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	PAGE
7780061	1

ADDRESS CORRESPONDENCE TO ATTENTION OF:
MICHAEL AUSTIN
304-558-2402

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE
NEUBERT AERO CORP
14141 46th St. N
Ste 1206
Clearwater, FL 33762

SHIP TO
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
03/25/2008				

BID OPENING DATE: 04/16/2008 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
0001	1	EA		845-63	$42,674.00	$42,674.00

CONTINOUS READING, FIXED SLIP TEST TRAILER

PER THE ATTACHED SPECIFICATIONS.

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:

( ) 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

( ) BIDDER IS A PARTNERSHIP, ASSOCIATION OR CORPORATION RESIDENT VENDOR AND 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 80% OF THE OWNERSHIP INTEREST OF BIDDER IS HELD BY ANOTHER INDIVIDUAL, PARTNERSHIP, ASSOCIATION OR CORPORATION RESIDENT VENDO 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

( ) BIDDER IS A CORPORATION NONRESIDENT VENDOR

RECEIVED
2008 APR 15 A 9:13
PURCHASING DIVISION
STATE OF WV

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE [signature] TELEPHONE 727 538 8244 DATE 4/14/08

TITLE President FEIN 59-3527102 ADDRESS CHANGES TO BE NOTED ABOVE

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

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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.

B. APPLICATION IS MADE FOR 2.5% PREFERENCE FOR THE REASON CHECKED:

( ) 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;
OR
( ) 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.

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 BIDDER IN AN AMOUNT NOT TO EXCEED 5% OF THE BID AMOUNT

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE [signature] TELEPHONE 727 538 8744 DATE 4/14/08

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INFORMATION	PAGE
7780061	3

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AND THAT SUCH PENALTY WILL BE PAID TO THE CONTRACTING AGENCY OR DEDUCTED FROM ANY UNPAID BALANCE ON THE CONTRACT OR PURCHASE ORDER.

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.

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.

BIDDER: NEUBERT AERO CORP.

DATE: 4/14/08

SIGNED: [signature]

TITLE: President

* CHECK ANY COMBINATION OF PREFERENCE CONSIDERATION(S) IN EITHER "A" OR "B", OR BOTH "A" AND "B" WHICH YOU

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SIGNATURE [signature] TELEPHONE 7275388244 DATE 4/14/08

TITLE Pres. FEIN 59-3527102 ADDRESS CHANGES TO BE NOTED ABOVE

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LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT

ARE ENTITLED TO RECEIVE. YOU MAY REQUEST UP TO THE MAXIMUM 5% PREFERENCE FOR BOTH "A" AND "B".
(REV. 12/00)

NOTICE

A SIGNED BID MUST BE SUBMITTED TO:

DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
BUILDING 15
2019 WASHINGTON STREET, EAST
CHARLESTON, WV 25305-0130

THE BID SHOULD CONTAIN THIS INFORMATION ON THE FACE OF THE ENVELOPE OR THE BID MAY NOT BE CONSIDERED:

SEALED BID

BUYER: 33

RFQ. NO.: 7780061

BID OPENING DATE: 04/16/2008

BID OPENING TIME: 1:30 PM

PLEASE PROVIDE A FAX NUMBER IN CASE IT IS NECESSARY TO CONTACT YOU REGARDING YOUR BID:

727-538-8765

CONTACT PERSON (PLEASE PRINT CLEARLY): Timothy W. Neubert

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE [signature] TELEPHONE 727 538 8764 DATE 4/14/08

TITLE President FEIN 59-3527102 ADDRESS CHANGES TO BE NOTED ABOVE

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

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	PAGE
7780061	5

ADDRESS CORRESPONDENCE TO ATTENTION OF:
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VENDOR
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****** THIS IS THE END OF RFQ 7780061 ****** TOTAL: $42,674.00

Forty-two Thousand, Six Hundred Seventy-four ^NO/100

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SIGNATURE [signature] TELEPHONE 727 538 8744 DATE 4/14/08

TITLE Pres FEIN 59-3527102 ADDRESS CHANGES TO BE NOTED ABOVE

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SPECIFICATIONS

Continuous Reading, Fixed Slip Test Trailer.

1. Shall be equipped with either a force transducer to provide direct measurement of the braking force, or a torque transducer to measure the torque on the test wheel or both. A load force transducer shall be included if the average load force cannot be shown to be within 1 % of the static wheel load over the reporting length.

1.1 Braking force transducer, if included, shall measure the force with minimal inertial effects. The effects of cross-axle loading shall be less than 1 % of the applied load and shall experience less than 1 degree angular rotation with respect to its longitudinal measuring plane at the expected maximum loading. It is preferable that the output is directly proportional to force with hysteresis less than 1 % of the applied load up to the maximum applied load.

1.2 Torque transducer, if included, shall provide output directly proportional to torque with hysteresis less than 1 % of the applied load and nonlinearity up to the maximum applied load of less than 1 % of the applied load. Torque measurements include all wheel/tire effects. These effects shall be compensated for at all test speeds.

1.3 If a load force transducer is included, it will meet the requirements of section 1.1. If not included, the load force will be assumed constant and the dynamic wheel load must be shown to be within ± 2 % of the actual dynamic wheel load.

