVENT BOARD

The following apply:

- (a) 56-key membrane keyboard
- (b) Key-pressed audible feedback
- (c) Power: +5VDC supplied by DAS

4.2.5.3 ONE HAND EVENT BOARD

The operator can be provided a one-hand data entry device. All lettering on the unit is large enough to be read by the operator at a glance.

After the operator has entered pertinent information prior to the testing of a roadway, the event board can be used to perform the functions listed below:

Initiate Testing

- 1) Initiate test
- 2) Abort or stop test
- 3) Start distance measurements
- 4) Stop distance measurements
- 5) Reset to start milepost (and set up distance increment)
- 6) Reset to end milepost (and set up distance decrement)

Mark Physical Roadway Features:

- 7) Identify milepost location of pavement change
- 8) Identify milepost location of bridge start
- 9) Identify milepost location of bridge end
- 10) Identify milepost location of intersection
- 11) Landmark a point for reference to a physical feature

Additionally, the unit is capable of expansion to support at least four (4) unspecified functions. These functions and/or similar functions can be provided as requirements change.

The following apply:

- (a) 16-key keyboard that fits in one hand
- (b) Key-pressed audible feedback
- (d) Power: +5VDC supplied by DAS

The system is designed so that the operation of the friction test vehicle can be performed by one individual using system control panel switches provided to initiate the test cycle and kill the test cycle. The operator is responsible for maintaining the test speed, observing accumulated data, distance, physical locations, and input as required during testing. Friction tests are conducted in urban and rural areas, under adverse driving conditions in some cases, usually at 40 miles per hour. Tests and kills may also be initiated from the computer keyboard and event board for ease of operation. A two-person operation is also provided where the second person can use both the keyboard and two hand event board.

All data is displayed to the operator on the CRT screen for data input, calibration, and monitoring vertical and horizontal transducer output signals. Gain and zeroing adjustments that are necessary for load and friction number calibration are automatically adjusted by the system when possible at calibration. Added adjustment controls are provided on the console panel for use prior to auto adjustment.

5.0 SYSTEM FUNCTIONAL SOFTWARE MODULES

The computer system contains all the necessary software modules to allow an operator to perform all tasks necessary to perform friction testing with or without a RFF file. The software can operate within the normal Windows XP operating system and can remain in control until the system is shut down by the operator. The system provides software to perform automatic execution, perform program initialization, allow operator selection of the required system operations and perform all of the required system operation functions to provide the operation of the friction testing.

5.1 PROGRAM INITIALIZATION

The software provides a central program initialization function, which is loaded by Windows. The program initialization performs start-up initialization, initialize program control parameters, and activate a start-up self test, which requires no operator input. If the start-up self test has indicated a NO-GO, the result of the test is displayed to the operator with a message to take some action. If the results of the start-up self test are GO, the operation selection function is activated with the Main Menu automatically selected.

5.2 OPERATION SELECTION

The operation selection function displays a main menu of system operations functions, which can be performed when selected by the operator. The main menu selection instructions are displayed

to the operator along with the main menu choices. The selection is provided via the computer keyboard and/or on the 56 key event board. Less than eight functions are displayed.

5.3 SYSTEM OPERATION FUNCTIONS

The system provides operation functions selected by the operator main menu. The system operation functions provide everything necessary for the operator to perform friction testing in a user friendly manner. The system operations include functions to (1) save parameters to disk and perform system shutdown, (2) perform a system self test, (3) perform all file manipulations required for operations, (4) allow ID's (such as driver, operator, and vehicle) and parameters to be saved and changed, (5) perform friction test control setup (6) provide operator activated distance calibration, bridge calibration, water flow calibration, (7) provide a friction test operation mode, save and display test results, (8) show the test status and (9) provide a distance movement simulation which exercise the functional systems.

5.3.1 SHUTDOWN

The system operation software provides a system shutdown which is operator activated via the keyboard. Prior to returning to Windows, the system saves all active parameter data so it may be restored when the program is restarted.

5.3.2 SELF-TEST

The system operational software provides a self test function which tests 65% of the system without operator action, and 90% of the system with operator action and decisions. Self test is usable with or without the movement simulation function. Self test guides the operator through all required input via the monitor selections. The test mode can provide verification for operation of the computer, the monitor, the keyboard, the DAS, the event board, the printer, and distance sensor.

5.3.3 FILE OPERATIONS

The operational system software provides all file operations necessary to perform all aspects of selecting a RFF file, saving test results, and creating a TRF. This includes creating and copying out RFF files, TRF files, log files, and parameter files without the operator using direct commands. All instructions for operator action and all file operation results are displayed on the monitor to the operator. The READ after WRITE verify is used for all disk write operations.

5.3.4 CHANGE ID'S AND PARAMETERS

The system maintain parameters in the program file which can be used to save calibration data, ID's for the vehicle, driver and operator, date and time used, test location data, etc., and information about the files on disk. The system displays the ID's to the operator by operator selection and saves new entries in the program file.

The system contains provisions to accept up over 20 variables similar to those listed below from the operator prior to the beginning of testing of a roadway section. The software insures that the operator enters all required variables. Numeric variables default to ascii zeros. Alpha variables default to blanks. The variable data is saved in the TRF files along with the test data for further post processing.

Abbreviations: A = alphabetic N = numeric

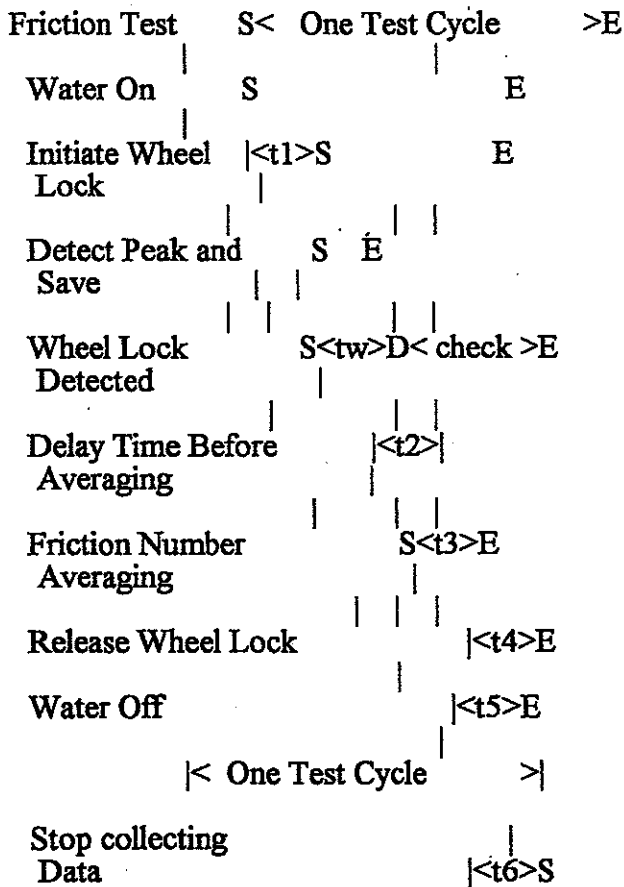
<u>VARIABLE</u>	<u>LENGTH</u>	<u>TYPE</u>	<u>EXAMPLE</u>
1) Calendar Date	8	A/N	02/12/86
2) Job Number	4	N	3433
3) State Road Number	5	A/N	26A
4) District	1	N	1
5) County Section Number	5	N	26260
6) Sub Section Number	4	N	3433
7) Beginning Milepost	6	A/N	99.999
8) Lane Tested	10	A	Traf
9) Milepost Count Up/Dn	1	A	U=up d=down
10) Number of Lanes	2	N	04
11) Day/Night	5	A	Night
12) Weather	6	A	Cloudy
13) Air temperature	3	N	95
14) Unit Number	2	N	01
15) Operators Initials	3	A/N	AMS
16) Request Type	1	N	5
17) Surface	2	N	26
18) Direction	5	A	North
19) Data File Name	(as required)		
20) Calibration Factors	(as required)		

5.3.5 FRICTION TESTS CONTROL SET UP

The friction test control set up function receives, displays, stores, and records basic information to control the automatic friction test cycle entered by the operator. The test cycle is performed as given in the Friction Test Timing Diagram, Figure 5-2. The values are entered by the operator in a test set up mode when chosen by the operator. The parameters are stored on a hard disk and loaded each time the test system is activated. The operator is able to (1) set the amount of time the water is on before the trailer brake is applied to lock the wheel (t1), (2) set the amount of time after the wheel is locked until data averaging starts (t2), (3) set the amount of time data averaging is performed (t3), (4) set the amount of time after data averaging stops until the brake is unlocked (t4), (5) set the amount of time after the brake is unlocked until the water is turned off (t5) and (6) set the amount of time after the water is turned off until the test data is stopped being collected (t6). The operator is able to set a time (tw) to determine the wheel lock is not occurring and cause a warning. The operator is also able to select a dry test without water being used with the rest of the cycle being the same. Values that meet the requirements of ASTM 274-90 are used as initial values in the program prior to the operator making any changes in the timing. The operator may review and modify the values if desired.

Figure 5-2

FRICITION TEST TIMING DIAGRAM



Note: A second test cycle can be initiated after t_6 if the successive test is being requested by the operator.

S - Start of Event E - End of Event

D - Wheel Lock Detected

< check > - System Verifies Wheel is Locked

5.3.6 CALIBRATION

The operational system software allows the operator to perform a distance sensor calibration and use the calculated factor to perform the operational distance measurements and speed calculations. The calibration software also allows the operator to save the factor calculated or change the calibration factor to other than the calculated value. The software also enters the calibration value into the program file from which it can be used to make file header entries. The operator only needs to enter the distance traveled in feet, kilometers, or miles and not make any calculations to determine the calibration factor.

