

## TECHNICAL SPECIFICATION



### **Dynatest 6875H**

### **HIGHWAY SLIP FRICTION TESTER**

**Dynatest Consulting, Inc.**  
**5950 East Executive Drive**  
**Westland, Michigan 48050-3627**  
**USA**  
**[mi@dynatest.com](mailto:mi@dynatest.com)**

**Dynatest 6875H Highway Slip Friction Tester Specifications**  
(January 2005)

**1.0 SCOPE**

- 1.1 The 6875H Highway Friction Tester (HFT) measures and records highway friction values.
- 1.2 The 6875H HFT is a self-contained vehicle designed to traverse the length of a highway and accurately measures the highway coefficient of friction. Loss of friction can be caused by contaminants such as water or snow and ice, and by the erosion and smoothing of original surface texture due to rolling and braking action of tires. The HFT can monitor this loss of friction, especially due to the build-up of contaminants such as rain, snow, and ice.
- 1.3 The 6875H can record and archive almost unlimited continuous friction data. Time and date of test, Highway name, number, test speed, weather notations and temperature are stored with the test data. The 1000 liter (250 gallon) capacity water tank is sufficient to test more than 21,940+ meters (72,000+ feet) of runway without refilling. Larger 1200 liter (300 gallon) systems are available, with specific vehicles, to provide additional test capacity.
- 1.4 A standard highway pickup modified to accept the test instrument is utilized. A two-axis force transducer accurately measures both continuous longitudinal slip friction forces while also measuring variations in the vertical force. Unwanted variations in vertical force are caused by tire bounce due to highway profile variance. This change in vertical force is measured and canceled, allowing continuous true and accurate slip friction measurement.

**2.0 OPERATION**

- 2.1 A laptop computer automatically processes speed, distance and force transducer output data. The 6875H is easily operated by one person (driver). An additional front bucket seat is provided for an observer or operator. The driver needs only to bring the friction tester to the desired speed of 30 to 115 km/h (20 to 70 mph) and press the hand-held test start button. All test functions such as lowering the test wheel, water application and friction measurement will be sequentially controlled by the computer.
- 2.2 The 6875H is a totally self-contained vehicle requiring little warm-up period. Automatic calibration verification and self-diagnostics

are initiated at start-up. The system is readily available for immediate use during rapidly changing winter weather conditions of accumulating snow, freezing rain or ice, or summer rain storms.

### **3.0 VEHICLE, Available in Chevrolet, Dodge, Ford, and GMC Pickups. (Others available on request)**

- 3.1 Vehicle will be the latest model year available at time of purchase and will include, but not be limited to the following features.
- 3.2 Heavy duty truck, crew cab or extended style, with either single (SRW) or dual rear wheels (DRW).
- 3.3 V-8, gasoline engine, minimum 250 HP.
- 3.4 Factory air conditioning
- 3.5 Tinted glass
- 3.6 Power steering/power brakes, ABS
- 3.7 Cruise control
- 3.8 **Vehicle available with either Two or Four wheel drive**

### **4.0 ADDITIONS TO VEHICLE:**

- 4.1 Dash mounted display providing speed, digital mu and analog mu display for **real time** test monitoring.
- 4.2 Industrial hardened system electronics Vehicle Control Unit (VCU).
- 4.3 Operator console and Laptop Computer with Windows XP operating system, 60 gigabyte hard drive, Pentium IV processor, USB2 port, Ethernet port, USB 4 port Hub.
- 4.4 Remote, hand-held test switch with event marker buttons
- 4.5 Inkjet Printer, color graphics
- 4.6 Keyboard for setup
- 4.7 Overhead roof mounted strobe light bar
- 4.8 Remote control Spot lights (two); one each passenger and driver side
- 4.9 Test equipment mounted below rear of truck
- 4.10 Baffled, non-corrosive aluminum water tank; 1000 liters capacity (250 gallon). Tank has overflow beneath the vehicle.
- 4.11 Digital water volume sensor connected to the system to provide real time water level indication.
- 4.12 Low profile bed cover
- 4.13 External large quick fill for water tank
- 4.14 Independent 12-volt auxiliary battery and charging system (mounted in test wheel enclosure)

- 4.15 Hydraulic pump and reservoir (for instant raise/lower of test wheel)
- 4.16 Inverter 12 volt 120 VAC power supply

## **5.0 TEST WHEEL ASSEMBLY**

- 5.1 Digital encoder for speed and distance. The encoder provides 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.
- 5.2 Positive displacement water pump assembly for constant 1.0 mm water layer thickness at all speeds
- 5.3 Water nozzle, ASTM Type Laminar flow uniform thickness and width. This nozzle provides a uniform thickness of water across the path of the test tire over the full range of test speeds.
- 5.4 Force transducer; two axis providing instantaneous true coefficient of friction continuously calculated. 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.
- 5.5 Two piece test wheel rim
- 5.6 Test tire, ASTM E1551 and/or European (PIARC, ICAO) AERO tire.
- 5.7 The test mechanism is offset in the rear of the vehicle to allow testing in the wheel track without leaving the normal vehicle wheel paths.