2. Shall include a mechanism or mechanisms to measure the test speed and distance traveled.

2.1 Distance shall be measured with a resolution of 0.1 % and an accuracy of ± 0.5 % and shall be continuously recorded.

2.2 Speed shall be measured with a resolution of 1 mph and an accuracy of ± 0.5 mph. These measurements should be continuously recorded.

3. Shall include a method for measuring the rate of water flow and preferably recording the flow rate continuously.

4. All necessary water tanks, pumps and connections needed to supply water to the trailer will be included.

5. The water flow rate shall be regulated within ± 10 %, and the discharge shall be protected from effects of side winds.

6. The test tire shall meet the requirements of ASTM E 1844.

7. A computer system with appropriate software and necessary connections will be included to allow the operator to view data as it is captured and allow future processing of information. Windows XP or Vista will be required as the operating system.

7

Designation: E 2340 – 06

Standard Test Method for Measuring the Skid Resistance of Pavements and Other Trafficked Surfaces Using a Continuous Reading, Fixed-Slip Technique[1]

This standard is issued under the fixed designation E 2340; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the measurement of the skid resistance of a pavement or other trafficked surface using the continuous reading, fixed-slip technique.

1.2 This test method covers braked wheel measurements obtained with less than 100 % slip. It does not cover side force measurements.

1.3 This test method provides a record of the skid resistance along the whole length of one track of the test surface and enables averages to be obtained for specified test segments.

1.4 This test method is used to measure skid resistance on a wide variety of surfaces in a wide variety of circumstances. Consequently, there are many different designs of continuous reading, fixed-slip measuring equipment (CFME) and as many different test procedures governing their use.

1.5 This test method does not attempt to cover these different equipments and procedures but does set out the essential common principles.

1.6 CFMEs function by creating and measuring a frictional force between a test tire operating at a selected slip and the test surface. Different types of CFME do not necessarily create the same frictional force between their particular test tire and a common test surface and do not necessarily use the same method to measure this frictional force.

1.7 CFME measurements are obtained at a selected steady test speed. This speed may vary according to the application.

1.8 The test surface may be contaminated or clean and dry. If it is clean and dry, a measured amount of water is normally deposited on the surface just in front of the test wheel.

1.9 The measuring apparatus may be built into a vehicle, built into a trailer that is towed by a vehicle, or built into a device that is manually pushed.

1.10 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.11 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Safety precautionary information is contained in Section 7.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

E 178 Practice for Dealing With Outlying Observations

E 501 Specification for Rib Tire for Pavement Skid-Resistance Tests

E 524 Specification for Smooth Tire for Pavement Skid-Resistance Tests

E 1551 Specification for Special Purpose, Smooth-Tread Tire, Operated on Fixed Braking Slip Continuous Friction Measuring Equipment

E 1844 Specification for A Size 10 × 4–5 Smooth-Tread Friction Test Tire

F 408 Test Method for Tires for Wet Traction in Straight-Ahead Braking, Using a Towed Trailer

F 457 Test Method for Speed and Distance Calibration of Fifth Wheel Equipped With Either Analog or Digital Instrumentation

3. Terminology

3.1 For definitions of terms used in this test method, refer to Terminology E 867.

3.2 *Definitions:*

3.2.1 *braking force, n*—dynamic instantaneous frictional force acting on the test wheel.

3.2.2 *braking force coefficient (BFC), n*—appropriately filtered mean of a number of instantaneous friction readings over a defined distance.

[1] This test method is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.21 on Field Methods for Measuring Tire Pavement Friction.

Current edition approved Dec. 1, 2006. Published December 2006.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.3 *braking slip friction, n*—tangential force generated between the test tire and the test surface.

3.2.4 *braking slip ratio, n*—ratio of relative braking slip circumferential speed to identical unbraked wheel circumferential speed, usually defined as a percent.

3.2.4.1 *Discussion*—An equivalent definition is the ratio of the relative braking slip velocity to the horizontal velocity of the wheel axle.

3.2.5 *continuous reading, fixed slip-measuring equipment (CFME), n*—apparatus that can be moved over the test surface at the chosen test speed and includes a test wheel, a system for braking the test wheel, and instrumentation for measuring the resulting frictional force between the test tire and test surface.

3.2.6 *fixed slip, n*—braking system that forces the test wheel to roll at a constant slip or fixed reduction of its free rolling speed.

3.2.7 *frictional force, n*—resistance generated when one surface moves relative to another with which it is in contact.

3.2.8 *instantaneous friction reading, n*—braking force divided by load or equivalently divided by torque on the test wheel (generated by braking force) divided by load times tire radius (moment arm).

3.2.9 *load force, n*—dynamic instantaneous vertical force acting on the test wheel.

3.2.10 *nominal water film thickness, n*—thickness of the film that the water application system is designed to create ahead of the test tire on an entirely smooth test surface.

3.2.11 *rate of water flow, n*—rate at which water is applied to the test surface in front of the test tire.

3.2.12 *reporting length, n*—defined length over which the BFC is calculated.