5.3.7 FRICTION TESTING

The operational system software provides all necessary functions for the operator to select and perform friction testing for a specific route in a county. The software determines both an average friction value during the time interval shown plus determines the peak friction value during the test cycle. The software also detects abnormal conditions in the test result data and reports the condition to the operator. The friction testing software saves the test result data and measured cartographic features in memory during friction testing and outputs them to disk after the data has been saved by operator action.

The friction test software activates the friction test cycle using the timing and control parameters stored by the friction test control set up software. The software monitors the signal to verify that the test was performed properly with the wheel locked, the average change normal and water flow normal. Abnormal test cycle data is stored for later operator review on the CRT.

The friction test software can receive, display, store and print load, traction (and water flow signals where available) received from transducers.

The friction test software can receive, display, store and print with each friction test corresponding distance (milepost) and test speed. Free wheeling tachometers are located on each trailer axle to measure speed. A pulse generator is associated with vehicle transmission to measure distance. The unit can select one of the tachometers for the test speed under operator control. The system obtains the test speed from the wheel not being locked. The selected sensor is displayed to the operator and its ID recorded with the test data.

The friction test software can receive, display, store and print pertinent and physical data relating to test site (key entry) observed during testing of a roadway, e.g., posted speed limit changes, surface changes, bridges, etc. The corresponding milepost is stored at the time of key entry.

The system is capable of calculating, displaying, and storing the peak and average friction value obtained from the received signals recorded (load and traction). Additionally, the system is capable of putting the accumulated friction test results through mathematical equations and printing results when enabled by the operator. For example, accumulated data would be placed

through a statistical analysis to determine N count, mean value (X), standard deviation (S), high friction value and low friction value.

The display of vehicle speed and current milepost data is very important to the operator. As stated earlier, the speed is displayed continuously on the dash mounted digital voltmeter during testing.

The current milepost is displayed constantly on the CRT during testing also. After the friction test cycle is completed and the friction number is computed, the milepost location of the brake lockup is displayed.

After the friction test cycle is complete, the operator is able to read the milepost location, average test speed during lockup, friction number and test validity.

The production of the friction number is the purpose of the friction test. The formula used for the calculation of the friction number is:

$$FN = F/W \times 100$$

where:

f = traction force, (horizontal force applied to the test tire at the tire-pavement contact patch), in pounds per foot (lbf)

w = the dynamic vertical load on the test wheel, pounds per foot (lbf).

After the test results are recorded, upon command, accumulated data can be processed through a mathematical equation to determine the following by section and/or route.

Number of Tests	N
Mean FN	X
Standard Deviation	S
High Friction Value	H
Low Friction Value	L

Note: The operator can command this or override the process depending on the situation.

When enabled by the operator, all recorded test results can be reported so that the data recorded on media can be verified.

5.3.8 SIMULATOR ON/OFF

The operational system software utilizes a distance pulse simulator feature. The software can provide for the simulator to be turned OFF or ON by operator selection. The status of the simulator is kept in memory. The simulator ON allows the other operational system software to perform normally but does not allow records to be saved in the TRF FILE. The simulation ON indicates the "ON" status to the operator when "ON". The simulator software provides the means to specify the simulation speed up to 65 MPH.

6.0 MOUNTING AND INSTALLATION OF EQUIPMENT

Installation of the equipment includes a mounting arrangement that can be easily used by the driver and operator.

Careful consideration has been given to the mounting and location of equipment. Mounting of equipment has been made in a manner to withstand normal vibrations that occur while traveling at speeds of 0-65 MPH. The location of equipment is accessible to the operator but does not impede safety.

Electronic components are restrained where possible with tie downs or other applicable methods.

6.1 POWER REQUIREMENTS

The power supply used for the microcomputer peripheral devices and remaining test equipment are independent of the electrical system used for normal vehicle functions.

6.2 MANUALS

Upon delivery of the system, the following are typically provided:

- (1) Two copies of operating procedures for all operational software.
- (2) One copy of schematics, block diagrams and wiring diagrams covering electronic circuitry of the new system.
- (3) One copy of parts lists listing the components of all equipment used.

6.3 OPERATOR TRAINING

6.4 ASTM E274

The system is capable of receiving and storing data obtained when conducting skid tests to measure the friction characteristics of paved surfaces using a full-scale tire in accordance with ASTM E274.

6.5 WARRANTIES

The system including any modifications to existing equipment required to produce the system, for a period of not less than 12 months from date of delivery to be free from defects in material and workmanship. This will include any latent software defects detected before and after acceptance of the equipment. Vehicle warranties are passed on to the procuring agency as per the vehicle manufacturer.

7.0 DELIVERY TIME AND PLACE

The delivery time for this vehicle is 180 days from the date it is received by the vender. Delivery address is WVDOT, 190 Dry Branch Road, Charleston, West Virginia 25306.

WV-96
Rev. 5/94

AGREEMENT ADDENDUM

In the event of conflict between this addendum and the agreement, this addendum shall control:

1. **ARBITRATION** - Any references to arbitration contained in the agreement are hereby deleted. Disputes arising out of the agreement shall be presented to the West Virginia Court of Claims.
2. **HOLD HARMLESS** - Any clause requiring the Agency to indemnify or hold harmless any party is hereby deleted in its entirety.
3. **GOVERNING LAW** - The agreement shall be governed by the laws of the State of West Virginia. This provision replaces any references to any other State's governing law.
4. **TAXES** - Provisions in the agreement requiring the Agency to pay taxes are deleted. As a State entity, the Agency is exempt from Federal, State, and local taxes and will not pay taxes for any Vendor including individuals, nor will the Agency file any tax returns or reports on behalf of Vendor or any other party.
5. **PAYMENT** - Any references to prepayment are deleted. Payment will be in arrears.
6. **INTEREST** - Should the agreement include a provision for interest on late payments, the Agency agrees to pay the maximum legal rate under West Virginia law. All other references to interest or late charges are deleted.
7. **RECOUPMENT** - Any language in the agreement waiving the Agency's right to set-off, counterclaim, recoupment, or other defense is hereby deleted.
8. **FISCAL YEAR FUNDING** - Service performed under the agreement may be continued in succeeding fiscal years for the term of the agreement, contingent upon funds being appropriated by the Legislature or otherwise being available for this service. In the event funds are not appropriated or otherwise available for this service, the agreement shall terminate without penalty on June 30. After that date, the agreement becomes of no effect and is null and void. However, the Agency agrees to use its best efforts to have the amounts contemplated under the agreement included in its budget. Non-appropriation or non-funding shall not be considered an event of default.
9. **STATUTE OF LIMITATION** - Any clauses limiting the time in which the Agency may bring suit against the Vendor, lessor, individual, or any other party are deleted.
10. **SIMILAR SERVICES** - Any provisions limiting the Agency's right to obtain similar services or equipment in the event of default or non-funding during the term of the agreement are hereby deleted.
11. **ATTORNEY FEES** - The Agency recognizes an obligation to pay attorney's fees or costs only when assessed by a court of competent jurisdiction. Any other provision is invalid and considered null and void.
12. **ASSIGNMENT** - Notwithstanding any clause to the contrary, the Agency reserves the right to assign the agreement to another State of West Virginia agency, board or commission upon thirty (30) days written notice to the Vendor and Vendor shall obtain the written consent of Agency prior to assigning the agreement.
13. **LIMITATION OF LIABILITY** - The Agency, as a State entity, cannot agree to assume the potential liability of a Vendor. Accordingly, any provision limiting the Vendor's liability for direct damages or limiting the Vendor's liability under a warranty to a certain dollar amount or to the amount of the agreement is hereby deleted. In addition, any limitation is null and void to the extent that it precludes any action for injury to persons or for damages to personal property.
14. **RIGHT TO TERMINATE** - Agency shall have the right to terminate the agreement upon thirty (30) days written notice to Vendor.
15. **TERMINATION CHARGES** - Any provision requiring the Agency to pay a fixed amount or liquidated damages upon termination of the agreement is hereby deleted. The Agency may only agree to reimburse a Vendor for actual costs incurred or losses sustained during the current fiscal year due to wrongful termination by the Agency prior to the end of any current agreement term.
16. **RENEWAL** - Any reference to automatic renewal is hereby deleted. The agreement may be renewed only upon mutual written agreement of the parties.
17. **INSURANCE** - Any provision requiring the Agency to insure equipment or property of any kind and name the Vendor as beneficiary or as an additional insured is hereby deleted.
18. **RIGHT TO NOTICE** - Any provision for repossession of equipment without notice is hereby deleted. However, the Agency does recognize a right of repossession with notice.
19. **ACCELERATION** - Any reference to acceleration of payments in the event of default or non-funding is hereby deleted.
20. **AMENDMENTS** - All amendments, modifications, alterations or changes to the agreement shall be in writing and signed by both parties. No amendment, modification, alteration or change may be made to this addendum without the express written approval of the Purchasing Division and the Attorney General.

ACCEPTED BY:
STATE OF WEST VIRGINIA

Spending Unit: _____

Signed: _____

Title: _____

Date: _____

VENDOR

Company Name: DYNATEST CONSULTING, INC

Signed: [Signature]

Title: Vice President

Date: Sept 19, 2007

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

West Virginia Code §5A-3-10a states: No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owned is an amount greater than one thousand dollars in the aggregate

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Debtor" means any individual, corporation, partnership, association, limited liability company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceeds five percent of the total contract amount.

EXCEPTION: The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

LICENSING: Vendors must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agencies or political subdivision. Furthermore, the vendor must provide all necessary releases to obtain information to enable the Director or spending unit to verify that the vendor is licensed and in good standing with the above entities.

CONFIDENTIALITY: The vendor agrees that he or she will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the agency's policies, procedures and rules. Vendors should visit www.state.wv.us/admin/purchase/privacy for the Notice of Agency Confidentiality Policies.