## **6.0 APPLICABLE STANDARDS**

FAA STANDARDS: The Dynatest 6875H fully meets the FAA Standards.

ICAO STANDARDS: The Dynatest 6875H fully meets the ICAO Standards.

## **7.0 MODE OF MEASUREMENT**

- 7.1 Continuous friction calculation in motion along the section of the pavement to be tested shall be performed.  
Speed and distance can be reported in either US Customary units or Metric mode as selected by the operator. Friction values can

be reported in any increment of distance from one meter up (one Foot up, e.g. 25 ft., 50 ft., 100ft. etc.)

- 7.2 The 6875H Highway Friction Tester is designed to withstand the rough use of high speed testing and still maintain calibration. All components are designed for long life and stability. The fifth-wheel assembly (test wheel) includes a two-axis force transducer to measure both the vertical force (load) and the horizontal force (traction). The two-axis force transducer is designed to withstand the high speed testing over rough surfaces, bad weather conditions and extreme temperature variations while maintaining calibration accuracy. Unit to be calibrated annually per ASTM E556<sup>5</sup>

#### **8.0 MODE OF BRAKING:**

The 6875H Highway Friction Tester is a continuous fixed slip system. The measuring wheel shall be continuously braked at a constant slip ratio of  $14\% \pm 1\%$ .

#### **9.0 STABILITY:**

The 6875H is equipped with a heavy-duty suspension system to give positive directional stability during all phases of operation. The system is able to perform high-speed tests on highways. The 6875H will include a fully baffled water tank to prevent side and forward water movement during high speed turns and fast braking.

#### **10.0 FRICTION COEFFICIENT RANGE:**

The friction coefficient recording range of the 6875H shall be from 0 to 1.0. A continuous friction trace and friction numbers will be recorded, displayed on the laptop computer and printed on the inkjet printer.

## **11.0 PRESENTATION OF THE RESULTS OF MEASUREMENTS:**

The test results are continuously displayed on the laptop computer as a continuous trace and as friction numbers. Low threshold friction, **Red**. Borderline Friction, **Yellow**. Acceptably High Friction, **Green**. The test run is stored on the computer hard drive for reprinting or for transfer to permanent storage and future retrieval. In addition to the continuous color graphics trace and friction numbers the operator is able to enter and record comments on the weather, highway condition, and any additional comments desired.

## **12.0 SYSTEM SOFTWARE:**

- 12.1 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.
- 12.2 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.
- 12.3 System Diagnostics: This section of the software shall allow for diagnostics of all digital encoders, analog devices, and analog to digital encoders and timers in the system.
- 12.4 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.
- 12.5 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.
- 12.6 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.
- 12.7 Test Screen: The software shall allow for the **real time** display of speed, MU, water tank volume, number of tests since water fillup, temperature sensor output, test cycle completion, test data values

such as MU average 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.

12.8 All data shall be stored in ASCII format

### **13.0 ACCEPTABLE ERROR:**

The 6875H Highway Friction Tester shall consistently repeat friction averages throughout the friction range at a confidence level of 95.5%,  $\pm 4 \mu$  (or two standard deviations). The two-axis force transducer shall measure true vertical load force and true horizontal drag force and shall have less than 1% non-linearity and hysteresis when subjected to torsional loads, and less than 1% crosstalk under 1,000 pounds load in bending.

### **13.0 MEASURED AND RECORDED PARAMETERS:**

The 6875H Highway Friction Tester is a slip friction system. The recorded friction value shall be proportional to the ratio of the instantaneous longitudinal slip tractive force to the instantaneous vertical wheel load.

### **14.0 SPEED RANGE**

When conducting friction measurements, the speed for the 6875H HFT shall be 65km/hr (40 mph) or 95km/hr (60 mph) in accordance with ASTM friction standards. Additionally the 6875H shall be capable of testing at speeds as low as 15 km/hr (10 mph) to speeds up to 130 km/hr (80 mph).

### **15.0 MANUALS**

15.1 Two each complete Operators and Maintenance manuals including Maintenance Drawings and Vehicle manuals.

### **16.0 WARRANTY**

16.1 One year from date of commissioning, or 15 months from the date of delivery, whichever is earliest.

### **17.0 TRAINING**

17.1 Two days training in operation and maintenance will be conducted at the buyer's site. The Training Program Outline will be provided preceding the training.

### **18.0 SYSTEM OPTIONS**

18.1 Tire Temperature Sensor

- 18.2 Photo Cell Start
- 18.3 DGPS
- 18.4 Water Flow meter
- 18.5 Pavement Temperature Sensor
- 18.6 Pavement Texture Laser to provide real time MPD during friction data collection
- 18.7 Data link transfer

**Reference Specifications:**

- 1) FAA Advisory 150/5200-30A
- 2) FAA Advisory 150/5320-12C
- 3) ICAO Standard 9137-AN/898 Part 2 Airport Services Manual
- 4) ASTM Standards: E1551
- 5) Calibration – ASTM E-556 Calibrating a Wheel force or Torque Transducer Using a Calibration Platform