3.2.13 *standard nominal water film thickness, n*—nominal water film thickness associated with CFME measurements of a particular type of test application to facilitate comparisons between the results of different tests.

3.2.14 *standard test speed, n*—steady test speed associated with CFME measurements of a particular type of test application to facilitate comparisons between the results of different tests.

3.2.15 *test speed, n*—steady test speed associated with CFME measurements.

3.2.16 *water application system, n*—system for depositing a given amount of water in front of the test tire so that it passes between the tire contact area and the test surface.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *certifying calibration, n*—verification of test equipment, calibration equipment (separate or inbuilt), calibration procedures, and equipment operation recommended to be carried out once a year; the procedure records both as found values and adjusted values.

3.3.2 *field calibration, n*—primary force calibration or the equivalent carried out before each test or series of tests by a trained operator using calibration equipment supplied by the manufacturer; this equipment may be built into the CFME.

3.3.3 *friction map, n*—presentation of friction readings obtained down the length of a test surface (typically an airport runway) over a series of selected paths down the surface.

3.3.4 *operational friction testing, n*—measurement of the friction of a surface in response to an operational need and in whatever conditions exist at the time of the test, which may include contamination by ice, snow, slush, or water; these tests do not include the application of water.

3.3.5 *routine friction testing, n*—measurement of the friction of a surface under standardized test conditions that normally includes a standard test speed and a rate of water flow which gives a standard nominal water film thickness.

3.3.6 *test tire, n*—standard tire for pavement friction testing; test tires for routine friction testing shall have a smooth tread.

4. Summary of Test Method

4.1 The test system is moved over the test surface at the chosen test speed with the test wheel, fitted with a test tire, and forced to roll at a particular braking slip ratio.

4.2 If routine friction testing is taking place, the rate of water flow is adjusted to the test speed so that the chosen nominal water film is achieved.

4.3 The braking force or torque is measured (see Terminology E 867) and the load is measured, calculated, or assumed to be the same as the dead weight load.

4.4 The instantaneous friction reading is calculated.

4.5 Either the instantaneous friction reading is recorded or the BFC for each friction length is calculated and recorded.

4.6 Test speed (see Test Method F 457), rate of water flow, and other essential supporting data are recorded.

5. Significance and Use

5.1 CFMEs are used to measure skid resistance on runways, roads, and various other trafficked surfaces. These tests may comprise operational testing, performed to obtain an immediate assessment of skid resistance in current conditions or routine testing in standardized conditions which include the application of a precise amount of water in front of the test tire.

5.2 Standard test speeds and nominal water film thicknesses are according to national or international agency standards, the type of CFME, and the test application. Some examples of typical applications are given in Appendix X1.

6. Apparatus

6.1 *Basic Measurements:*

6.1.1 The test apparatus shall be equipped with a force transducer to provide a direct measurement of the braking force or a torque transducer to measure the torque on the test wheel generated by this force or both.

6.1.2 The design of the test apparatus shall ensure that unless the average load force acting on the test wheel remains within 1 % of the static wheel load over the reporting length, the apparatus shall be equipped with a force transducer to measure the load force.

6.1.3 The test apparatus shall include a mechanism for measuring test speed and distance traveled.

6.1.4 Unless the test apparatus is to be used solely for operational testing, it shall include a mechanism for measuring rate of water flow.

6.2 *Tolerance for Adverse Conditions:*

6.2.1 The exposed portions of the system shall tolerate 100 % relative humidity (RH) (rain or spray) and all other

adverse conditions, such as de-icing chemicals, dust, shock, and vibrations that may be encountered in the type of testing for which the equipment is designed. The suspension system shall minimize the influence of normal pavement roughness on the accuracy and fidelity of the data collection.

6.3 *Accuracy, Resolution, and Stability of Measuring System:*

6.3.1 At outside ambient air temperatures between –40 and 45°C (–40 and 110°F), overall static system measurement accuracy shall be ±1 % of full scale.

6.3.2 Certifying calibration or other time stability calibration shall not be required more than once a year unless the measuring system sustains damage requiring significant repair.

6.3.3 If there is a force transducer that provides a direct measurement of the braking force, it shall do so with minimal inertial effects. It is recommended that this transducer provides output directly proportional to force with hysteresis less than 1 % of the applied load up to the maximum expected loading. The mounting of the braking force-measuring transducer shall be such that the effects of cross-axle loading or torque loading shall be less than 1 % of the applied load. The braking force transducer shall be mounted in such a manner as to experience less than 1° angular rotation with respect to its longitudinal measuring plane at the maximum expected loading.

6.3.4 If there is a torque transducer that measures the torque on the test wheel generated by the braking force, this shall provide output directly proportional to torque with hysteresis less than 1 % of the applied load and nonlinearity up to the maximum expected loading less than 1 % of the applied load. The sensitivity to any cross-axis loading shall be less than 1 % of the applied load. Torque transducer measurements include rolling tire/wheel inertial effects, which shall be compensated for at all test speeds.

6.3.5 If the load force is measured, the accuracy of the measurement shall conform to the requirements set out in 6.3.3. If the load force is assumed constant, it shall be possible to show that the assumed dynamic wheel load is within ±2 % of the actual dynamic wheel load.