Under penalty of law for false swearing (West Virginia Code, §61-5-3), it is hereby certified that the vendor acknowledges the information in this said affidavit and are in compliance with the requirements as stated.

Vendor's Name: DYNAREST CONSULTING INC.

Authorized Signature: [Signature] Date: Sept 10, 2007



DYNATEST CONSULTING, INC.

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Pavement Engineering Specialists
and Equipment

September 10, 2007

Michael Austin
State of West Virginia
Department of Administration
Purchasing Division
Building 15
2019 Washington Street East
Charleston, WV 25305-0130

Reference: Dynatest 1295 Pavement Friction Tester RFQ 7770095

Dynatest is pleased to provide this proposal for a Dynatest 1295 Pavement Friction Tester.

The required bid documents follow this cover letter

Background

Dynatest Consulting Inc. is a small business, incorporated in California in 1978. Dynatest is best known around the world for its Falling Weight Deflectometer (FWD) product and its Road Surface Profiler (RSP). Both of these devices are world renown for setting industry standards, product quality, and longevity in service.

In January of 2002 Dynatest acquired the Transportation Test Division of K.J.Law Engineers. A facility was opened in Westland Michigan to provide continued sales, service and support to the K.J.Law 1290 Pavement Friction Tester owners around the world. Five former K.J. Law employees were hired for the facility and bring a combined total of almost 100 years of experience in production and servicing for the Dynatest 1295 Pavement Friction Tester to the Dynatest team.

The Dynatest 1295 test systems produced by Dynatest are technically sophisticated, yet very user oriented (i.e. they are designed to get the job done, and done accurately). Additionally, Dynatest has made a strong investment in after-sale support of its equipment. To assist customers, Dynatest maintains a web site at <http://www.dynatest.com> for general equipment specifications and product information and support.

We endeavor to satisfy the needs of our customers to the best of our resources - "the customer comes first". Our 25 years of experience and commitment to our customer base provides a valuable asset to purchasers/owners of new Dynatest equipment.

Tow Vehicle Supplier

For the purpose of this bid Dynatest will have the tow vehicle, a 2008 Ford F350 supplied by Bert Wolfe Ford in Charleston West Virginia.

Deviations from Bid Specifications

The Dynatest 1295 deviates from the ICC bid specifications in the following areas:

1. Bid Item 2.0: The Dynatest 1295 trailer has a front compartment but no rear compartment. The Dynatest trailer does not allow the storage of equipment or the spare tire as this will create a weight change in the trailer which may make the accuracy of the data questionable.
2. Bid Item 2.2: The Dynatest 1295 trailer is a parallelogram design based on ASTM E274. The Dynatest 1295 trailer does not have adjustable upper control arms as this feature defeats the parallelogram design and thus will allow the two axis transducer to become misaligned and produce erroneous data.
3. Bid item 2.3.1: The Dynatest 1295 has two digital encoders, one for each wheel. These are mounted internal to the trailer axle to first protect them and to ensure, that unless the trailer is submerged in water, the unit should function normally for at least ten years without service.
4. Bid item 3.1: The Dynatest 1295 electronics for capturing data are mounted in the vehicle to eliminate environmental effects on electronics. No "digital capture system" is mounted in the trailer. No speaker system is part of the Dynatest 1295.
5. Bid item 3.1.1 (10): The Dynatest 1295 provides a digital water gauge on the screen so the number of gallons can be read while testing. There are no indicator lights for the water tank.
6. Bid item 3.1.2: The Dynatest 1295 tow vehicle has a light bar mounted to the cab of the vehicle with controls mounted inside the cab.
7. Bid item 3.2.1: The Dynatest 1295 will have an integrated digital water gauge.
8. Bid item 4.0: The Dynatest 1295 analog to digital conversion electronics are mounted in the tow vehicle.
 - a. The Dynatest 1295 uses shielded cables to protect all signals.

- b. The potential loss due to length of wiring harness is less than the loss due to heating of the electronics in the non climate controlled trailer enclosure.
 - c. The Dynatest 1295 uses the digital encoders on the trailer to ensure that the distance and speed can be calibrated to within +/- 0.1% per mile.
 - d. The Dynatest 1295 does not display the vehicle location on the system monitor.
 - e. The Dynatest 1295 does not display "road feature data"
9. Bid item 4.2: The Dynatest 1295 uses a laptop computer typically an HP NC8430 2 GHz Intel Core 2 Duo 15.4 inch display including touchpad, 1 Gigabyte of RAM, CD/DVD RW, Bluetooth, Ethernet, 100 GB hard drive, RJ-11, RJ45, Serial port, IEEE 1394a, S video, USB 2.0 with a three year warranty. The laptop does not have expansion slots.
10. Bid Item 4.2.2: The Dynatest 1295 does not have a flat panel display. The laptop has a 15.4 inch display.
11. Bid item 4.2.3: The Dynatest 1295 does not have a trackball. The Dynatest 1295 does not have an event board.
12. Bid item 4.2.4: The Dynatest 1295 has its Vehicle Control Unit (VCU), the equal of the DAS, mounted in the vehicle with all system electronics to ensure that water and temperature do not get into the critical electronic components.
- a. The Dynatest 1295 controls all actions from the 1295 software.
 - b. The Dynatest 1295 has sixteen 16 bit A/D channels, with 24 digital I&O, with three 16 bit counter timers, two 150 pulse digital encoders.
 - c. The Dynatest 1295 power systems have +5VDC, +12VDC and +15VDC and -15VDC
 - d. The Dynatest 1295 digital encoders provide distance information with no connection to the transmission of the vehicle.
13. Bid item 4.2.5: The Dynatest 1295 has an HP Inkjet printer connected by USB. The HP Inkjet printer does not produce "dot-addressable graphics" as this is ancient technology.
14. Bid item 4.2.5.1: The Dynatest 1295 does not include event boards. The operator pendant allows for event marking during tests.
15. Bid item 4.2.5.2: The Dynatest 1295 does not include event boards.
16. Bid item 4.2.5.3: The Dynatest 1295 does not include event boards.

- a. The Dynatest 1295 operator pendant can be used to initiate the test, stop the test, and mark events as chosen by the operator.
17. Bid item 5.0: The ICC file named "RFF" is not included with the Dynatest 1295. The Dynatest 1295 software operates in Windows XP and performs all the functions described in the attached documentation.
18. Bid item 5.3.2: The Dynatest 1295 software includes full system diagnostics and calibration of systems including the VCU and all sensors on the system.
19. Bid item 5.3.3: The Dynatest 1295 does not produce the ICC format files "RFF", "TRF", "log files and parameter files". The Dynatest 1295 does store all system settings and parameters into the system as well as store them with the raw data and data summary files. These are both ASCII data files allowing easy importation into any number of windows programs.
20. Bid Item 5.3.4: The Dynatest 1295 not only stores the test parameters and all calibration data for all sensors, but allows the user to identify, define and store up to 64 additional variables or characteristics as desired. Additionally up to four additional sets of 64 data can be defined for multiple operator or applications.
21. Bid item 5.3.5: The Dynatest 1295 meets the requirements of ASTM E274-2006
22. Bid item 5.3.8: The Dynatest 1295 does not use the ICC data file named "TRF".
23. Bid item 6.0: The Dynatest 1295 mounting of equipment is done to allow the system to be run by one person while driving the unit.
24. Bid item 6.2: Dynatest also provides all of the documentation listed on a CD for easy access and storage.

Technical specifications for the Dynatest 1295 and pictures are found in Appendix A.

Owners list and References for the Dynatest 1295 are found in Appendix B.

Details on the tow vehicle supplied by Bert Wolfe Ford in Charleston West Virginia are found in Appendix C.

Dynatest 1295 Test Trailer

The test trailer will meet or exceed all requirements of ASTM E274. It will be two-wheeled, and equipped with a tongue that is on the same level and plane as the tow vehicle's hitch, so that the pulling force through the tongue to the trailer is horizontal when the vehicle-trailer system is on a horizontal surface. It is ballasted so as to make the vertical load on each wheel 1,085 lbs (plus or minus 15 lbs), and the tongue weight between 100 and 200 lbs at the hitch point. The trailer will be equipped with the proper non-resonant combination of coil springs, heavy duty air shock absorbers and power disk brakes, and will accommodate the test tires specified in ASTM E501 and E524. Upon delivery it will be equipped with standard ribbed test tires, per ASTM E501. The trailer will be durable construction, incorporating welded rectangular steel tubing to resist twisting and excessive deflection. The trailer will be equipped so that all of its signal lights act in concert with those of the tow vehicle. To the extent possible, all materials will be corrosion resistant, weatherproofed, and resistant to impacts by small stones and other flying objects.

The Trailer will be fitted with the following accessories:

- Dynatest Two Axis Force transducer on the left wheel to accurately measure horizontal friction forces and vertical dynamic loads during testing.
- Two angular velocity tachometers directly and separately driven by the trailer wheels to measure wheel rotational speeds.
- An ASTM E274 specified water nozzle to be automatically lowered before each test series, to distribute water in front of test wheel, and to automatically rise back into travel position after completion of the testing series.
- A durable shell or cover to protect system components from weather and impact damage.
- A rear lighting system, to include brake, backup, tail, and turn signal lights. In addition, four amber halogen-warning lights will be mounted

to face the rear of the trailer. They will be wired to flash alternately, in pairs, whenever the tow vehicle's light bar is in operation.

