

SKID\FRICTION TESTING SYSTEM



Skid or Friction Tester

RITU performs skid testing on the order of 2000 to 3000 miles annually for the investigation of Wet Pavement Accident Clusters (WPAC), the investigation of the Skid Resistance Level (SRL) of aggregates in bituminous pavements, and the investigation of other special circumstances, typically as requested by District offices.

RITU currently owns three Pavement Skid Test System (SFT) 5040 models, manufactured by International Cybernetics Corporation, of Largo, Florida. These devices are specially equipped pickup trucks with custom two-wheel trailers. The pickup trucks are equipped with 300 to 600 gallon water tanks (located in the bed), a water pump, and computer system electronics to control the testing and record the skid measurements. The system hardware consists of an IBM-PC compatible computer System Unit with associated LED monitor, compact keyboard, printer and RS-232C Serial Interface. A Data Measurement Subsystem installed in the System Unit provides interfaces to a transmission mounted distance transducer and a custom designed Event Keyboard.



The system accepts a downloaded RMS file containing all roadway information as an input database for test data. Vehicle location and roadway features are displayed on the computer screen in a Straight Line Diagram (SLD) format, and the software accepts operator inputs verifying segment locations, known as “events”. Routes can be tested in increasing or decreasing segment order, and test sections may begin on a segment beginning, ending, or any permanent landmark feature.

The trailer is equipped with two standard test tires, wheels that are coupled by disc brake assemblies, and calibrated force transducers which measure the horizontal force on the wheel under braking. The test tires may either be ribbed or smooth

The test method and equipment are defined in ASTM E 274. The specification for the standard ribbed tire is ASTM E 501. The specification for the standard smooth tire is ASTM E 524.

Two persons are needed to perform testing, a driver and an operator. Typically, the operator is a permanent Roadway Programs Technician 2, and the driver is a temporary Roadway Programs Technician 1. Testing is typically performed during the months of March through November, but can vary depending on weather conditions. During the winter months, test results may be misleading due to colder temperatures and the potential for the presence of anti-skid material on the pavement.



Computer Control Center in Cab

To perform the test, water is dispensed onto the pavement immediately ahead of the tire on the trailer and the trailer braking system is actuated to lock the test wheel (typically, only the left trailer wheel is used to test). The system detects and records the horizontal tractive force, which is the force necessary to slide the locked test tire along the pavement at the test speed, the vertical load on the test wheel, and the vehicle speed.

A test cycle takes approximately 2.5 seconds. Water dispersion begins 0.1 seconds prior to wheel lock (and continues during the entire test cycle), it takes approximately 1 second to lock the wheel (the higher the speed, the longer it takes to lock the wheel), and measurements are made for 1 second while the wheel is locked (200 separate measurements are recorded during that 1 second interval).

A minimum of five tests (cycles) are performed per segment. Water is dispensed at the rate of approximately 28 gallons per minute. Approximately 200 to 400 test cycles can be performed per water tank capacity (approximately 20 to 40 directional miles). Tests are not typically performed on bridges, but can be as requested.



Skid Trailer

The average skid number (SN) for each test cycle equals the Horizontal Tractive Force divided by the Vertical Load, multiplied by 100. The coefficient of friction is simply Horizontal Tractive

Force divided by Vertical Load.

The high, low, and average SN values are reported for each segment. SN values vary based on test speed; the lower the speed, the higher the SN. For PennDOT, tests are performed at speeds between 25 MPH and 50 MPH, but results are always adjusted and reported to 40 MPH values. Adjustments are made as follows: if test speed is 40 MPH, no adjustment; if test speed is 35 MPH, subtract 2, if test speed is 30 MPH, subtract 5, if test speed is 25 MPH, subtract 7, if the test speed is 45 MPH, add 2, if test speed is 50 MPH add 5.

The Department's "Skid Policy" establishes guidelines for identifying frictional characteristics of pavements, defining appropriate remedial actions, and establishing the procedure for corrective actions. This policy states that action should be taken for pavements which meet all of the following: the site is on the wet pavement accident cluster list or a known skid friction problem exists (during a 5-year interval, 8 or more wet pavement accidents within 3000 feet, and the wet/total accident rate equals or exceeds 0.30); one or more high friction needs exist within the cluster area (such as curves with low design speed, high speed areas with a high frequency of access points, short stopping sight distance for vertical curves, short accel./decel. lanes at interchanges, ground and/or polished surfaces); either the ribbed tire SN is less than 35, or the smooth tire SN is less than 20.

The use of both tires provides more data than does either tire alone. If only one tire is used, the smooth tire is generally recommended because it is sensitive to both microtexture and macrotexture, whereas ribbed tires respond primarily to microtexture. When skid friction testing is performed for the purpose of evaluating SRL levels of aggregate, ribbed tires are used since microtexture is of concern. There is no correlation between ribbed tire and smooth tire data, since varying macrotexture can cause varying differences in the data.