6.3.6 Distance shall be measured with a resolution of 0.1 % and an accuracy of ±0.5 % and shall be continuously recorded.

6.3.7 Speed shall be measured with a resolution of 2 km/h (1 mph) and an accuracy of ±1 km/h (±0.5 mph). It is recommended that these measurements be continuously recorded.

6.4 *Braking Slip:*

6.4.1 The test apparatus shall be such that the chosen fixed braking slip can be maintained within ±3 % of full scale throughout the length of the test surface at the chosen test speed (for example, if the chosen fixed braking slip is 15 %, a braking slip between 12 and 18 % shall be maintained).

6.5 *Test Speed*—With the test tire operating at the chosen fixed braking slip, the test apparatus shall be capable of maintaining the chosen test speed within ±3 % for the duration of the survey.

6.6 *Test Tire*—The test tire shall conform to the applicable ASTM, ISO, or RST specification or equivalent. Applicable ASTM standards include Specifications E 501, E 524, E 1551 and E 1844.

6.7 *Water Application System:*

6.7.1 Water shall be applied to the test surface just ahead of the test tire so as to provide the chosen nominal water film thickness across the full width of the test tire at any test speed.

6.7.2 The water application system shall be protected from the effects of side winds, either by use of a flexible nozzle very close to the test surface or by shielding the nozzle in some way or by using a jet of water with horizontal speed equal and opposite to the test speed and applied slightly wider than the width of the test tire tread.

6.7.3 Water used for testing shall be reasonably clean and have no chemicals such as wetting agents or detergents added and shall not be above 30°C (86°F).

6.7.4 The nominal water film thickness shall be in accordance with the manufacturer's handbook and the test application.

6.7.5 Rate of water flow shall be continuously measured and it is recommended that it be continuously recorded.

6.7.6 Regulation of rate of water flow shall be within ±10 %.

6.8 *Signal Conditioning and Recording Systems:*

6.8.1 All signal-conditioning and recording equipment shall provide linear output and allow data reading resolution to meet the requirements of 6.3. All systems except the smoothing filter described in 6.8.3 shall provide a minimum bandwidth of at least 0 to 20 Hz (flat within ±1 %).

6.8.2 Measurements shall be recorded in phase and all force signals shall be referenced to a common time base and be passed through the same filter.

6.8.3 A low-pass electronic filter, typically between 4.8 Hz/-3db/4 pole and a 10 Hz/-3db/8 pole, shall be installed in the signal-conditioning circuit.

6.8.4 The static signal-to-noise ratio shall be at least 100 to 1 at full scale on all recording channels.

7. Hazards

7.1 The test apparatus shall comply with all applicable laws and regulations, and all necessary precautions shall be taken to ensure maximum safety of operating personnel and other traffic. No test that involves surface wetting shall be made when the pavement temperature is below 2°C (35°F) and there is a consequent danger that water may freeze on the pavement.

8. Preparation of Apparatus

8.1 Field calibration is carried out according to the manufacturer's handbook.

8.2 Test speed and rate of water flow is chosen according to the test site and the manufacturer's handbook.

8.3 Particular attention shall be paid to the condition of the test tire.

8.3.1 A new test tire shall not be used until it has been conditioned by running at fixed slip at the normal tire inflation pressure to obtain a smooth, uniform rubber tread surface free of any curing agents. For tires not conditioned and tested by the supplier, conditioning may typically be carried out by the operator running the tire dry for about 30 m (100 ft) followed by about 300 m (1000 ft) on a wet surface. The operator shall be aware that these lengths are typical and, on an aggressive surface, the tire shall not be run dry for as much as 30 m and, on a smooth surface, longer conditioning will be required.

8.3.2 A test tire exhibiting damage, flat spots, and other irregularities that may affect test results shall not be used.

8.3.3 A test tire worn to the extent that it is unlikely to complete the test (or series of tests) shall not be used. Criteria for determining wear on the measuring tire are given in the appropriate tire standards (see Specifications E 501, E 524, E 1551 and E 1844) and the appropriate manufacturer's handbooks.

8.3.4 For all test tires, the appropriate tire standards (see Specifications E 501, E 524, E 1551 and E 1844) provide storage limitations and guidance. If these requirements have not been observed, the tire shall not be used.

8.3.5 Just before each series of tests, the test tire shall be brought to operational readiness by running the test apparatus in test mode and test conditions according to the manufacturer's handbook. The test tire inflation pressure shall then be set to the required value.

9. Calibration

9.1 Field calibration of the force transducers or torque transducers or both is carried out before each test. The calibration signal shall be at least 50 % of the normal vertical load, and the calibration process shall be such that the effects of cross-axle loading or torque loading shall be less than 1 % of the applied load.

9.2 Certifying calibration is performed once per year on a regular basis and also after any major repair to the equipment.

9.3 Calibration of the distance- and speed-measuring systems is carried out to meet the requirements set out in 6.3.6 and 6.3.7.

10. Procedure

10.1 The start point for the test both longitudinal and lateral, is clearly established at the test site.

10.2 The test is established at [illegible] chosen test speed and rate of water flow (in the case of routine testing) to be achieved before the start point.