- One spare wheel, complete with ASTM E501 ribbed tire. Space shall be provided in the tow vehicle to carry at least one spare test tire and wheel with the system during extended testing periods.
- Two powered jacks on the rear corners of the trailer to permit fast, easy changing of test tires. The operations of the jacks shall be controlled by a switch inside the trailer cover or enabled by a switch in the cab to prevent unauthorized use.
- Markers (see pictures below) by which the driver of the tow vehicle can monitor the position of the rear corners of the trailer while backing.
- Quick air and water hose disconnects at the rear bumper of the tow vehicle. The air disconnect shall be fitted with a valve to permit use of an external air source to operate the air powered trailer systems.
- The electrical connections to the tow vehicle will be "Mil Spec" or equivalent and will be of such design to connect with a quarter turn of the housing, if available.
- The trailer will be equipped with a safety brake feature that can activate both trailer brakes equally when the truck brake pedal is depressed. This system will be enabled by switch in the cab that is easily accessible by the driver and will operate whether the computer system is powered on or not.



Typical Dynatest 1295 Trailer configuration.

Dynatest 1295 Force Transducer

The force measuring transducer will be mounted on the trailer axle at the test wheel, and will conform to the specifications in E274. It will produce an accurate, repeatable electrical signal proportional to the horizontal force at the tire-pavement interface, and a second, simultaneous electrical signal proportional to the vertical load on the wheel. These two forces will be sensed, measured and recorded continuously during incipient and locked-wheel skidding conditions. The transducer will be fitted with strain gauges in a bridge configuration, and will incorporate a shunt-calibrating resistor. Nonlinearity and hysteresis shall be less than one percent of the applied load (up to 1500 lbs) for both horizontal and vertical outputs. Sensitivity to cross-axis or torque loading, and angular rotation limits shall be as stated in E274.

Dynatest 1295 Compatibility

The Dynatest 1295 Pavement Friction tester is 100% compatible with not only the existing WVDOT unit, but also with spare parts such as the K.J.Law Two Axis Force transducer.

Dynatest 1295 Tow Vehicle

The tow vehicle proposed will be brand new 2008 Ford F350 4x2 S/C Crew cab. The unit will be a four-door Crew cab with 6.8 L V10 Gas engine and dual rear wheels. It will be a one-ton model with an eight-foot bed and manufacturer-recommended heavy-duty automatic transmission and power train. It will be fitted with a non-corrosive, baffled water tank of approximately 320-gallon capacity. The Gross Vehicle Weight will be around 13,000. The vehicle will include but not be limited to the following additions:

Lockable, lightweight, low-profile, white fiberglass bed cover with gas shocks to assist with opening	Roof mounted strobe bar Whelen model 9004/4SL 52 inch or equivalent
Adjustable trailer hitch (compatible with trailer and meeting ASTM E274)	Highway tread tires
Digital speedometer display mounted on top of the dashboard directly in front of the driver. The speedometer will be accurate to 0.1 mph and will reflect speed directly from the freewheeling (right)	

trailer wheel tachometer. The size, lighting and shading of the readout will be such that the diver can easily view it in a variety of lighting situations.	
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Additionally, a hookup point for external AC power and a 30-foot retractable cord will be installed for power of all AC components while the vehicle engine is turned off. The vehicle will be fitted with a switch or other device to ensure that the system cannot accidentally be “reverse powered”.

The vehicle front cab interior will be configured to accommodate driver, operator, passenger(s) and necessary computers, displays and test equipment described below.

An air pump with air desiccant dryer for supply of air to the trailer will be 12V, DC oil-less, no maintenance type (Gaste or equivalent).

Internal circuitry will be installed to delay power-up of instruments before the inverter stabilizes.

Dynatest 1295 Watering System

The watering system shall consist of an aluminum baffled, corrosion-resistant, 320 gallon (approximate) water tank on the back of the tow vehicle, with positive displacement water pump, relief valves, bypasses, regulators, flow lines and related equipment to conduct water to the nozzle in front of the trailer test wheel when required. The water line will be equipped with a quick disconnect at the rear bumper of the tow truck. The tank will have a three-inch (3”) diameter fill hole with cap at the top, an overflow pipe and drain valve both emptying under the tow vehicle, and a removable, non-corrosive strain filter mounted in the water line. The nozzle and the positive water flow rates for testing will meet the specifications prescribed by ASTM E274.

Dynatest 1295 Electronics and Sensors

The accuracy of the signal conditioning electronics shall be within one percent, using simulated inputs in a constant temperature environment.

A digital computer (described below) will coordinate all test activities, when instructed to do so by the operator. It will capture and store all pertinent data over the test interval, and will be able to report the results in graphical or digital form to the operator after completion of the test cycle.

The vehicle will come equipped with two different temperature sensors mounted on the tow vehicle. One will be an infrared sensor to provide accurate measurement of pavement temperatures. The other will measure the corresponding ambient air temperature. These sensors will be located to provide for accurate temperature measurements with no interference from, sunlight, engine heat, wind, or other environmental conditions. Both sensors will display their readings in the truck cab in real-time mode. These readings will be displayed and recorded with other test information data. They will be available for display, printout, and analysis with other skid cycle data during post-processing procedures. These sensors will come with instructions or procedures to verify their accuracy, and if necessary, to calibrate them.

Wires to equipment items, computer ports, and electric conduits or hookups will be clearly tagged or labeled, to assist the user with system diagnostics and maintenance.

Dynatest 1295 Computerized Control and Data Processing Equipment

The tow vehicle shall be equipped with a laptop computer to control the calibration and setup of the system equipment, the conduct of skid tests, and the capture/recording and output of resulting suitable for this application. It shall be mounted in the center of the vehicle (from side to side). It will be fully adjustable in height, left to right swivel, and top to bottom tilt to provide convenient viewing by personnel of different heights, and by both driver and operator in a variety of lighting conditions. The entire assembly will be sufficiently robust and rugged to operate in a field environment, and will be flexible enough to accept future add-ons and enhancements, if required. The computer will be configured so that the user can load and use MS Windows programs into the Windows XP Professional environment for analysis. A touchpad/trackpad will be installed in lieu of a mouse, for use in the Windows environment. A graphics-capable, ink jet printer will be installed in the tow vehicle for optional printing of test output information.

The system software is an easy-to-read menu format, which permits operators to set up testing parameters prior to multiple test runs. Once setup is complete, an operator is able to conduct a series of tests, each initiated by a single keyboard or pushbutton command. The automated test cycle will be able to produce the following:

- Real-time plots and data listing of SN and speed for each test-on the display screen and on hard copy
- Automatic storage of all test data on fixed or removable hard disk (operator's choice), including header information, point-by-point graphic curves, and digital test data. Header information will include: date, time, location (County, Route, Log Point), lane number, direction of travel, operator/driver names, ambient air temperature, and operator-selected file name. This header information will print out at the beginning of every run. At the conclusion of each run, the printer will scroll to the top of the next page, separating the different runs. A new header will then print out at the start of the next run. The current log point number will be displayed on the screen in a larger font or different color than other information, to assist the operator in monitoring it while testing. It will increase or decrease numerically, as the vehicle moves, depending on the direction of travel set by the operator. The operator will also have the option/ability to make corrections to the location (log point) while the vehicle is in motion ("on-the-fly" corrections.)
- An on screen display of system status before and after each test, including water level, compressor status, ambient and pavement temperatures, speeds, transducer load and force, and other diagnostic/warning functions.
- Backward compatibility with existing files, Custom template capability, Offline companion software for viewing and printing existing and new data files.
- The control system incorporates automatic startup and calibration of the computer, and related setup of the test equipment and software. The operator is able to view the calibration/setup status on the video screen, via diagnostic menus, graphs, and other mixed graphical/digital displays. System diagnostics, to determine the status of specific mechanical and electrical components of the system is available to the operator for use upon startup or during the workday. The monitoring/calibration functions include: Left and Right trailer wheel speeds, operators/users will be provided with file utilities that allow them to examine actual data points on the SN or speed traces. Utilities to recall, delete, display, or print selected files will be included. A "help" menu is available to provide guidance and to assist in the training of operators.

- All data files will be in ASCII and/or IBM-format (preferred) to allow post processing, editing and analysis using IBM-compatible PC's and commercial, MS Windows applications software. The data files, once processed will contain at minimum, the following information: Date, Truck Number, District, County, Route, Direction, Weather, Surface Temperature, Pavement Condition, Test Log point, Skid Number, Speed, Time of Test, Ambient Temperature and Total Cycles.
- The test cycle time shall be operator-programmable, to allow the operator to create specific test cycles for special applications. Cycle time default will be two seconds.
- The computer will assign a unique, sortable, sequence "number" to each test, so that post-processing can more easily put tests in the proper order using only this information field.
- The processing software will include the ability to copy multiple files and/or directories to the floppy drive, USB drive or to a hard drive in a single operation. The operator will have flexibility in naming files (within the limits imposed by DOS/Windows.) Menu driven software will allow the user to escape backwards one menu at a time, to allow correction of inadvertent errors or changes to specific menu selections.

GPS

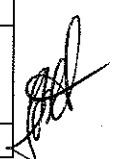
A Tribble AgGPS 132 system will be mounted and integrated to the data collection system storing the GPS data within the data files.

Training

Dynatest will deliver the system to West Virginia DOT offices, perform a two-day on-site training session with system operators and maintenance staff. This training session will include all aspects of operation and maintenance on the system.

Costs

<i>ITEM</i>	<i>UNIT (USD)</i>	<i>EXTENDED*</i>
New 2008 Ford F350: ¹	\$25,967.00	\$25,967.00
NEW Dynatest 1295 Pavement Friction System including shipping and training:	\$128,894.00	\$128,894.00
TOTAL:	\$154,861.00	\$154,861.00



*All prices are in U.S. Dollars.

1. If desired, delivery and training can be done at the Michigan facility, which will reduce costs for training and eliminate shipping costs. Shipping costs subject to verification at time of order.