10.3 If there is the possibility of a delay between completing the process described in 8.3.5 and starting the test, the run in is also long enough to bring the test tire back to the stable test condition.

11. Faulty Tests

11.1 Tests that are faulty shall be treated as outliers in accordance with Practice E 178. Reasons for identifying a test as faulty include:

11.1.1 Incorrect test speed;

11.1.2 Incorrect rate of water flow;

11.1.3 Incorrect start or finish point;

11.1.4 Incorrect track (normally defined by distance from the center line of the runway or road);

11.1.5 Test tire not having been brought to operational readiness before the start of the test (see 8.3.5);

11.1.6 Test tire tread exceeds wear limits at end of test run;

11.1.7 Incorrect test tire inflation pressure;

11.1.8 Inappropriate surface conditions (for example, buildup of water from previous routine test(s); and

11.1.9 Anomalous test values.

12. Test Data

12.1 [illegible] without supporting data. This supporting data may be manually collected by the operator or automatically collected and written to the computer file.

12.2 Essential supporting data includes:

12.2.1 Sufficient locational referencing for the test to be repeated if required and for friction data collected to be analyzed in conjunction with other locationally referenced data. Test site, lateral position (such as distance from center line) of the track tested by the CFME, and longitudinal position of each friction length are required;

12.2.2 CFME type and serial number;

12.2.3 Test speed, intended and actual (it is recommended that the actual test speed be recorded for each friction length);

12.2.4 Rate of water flow, intended and actual (it is recommended that the actual rate of water flow be recorded for each friction length). If operational testing is being carried out, rate of water flow will be zero;

12.2.5 Surface condition prior to the test;

12.2.6 Date of test; and

12.2.7 Tire type, serial number, and inflation pressure.

12.3 Nonessential but recommended supporting data include:

12.3.1 Surface temperature, test tire temperature, and ambient temperature;

12.3.2 Weather conditions;

12.3.3 Time of start of test;

12.3.4 Operator; and

12.3.5 Test surface type(s).

13. Report

13.1 The test report shall include all the items listed in 12.2 and it is recommended that it also include the items listed in 12.3.

14. Precision and Bias

14.1 *Precision*—The measurements made in this test method are of the frictional force between a test tire operating at a selected slip and a test surface. Many parameters may cause this frictional force to vary and, consequently, measurements obtained using different types of CFME, or at different test speeds, or with different amounts of water (or other contamination) will not necessarily agree with each other.

14.2 *Bias*—There are no standards or references with which the results of this test can be compared.

15. Keywords

15.1 braking slip friction; braking slip ratio; fixed slip; operational friction testing; routine friction testing

APPENDIX

(Nonmandatory Information)

X1. TEST PROCEDURES

X1.1 CFMEs are used to measure skid resistance on a wide variety of surfaces in a wide variety of circumstances. Consequently, there are many different test procedures governing their use (see Test Method F 408).

X1.2 *Airports*:

X1.2.1 Operational testing is carried out to determine whether a winter-contaminated runway is suitable for use (see Test Method F 408). It usually consists of two runs, one on either side of the runway centerline, the distance from the centerline being determined by the width of undercarriage of the largest aircraft using the runway. The standard test speed is typically 65 kmh (40 mph).

X1.2.2 Routine testing is carried out to obtain data for scheduling remedial work on the runway surface. A single run on either side of the centerline may be regarded as sufficient or a set of runs covering the whole width of the runway may be preferred. At 3-m (10-ft) spacing, the friction map that can be prepared from a set of runs of this kind provides useful information on rubber buildup and surface polishing. Standard test speeds are typically 65 or 95 kmh (40 or 60 mph) and standard nominal water film thickness is typically 1.00 mm (0.04 in.).

X1.2.3 For all runway testing, it is recommended that the start point for the test shall be as near the runway start as is consistent with the need to achieve the chosen test speed, chosen rate of water flow, and stable condition of the test tire, and that the finish point for the test shall be as near the runway end as is consistent with safe deceleration.

X1.3 *Roads*:

X1.3.1 Operational testing is not often carried out on roads.

X1.3.2 Routine testing is usually carried out on the left wheel track of each lane. The length of the test may be as little as 100 m (300 ft) or as much as 50 km (30 miles). Standard test speeds as low as 20 kmh (12 mph) and as high as 80 kmh (50 mph) have been established for particular types of CFME and particular applications. Standard nominal water film thicknesses are typically 0.25, 0.50, and 1.00 mm (0.01, 0.02, and 0.04 in.) according to the type of CFME and the application.

X1.4 *Other*:

X1.4.1 On footways and helidecks where the CFME is manually pushed, a standard test speed of 5 kmh (3 mph) has been established. Standard nominal water film thicknesses are typically 1.0 and 0.5 mm (0.04 and 0.02 in.).

BIBLIOGRAPHY

(1) [illegible] to the Convention on International Civil Aviation, Volume I, *Aerodrome Design and Operations*, fourth edition, International Civil Aviation Organization, Montreal, Quebec, Canada, July 2004.