Delivery time

The delivery time for a new or recycled system is **180** days from the date the PO is received at the Dynatest facility. Delivery may be sooner than the 180 days depending on production schedules.

The order is initiated by Dynatest Consulting, Inc receiving a Purchase Order from your Agency for the order specified. Payment is due and payable upon delivery (terms are 21 days). Delivery is memorialized by the signing and dating by the purchaser's delivery representative of the Dynatest Acceptance of Delivery document. Warranty also initiates on that date. It is herein agreed that Dynatest will not be held responsible for any fees associated with financial transactions, or any taxes, levies, duties or fees not herein clearly shown in the prices quoted.

The Dynatest standard one year warranty for new equipment, will apply to all equipment and modifications manufactured and made by Dynatest offered in this agreement. The standard manufacturer's warranty will apply to other components of the contract (e.g., PC equipment, vehicle components, and some setup parts installed by Dynatest).

Should you have any questions concerning this quotation please feel free to call me at +1 734-729-0400 or email at fholt@dynatest.com

Best regards,

DYNATEST CONSULTING, INC.



Frank B. Holt
Vice President
Dynatest International A/S
Business Development Division



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Webpage: www.dynatest.com
E-mail: mi@dynatest.com

Pavement Engineering Specialists
and Equipment

TECHNICAL SPECIFICATION

Dynatest 1295 Pavement Friction Tester (PFT)

Dynatest Consulting, Inc.
5950 East Executive Drive
Westland, Michigan 48050-3627
USA
mi@dynatest.com



Dynatest 1295 Pavement Friction Tester
Measurement System Specifications
(January, 2005)

The Dynatest 1295 Pavement Friction Tester (PFT) is used for the purpose of traveling the highway at normal traffic speeds and producing an accurate measurement and record of highway friction values using full size ASTM E501 or E524 test tires. The 1295 PFT fully complies with the requirements set out in ASTM E-274 "Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire".

1. General

The 1295 PFT shall consist of a standard highway vehicle (one-ton crew cab pick-up truck) and two-wheel trailer. The system shall be instrumented with a computer for processing, recording, display and a printer for printing of friction data.

The PFT shall utilize a two-axis force transducer to measure both the horizontal (friction) value and the dynamic vertical load and compensate for the constantly changing vertical load due to tire/trailer bounce over uneven surfaces.

The PFT shall be easily operated by one person (driver). The driver needs only to bring the pavement friction tester to the desired test speed 30 to 115 km/hr (20 to 70 mph) and press the hand held start button to complete a test. All test functions such as lowering the water nozzle, water application and test wheel lockup and release shall be automatic and sequentially controlled by the system electronics and computer. All test functions shall also be manually controlled by the operator if desired.

The PFT shall perform automatic calibration verification and self-diagnostics at startup. The system shall include the following:

2. Tow Vehicle

- 2.1 Vehicle shall typically be a Ford, Dodge or Chevrolet, one ton heavy duty truck, crew cab or extended style, with either single (SRW) or dual rear wheels (DRW).

3. Vehicle Instrumentation Additions

- 3.1 Dash mounted digital speed display for accurate test speed monitoring.
- 3.2 Operator/driver console with remote hand switch to start and control the automatic test.
- 3.3 Industrial hardened system electronics Vehicle Control Unit (VCU).
 - 3.3.1 Laptop computer with Windows XP operating system, 60 gigabyte hard drive, Pentium IV processor, USB2 port, Ethernet port, USB 4 port Hub.
 - 3.3.2 Inkjet color graphics printer with mount in rear of vehicle.
 - 3.3.3 Lightbar (Specifications to Purchaser requirements).

4. Vehicle Hardware Additions

- 4.1 Aluminum water tank, 1000 liter (250 gallon) or 1200 liter (300 gallon). The tank shall have internal baffle plates to reduce water motion.
- 4.2 Digital water volume gauge connected to VCU.
- 4.3 Water tank shall have a 2.5 NPSH Standard hydrant thread 75mm (3 inch) water fill opening with cap.
- 4.4 Electrical power supply for 115 VAC electronics, computer and printer operation
- 4.5 Air compressor, GAST 12 volt heavy duty, with filter and accumulator for operation of the air over hydraulic trailer brake system.
- 4.6 Water Pump, speed controlled, positive displacement to provide the correct volume and thickness of water over the entire operating range of speed. Bed cover – may be either full size or low profile, with water fill access.
- 4.7 Test Tires. The system shall come with one spare test tire (E501 or E524), and two test tires mounted on the trailer.
- 4.8 The system shall have an air temperature sensor mounted and connected to the data collection system electronics.
- 4.9 Heavy duty, height adjustable rear step bumper, color coordinated, with mil spec electrical disconnects, quick disconnect non-corrosive pneumatic and water connectors.

5. Trailer Assembly

- 5.1 The two-wheel trailer shall have parallelogram suspension, non-resonant combination coil springs, heavy-duty shocks and power disk brakes.

- 5.2 The trailer shall have an optional mechanical parking brake.
- 5.3 The trailer shall be equipped with four flashing lights with alternate flashing patterns.
- 5.4 The trailer shall provide an equal static load of 4800 \pm 65 N (1085 \pm 15 lbf) to each test wheel and 450 to 900 N (100 to 200 lbf) at the hitch point.
- 5.5 A two-axis force transducer shall be installed at one trailer test wheel, for single sided testers. The two-axis force transducer shall provide direct measurement of the horizontal tractive friction force of pavement-tire braking traction and the dynamic vertical load on the instrumented test wheel. The transducer shall provide an output directly proportional to force with hysteresis less than 1% of the applied load, nonlinearity less than 1% of the applied load up to the maximum expected loading, and sensitivity to any expected cross-axis loading or torque loading less than 1% of the applied load. The force transducer shall be mounted in such a manner as to experience less than 1 degree angular rotation with respect to its measuring plane at the maximum expected loading.
- 5.6 The trailer will include two electric lift jacks for automatic raising/lowering the trailer for fast tire changing. The automatic jacks are controlled by a switch on the trailer, under the front cover.
- 5.7 A laminar flow water nozzle will be located in front of the test wheel. This nozzle provides a uniform thickness of water across the path of the test tire over the full range of test speeds. The 177-mm wide nozzle provides shall be 600 mL/min.mm \pm 10%/min.mm (4.0 gal \pm 10%/min.in) at 65 km/h (40 mph). The nozzle is lowered automatically during testing.
- 5.8 An angular velocity transducer (distance and speed measuring tachometer) is mounted on each trailer wheel spindle to provide accurate speed and distance of both the wheel under test and the free rolling wheel. The transducers shall provide speed resolution and accuracy of \pm 1.5% of the indicated speed or \pm 0.8 km/h (\pm 0.5 mph), whichever is greater.
- 5.9 The trailer shall include air over hydraulic disk brakes. The trailer brakes shall be capable of locking the designated test wheel. Lockup time from the time of automatic application to lockup and release (cycle time) is variable but shall not exceed five seconds in accordance with ASTM E274 specification. The test wheel with two-axis force transducer shall typically be mounted on the left-hand side.

5.10 The trailer cover shall be painted steel and fenders shall be stainless steel.

6.0 Skid Number Reporting

- 6.1 The System will calculate, display, store, and copy to disk and/or printer.
- 6.2 The system shall provide the Locked Wheel Skid Number (SN) in real time.
- 6.3 The system shall plot friction curves, starting with brake application, peak incipient friction, wheel lockup and wheel release. All data shall be stored in an ASCII file format.

7.0 Software Description

- 7.1 The software shall be Windows based software running in a Windows XP environment. The software shall have on-line Help functions. The software shall have five primary selections. All selections shall be mouse and hot-key selectable. The software shall be capable of operating in both Metric and US Standard units.
- 7.2 The software shall ensure that calibration must be performed prior to testing by locking out the test section of the software until field calibration has been completed.
- 7.3 The software shall allow for testing in either a time or distance mode.
- 7.4 System Diagnostics: This section of the software shall allow for diagnostics of all digital encoders, analog devices, analog to digital encoders and timers in the sytem.
- 7.5 System Settings: This section of the software shall allow the operator to select and configure all devices on the system including selection of test type, test watering, test cycling, test cycle times, measurement units, data display options and formats, data storage and printer options. The software shall provide for on board printing of the test data both during the testing sequence and after testing is complete.
- 7.6 Test Information: The software shall provide test information templates which are customizable by the user. The software shall allow multiple templates to be stored and recalled from the test screen. All information shall be stored with the test data.
- 7.7 System Calibration: The software shall allow the operator to calibrate the force transducer(s), distance encoders, flow meters and temperature sensors on the system. The screens shall provide details on the values determined by the calibration system.

7.8 Test Screen: The software shall allow for the real time display of speed, SN, water tank volume, number of tests since water fillup, temperature sensor output, test cycle completion, test data values such as SN average, minimum, maximum and standard deviation, traction values and load values from the two axis transducer. The software shall allow the user to select what data is displayed during the test sequence.

8.0 System Warranty

8.1 The System warranty shall be one year from date of commissioning. Additional Warranty available.

8.2 The warranty shall cover all parts manufactured by Dynatest.

9.0 Vehicle Warranty

9.1 The Tow Vehicle will be warranted by the manufacturer

10.0 Laptop and Printer Warranty

10.1 The system laptop and printer will be warranted by the manufacturer

11.0 Documentation

11.1 Two sets of System operation and maintenance manuals shall be provided.

11.2 Two sets of System drawings and schematics shall be provided.

11.3 Two sets of spare parts lists shall be provided.

12.0 Training

12.1 Three days training in operation and maintenance, at the sellers Westland, Michigan, USA location or alternatively at the purchasers location.

13.0 System Options

13.1 The system shall have the capability to integrate the following additional syensors:

- Dual sided testing capability
- Global Positioning Systems (GPS)
- Pavement surface temperature sensor.
- Selcom texture laser with real time Mean Profile Depth (MPD per ASTM E1845) data calculation and storage
- Tire Surface temperature sensor

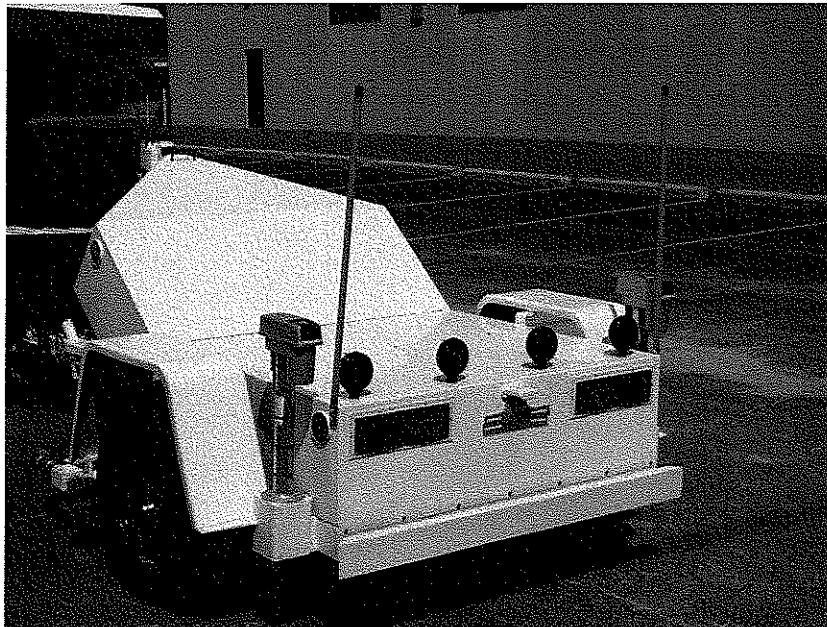
14.0 Applicable Standards

- 14.1 The following ASTM standards are applicable to this system:
- 14.2 ASTM E274 “Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire”
- 14.3 ASTM E501 “Standard Specification for Standard Rib Tire for Pavement Skid-Resistance Tests”
- 14.4 ASTM E524 “Standard Specification for Standard Smooth Tire for Pavement Skid-Resistance Tests”
- 14.5 ASTM E1136 “Standard Specification for A Radial Standard Reference Test Tire”
- 14.6 ASTM E1337 “Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using a Standard Reference Test Tire”
- 14.7 ASTM E556 “Standard Test Method for Calibrating a Wheel Force or Torque Transducer Using a Calibration Platform (User Level)”

THE DYNATEST 1295 PAVEMENT FRICTION TESTER

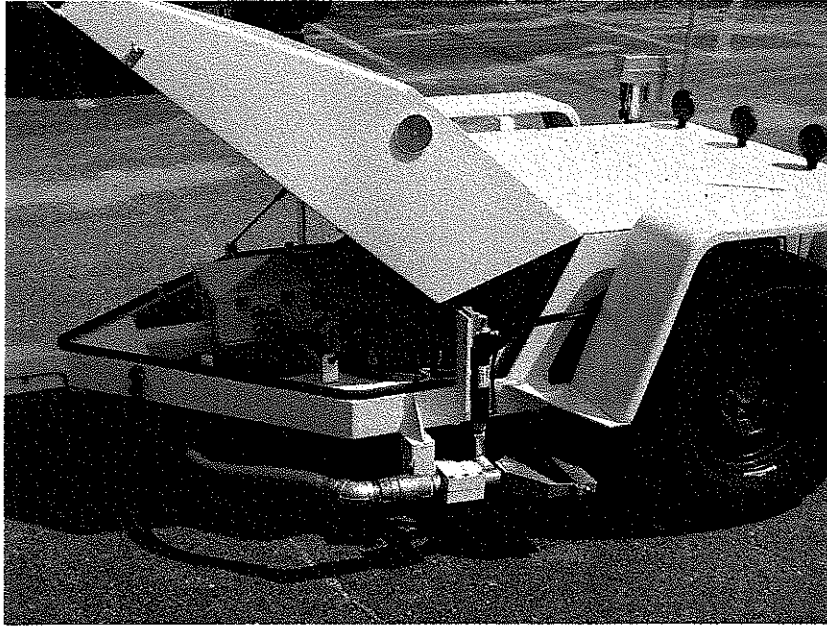


Dual Rear Wheel Unit

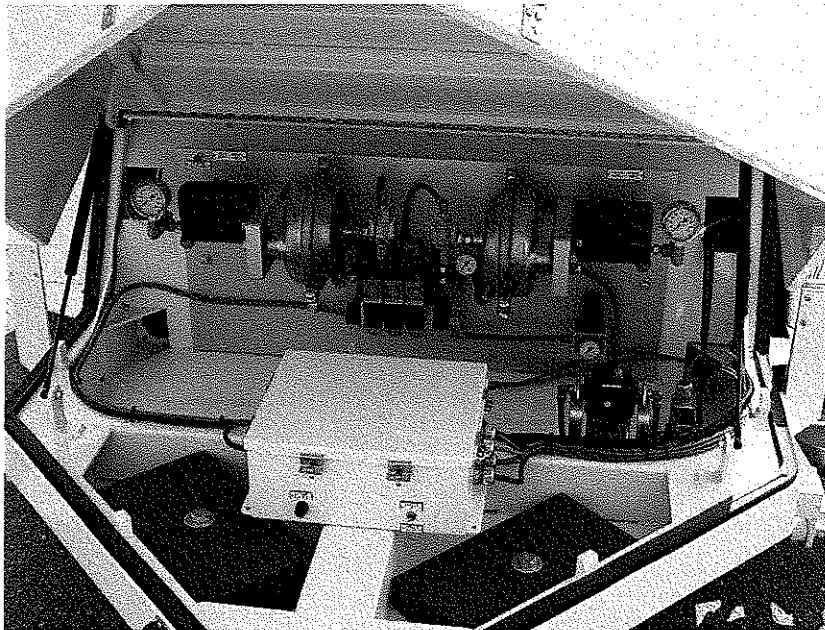


Trailer Rear View with power lift jacks, lights (yellow or red) and backup markers

Visit the Dynatest Web Page at <http://www.dynatest.com>

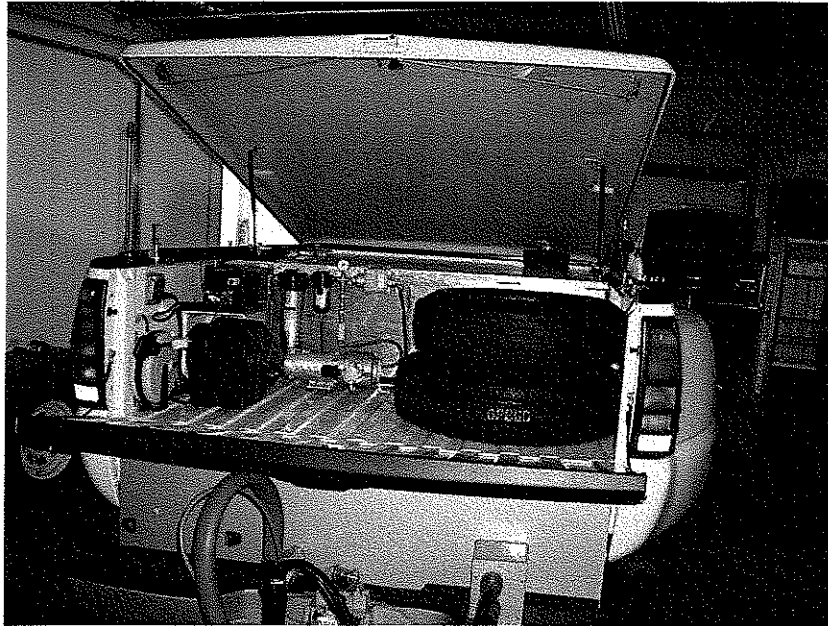


Side View Trailer with hood up, ASTM 274 water nozzle

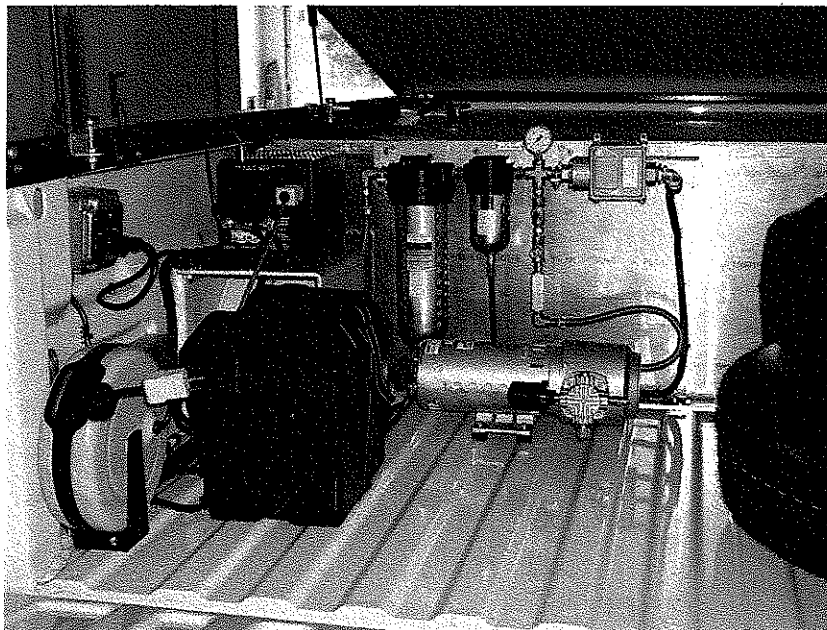


Trailer Front showing equipment layout including electric jack controls and brake control systems