(2) *Airport Services Manual, Part 2, Pavement Surface Conditions*, fourth edition, Doc 9137, AN/898, International Civil Aviation Organization, Montreal, Quebec, Canada, 2002.

(3) Andresen, A., and Wambold, J. C., "Friction Fundamentals, Concepts and Methodology," TP 13837E, Transportation Development Centre, Transport Canada, October 1999.

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(5) FAA Advisory Circular AC/150/5320-12 Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces[4]

(6) Goodenow, G. L., Kolhoff, T. R., and Smithson, R. D., "Tire-Load Friction Measuring System—A Second Generation," Society of Automotive Engineers, Paper No. 680137.

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(8) Kummer, H. W., and Meyer, W. E., "Tentative Skid Resistance Requirements for Main Rural Highways," National Cooperative Highway Research Program, Report No. 37, Highway Research Board, 1967.

(9) *National Cooperative Highway Research Program Synthesis 291: Evaluation of Pavement Friction Characteristics, a Synthesis of Highway Practice*, February 2000.

(10) Neill, A. H., Jr., Boyd, P. L., and Hinch, J., "Filtering Techniques for Measuring Peak Braking Coefficients," *Tire Science and Technology*, Vol 6, No. 4, Nov. 1978, pp. 275-303. (Also see Test Method F 408.)

(11) "Proceedings of the 2nd International Meeting on Aircraft Performance on Contaminated Runways (IMAPCR'99)," TP 13579, 1999.

(12) Pottinger, M. G., and Yager, T. J., *The Tire Pavement Interface, STP 929*, American Society for Testing and Materials, West Conshohocken, PA, 1986.

(13) "Proceedings of the International Meeting on Aircraft Performance on Contaminated Runways (IMAPCR'96)," TP 12943, 1996.

(14) Shahin, M. Y., *Pavement Management for Airports, Roads, and Parking Lots*, Chapman & Hall, 1994.

(15) Yager, T. J., Vogler, W. A., and Baldasare, P., "Evaluation of Two Transport Aircraft and Several Ground Test Vehicle Friction Measurements Obtained for Various Runway Surface Types and Conditions," NASA TP 2917, 1990.

[3] Available from the U.K. Civil Aviation Authority, CAA House, 45-59 Kingsway, London WC2B 6TE United Kingdom.

[4] Available from the U.S. Department of Transportation, Federal Aviation Administration, 800 Independence Ave., SW, Washington, DC 20591.

13

RFQ No 7780061

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 owed 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 exceed 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: NEUBERT AERO CORP

Authorized Signature: [signature] Date: 4/14/08

Purchasing Affidavit (Revised 05/15/07)

NAC
NEUBERT AERO CORP.
AIRPORT PRODUCTS & SERVICES

Strategic Airport Safety Solutions

April 14, 2008

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

Re. Invitation For Bid # 7780061
Closing Date: 4/16/08
"Friction Tester Trailer Unit"
NAC Dynamic Friction Tester™ (DFT) – Total Bid: $ 42.674.00

Dear Mr. Austin:

It is our pleasure to submit the enclosed bid response for the above referenced subject to the State of West Virginia for consideration and acceptance. Neubert Aero Corp. (NAC) offers quality safety products and is located in Clearwater, Florida. NAC is a *Service Disabled Veteran Small Business* and is an authorized Dealer/Distributor for NAC Dynamics, LLC of the Dynamic Friction Tester™ (DFT). The DFT is manufactured and serviced in Clearwater, Florida.

The following exception is stated:

Specification: Item #6 – The test tire shall meet the requirement of ASTM E 1844

Justification: The DFT friction tire is meets the ASTM E 1551. The tire referenced by the Authority is a product specific tire used on a competing device using the ASTM E 1844. As referenced in Federal Aviation Administration Advisory Circular No. 150/5320-12C (see attached copy), the DFT is an FAA Qualified Continuous Friction Measurement Equipment (CFME) for use.

If you need any additional information regarding our bid response or product specificaitons, please call me directly at 727.538.8744 or my cell at 727.643.7681.

Respectfully yours,

Timothy W. Neubert, MBA, A.A.E.
President

14141 46th Street North, Suite 1206 • Clearwater, Florida 33762 USA • Phone: 727.538.8744 Fax: 727.538.8765
www.airportnac.com
Certified Service Disabled Veteran - Owned Small Business

U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: Change 7 to MEASUREMENT, CONSTRUCTION, AND MAINTENANCE OF SKID-RESISTANT AIRPORT PAVEMENT SURFACES

Date: 12/05/2005 **AC No:** 150/5320-12C
Initiated by: AAS-100 **Change:** 7

1. **PURPOSE.** This change updates information regarding FAA qualified Continuous Friction Measuring Equipment.

2. **PRINCIPAL CHANGES.** The following editorial changes have been made:

   a. Appendix 4. Changes have been made to reflect updated information for manufacturers.