Visit the Dynatest Web Page at <http://www.dynatest.com>

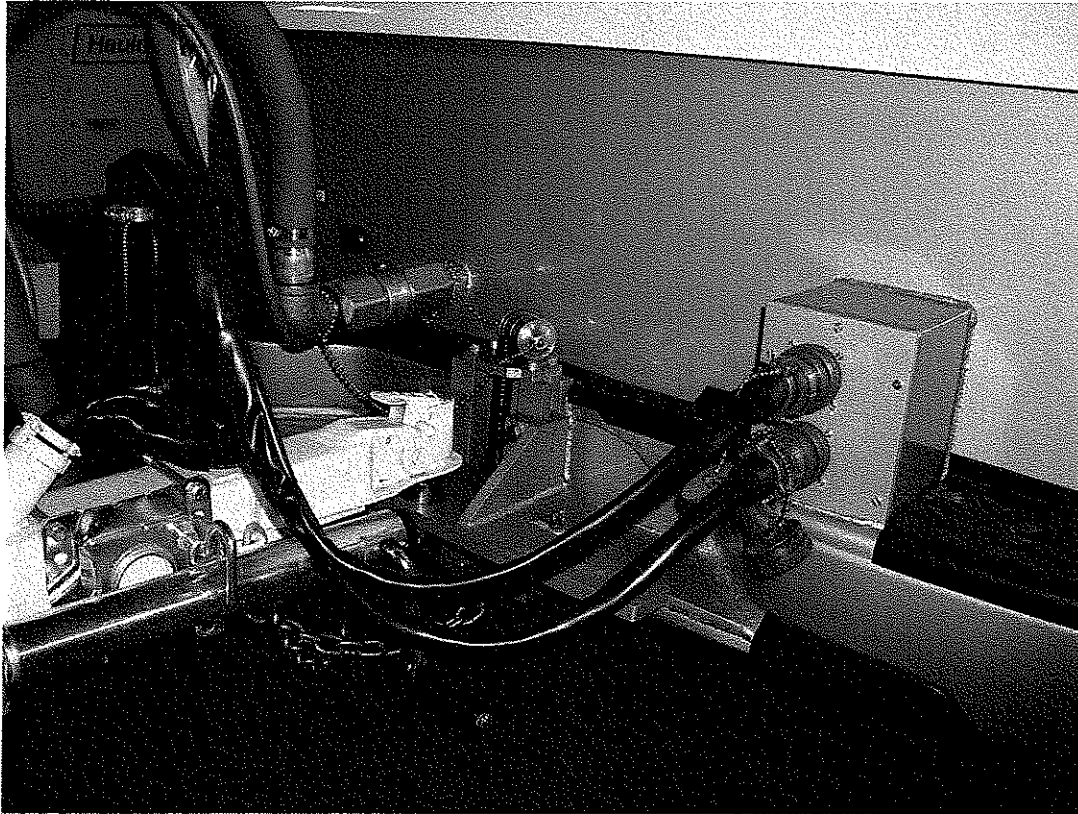


Truck bed layout showing, lockable bed cover, 300 gallon tank (250 gallon with single rear wheel), power inverter, air compressor with filter and dryer, auxiliary 12-volt battery, external power extension cord and spare tires

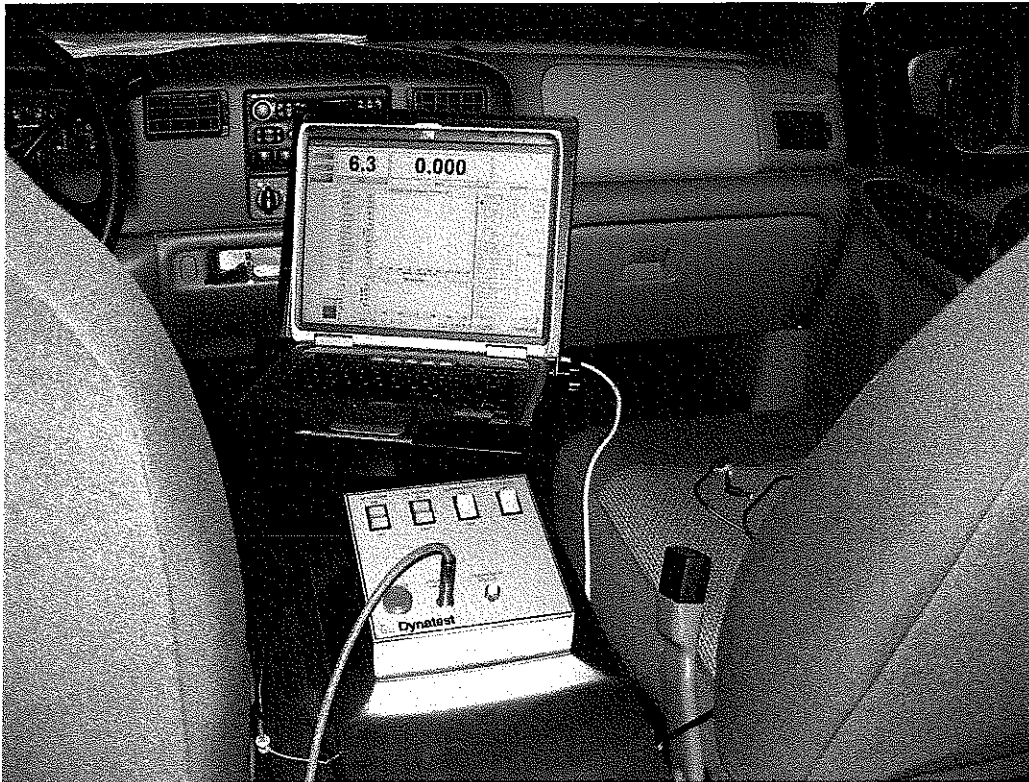


Close up view of bed equipment.

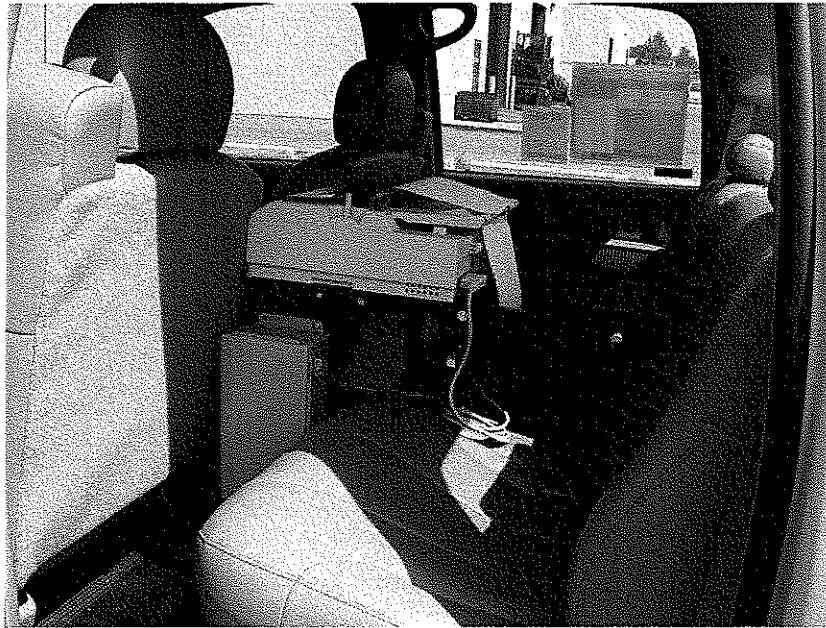
Visit the Dynatest Web Page at <http://www.dynatest.com>



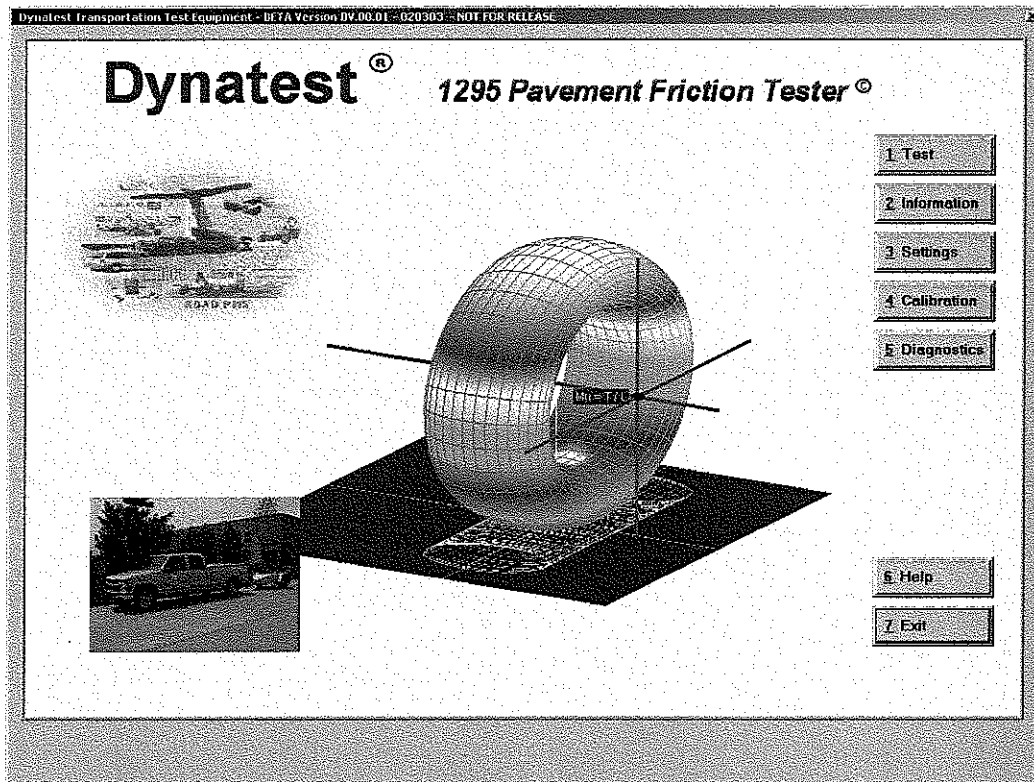
**Typical bumper installation with fully adjustable ball hitch to ensure proper alignment and leveling of the trailer, system and electrical connectors.
(Note: installation shown for Dual Rear Wheel vehicle. Single wheel similar without the large gray panel.)**