PAGE CONTROL CHART

Remove Pages	Dated	Insert Pages	Dated
Appendix 4 pg. 1 (and 2)	05/25/05	Appendix 4 pg. 1 (and 2)	12/05/05

DAVID L. BENNETT
Director of Airport Safety
and Standards

APPENDIX 4. FAA APPROVED CFME

AIRPORT SURFACE FRICTION TESTER INDUSTRIES AB Metallgatan 7 271 39 Ystad, Sweden SWEDEN	**AIRPORT SURFACE FRICTION TESTER** +46 0 411 651 00 FAX +46 0 411 190 12 email: sales@asft.se
AIRPORT TECHNOLOGY USA NO LONGER AVAILABLE	**SAFEGATE FRICTION TESTER**
DOUGLAS EQUIPMENT LTD Douglas House, Village Road Arle, Cheltenham Gloucestershire GL51 0AB UK	**MU METER** +44 1242 531219 FAX +44 1242 571667 email: spd@douglas-equipment.com
DYNATEST CONSULTING, INC., **(FORMERLY K.J. LAW ENGINEERS, INC.)** 13952 US Highway 301 South Starke, FL 32091	**RUNWAY FRICTION TESTER (6810, 6850 and 6875)** +(904) 964-3777 FAX +(904) 964-3749
FINDLAY, IRVINE, LTD. **'ESTER** 42-44 Bog Road, Penicuik Midlothian EH 26 9 BU SCOTLAND vww.findlayirvine.com	**GRIPTESTER FRICTION** +44 1968 672111 FAX +44 1968 671237
INTERTECH ENGINEERING NO LONGER AVAILABLE	**TATRA FRICTION TESTER**
NEUBERT AERO CORP. **'ESTER** 4105 West De Leon Street Tampa, FL 33609	**NAC DYNAMIC FRICTION** +(727) 538-8744 FAX +(727) 538-8765 email: info@airportnac.com www.airportnac.com
NORSEMETER P. O. Box 125 Bogstadvien 0323 0310 NORWAY	**RUNAR RUNWAY ANALYSER AND RECORDER** +47 23 20 1270 FAX +47 23 20 1271
PATRIA VAMMAS AEC **SKIDDOMETER** P.O. Box 18 Vammaksentie FIN-38201 Vammala 4694250 FINLAND	**BV-11** +358 20 4694041 FAX +358 20 www.patria.fi
SCANDINAVIAN AIRPORT AND ROAD SYSTEMS AB **(SFT)** Box 31, Sjoviksvagen 4 23121 Trelleborg SWEDEN US/Canada Tradewind Scientific Ltd.	**SARSYS FRICTION TESTER** **SARSYS TRAILER FRICTION TESTER (STFT)** +46 410 46 110 FAX +46 410 46 111 www.tradewindscientific.com

Neubert Aero Corp
14141 46th Street North
Suite 1206
Clearwater, FL 33762

NAC
NEUBERT AERO CORP.
Airport Products & Services

Estimate

Date	Estimate #
4/14/2008	43579

Exp Date
6/14/2008

Name / Address
State of West Virginia Dept of Administration-Purchasing Div. 2019 Washington Street East PO Box 50130 Charleston, WV 25305-0130

Phone	304-558-2402	Fax	

Ship To
Division of Highways **Material, Control, Soil, & Testing** **190 Dry Branch Drive**

Ship Via	Project
Destination	

Description	Qty	Cost	Total
RFP#7780061			
Dynamic Friction Tester - CFME System Trailer Unit (DFT-60/641863) US Patent No. 7117716B2 **1) Fully Integrated Software - Mu Value Reporting** **2) Ambient and Pavement Surface Temperature Sensors** **3) Samsung Q1 Handheld(1) w/ Vehicle Mount (1)** **4) Honda WX10 1.5 HP Water Pump** **5) Flow Meter - Digital** **6) Tire Pressure Gauge** **7) 500 Liter Stainless Water Tank** **8) Fitted Standard US 2" Tow Ball Socket** **9) Strobe Amber Safety Beacon** **10 One (1) Year Warranty**	1.00	**36,534.00**	**36,534.00**
Dynamic Friction Tester Wheel-up 4316 Upgrade Modification Electric Tow-Hitch Kit **- 12 volt.DC 2000 lbs. Actuator** **- DFT Electric Motor Configuration** **- Software Upgrade**	1.00	**2,890.00**	**2,890.00**
DFT-60/641863 Two(2) day on-site training & installation	1.00	**850.00**	**850.00**
Price includes expenses related to travel, subsistence, and lodging.	1.00	**550.00**	**550.00**
Shipping & Handling	1.00	**1,850.00**	**1,850.00**

Federal Tax ID- 59-3527102 - D & B- 035516934
CAGE- 1W2L9 - Make checks payable to- Neubert Aero Co