Interior layout view with Laptop computer, distance display on dash, system controls between seats and operator control pendant

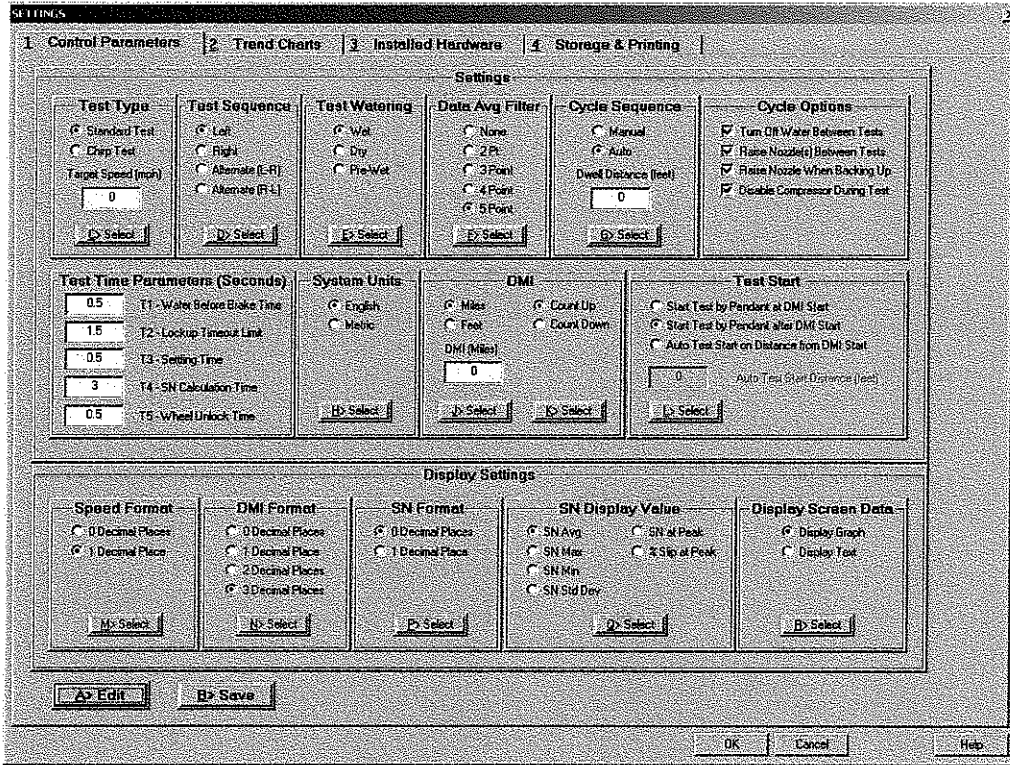


Printer mount extension between front seats and into Crew Cab area.

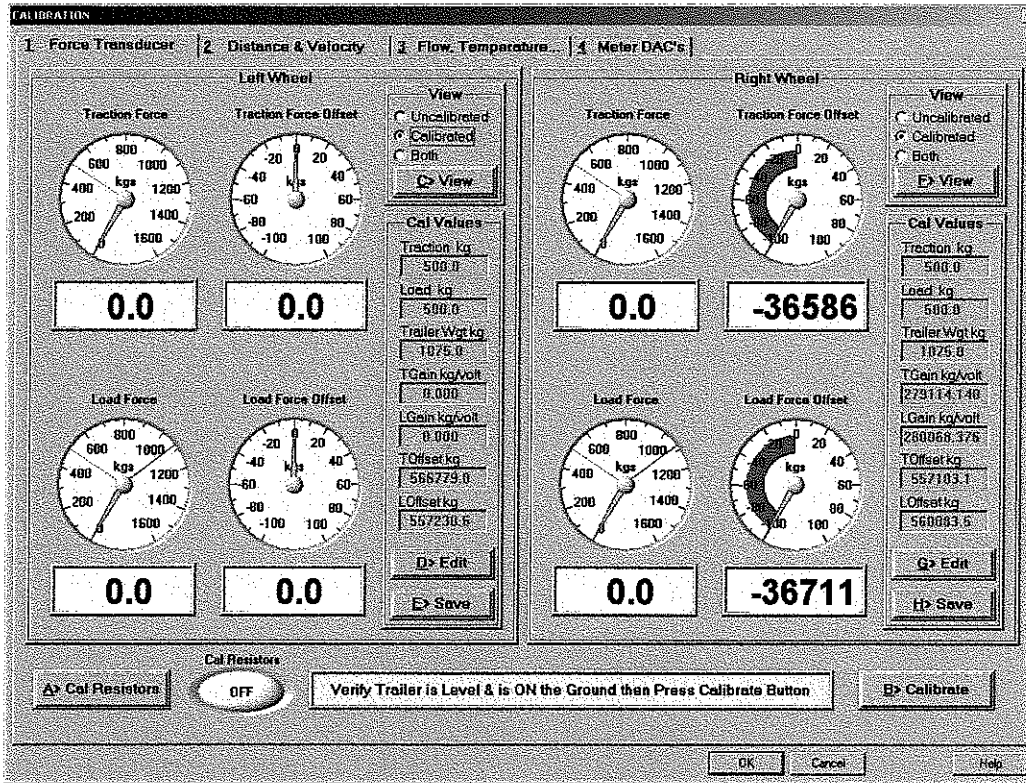


Opening menu for data collection

Visit the Dynatest Web Page at <http://www.dynatest.com>

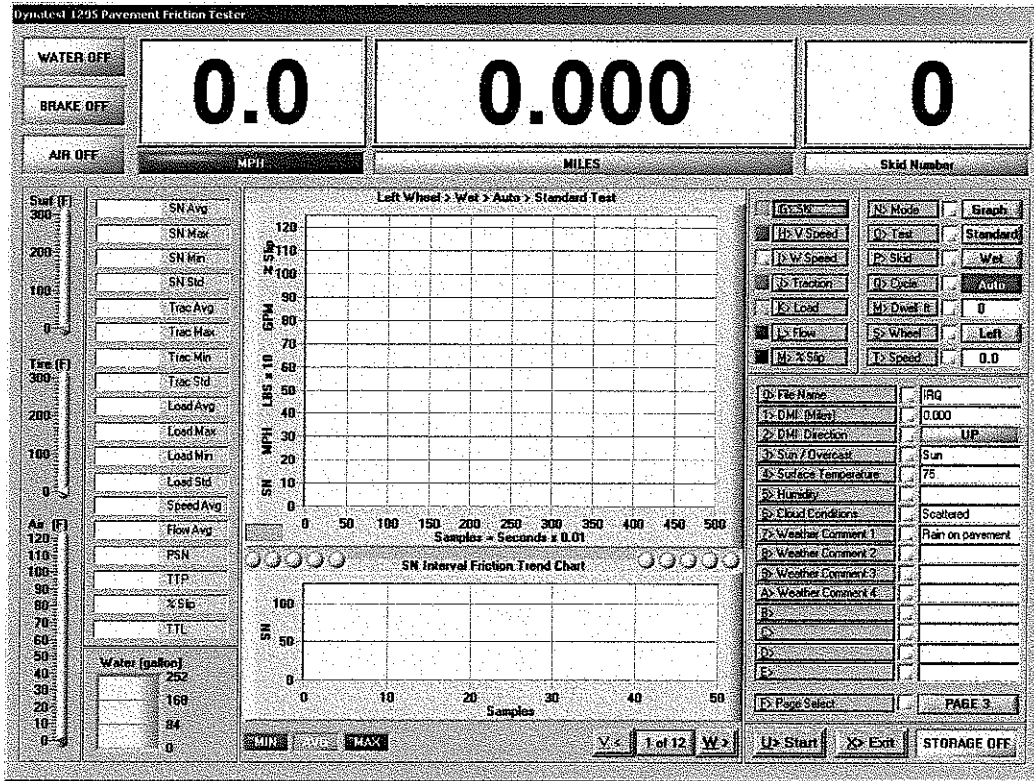


Data collection/system set up screens.



System calibration screens

Visit the Dynatest Web Page at <http://www.dynatest.com>



Data collection screen

**Dynatest 1270/1290/1295 Locked Wheel Pavement Friction
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- NAT'L CONSTRUCTION RESEARCH OF KOREA
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- NATIONAL FREEWAY BUREAU OF TAIWAN
- UNIROYAL/GOODRICH CORP.



Michigan Department of Transportation

2522 West Main Street
Lansing, Michigan 48917
USA

Mr. Tommy Hattis
Tel : +1 517 241-1145
HATTIST@michigan.gov

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Minnesota Department of Transportation

1400 Gervais Avenue
Mail Stop 645
Maplewood, Minnesota 55109-2044
USA

Mr. Greg Fischer
Tel : +1 651 779-5542
Greg.Fischer@dot.state.mn.us

1295 Unit (Delivered 2003)

Connecticut Department of Transportation

Division of Research
280 West Street
Rocky Hill, CT 06067

Mr. Eric Feldblum
Tel: +1 860 258-0392
eric.feldblum@po.state.ct.us

1295 Unit (Delivered 2005)

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8-29-07

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