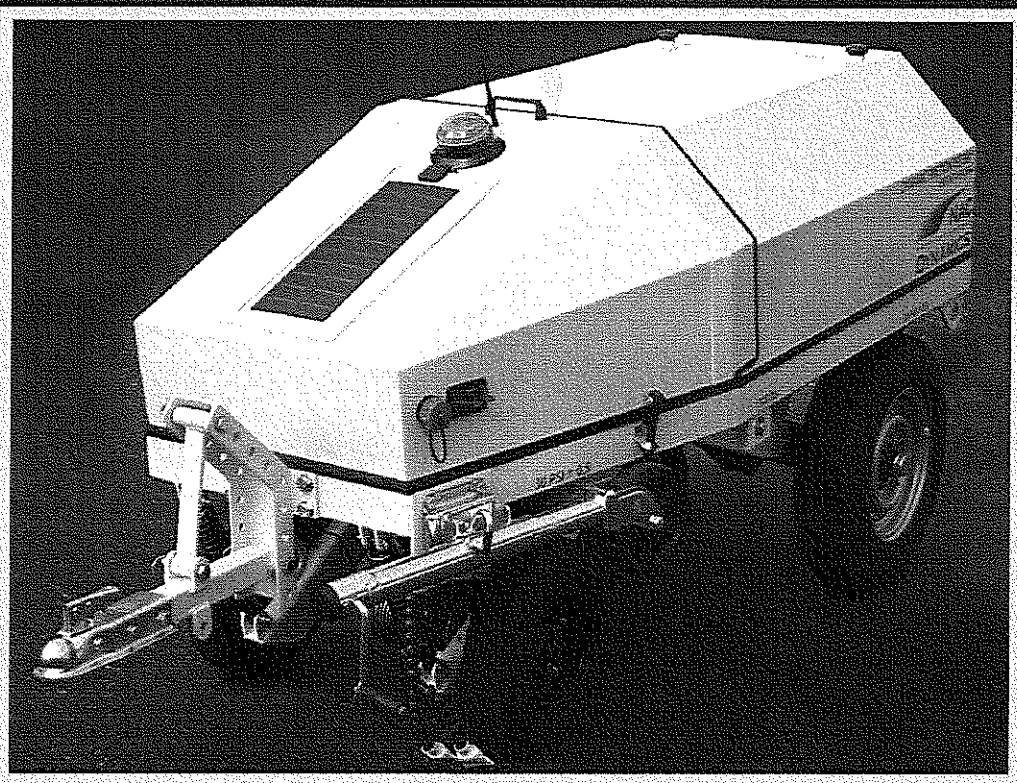
Total $42,674.00

If this estimate is acceptable, please sign and fax to 727.538.8765, along with your purchase order. We sincerely appreciate your business.

Signature _____ Date _____

Neubert Aero Corp.

Dynamic Friction Tester™
US Patent 7,117,716 B2



FAA Certified
Meets and Exceeds Appendix 4 of FAA AC 150/5320-12C

NAC Dynamic Friction Testing Device (DFT)™ *US Patent 7,117,716 B2*

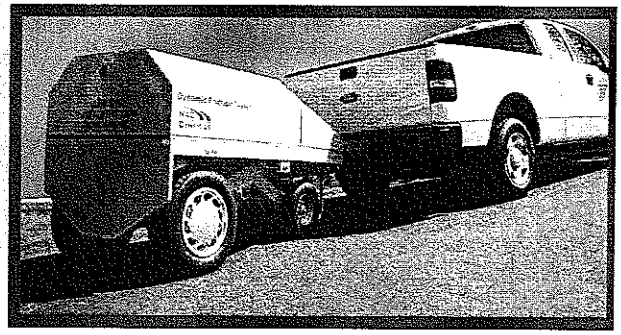
CONTINUOUS FRICTION & FLUID DRAG MEASUREMENT DEVICE (CFME)

Neubert Aero Corp (NAC) offers the most technologically advanced and only "Made In the USA" precision tow-behind CFME device. The DFT is a trailer mounted system with an integrated water tank designed to accurately measure surface coefficient of friction.

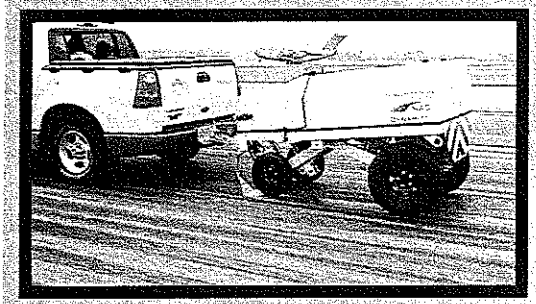
NAC DYNAMICS™
Specializing in Friction Measurement Technologies

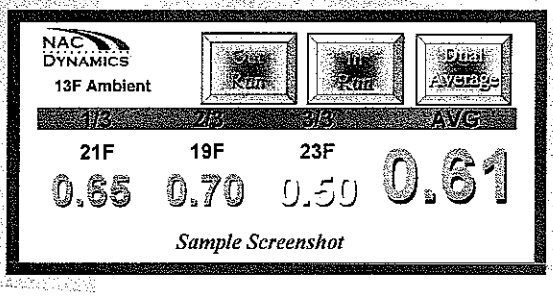
Why use unreliable decelerometers in testing your runway friction?

The Dynamic Friction Tester™ (US Patent No. 7117716B2) is an all-inclusive device designed to measure Coefficient of Friction (Mu) and is equipped with the capability to separate the $Mu_{(Roll)}$ and $Mu_{(Slip)}$ values enabling the calculation of fluid drag properties of the runway pavement contamination.



- Performs friction testing in summer and winter conditions
- Second wheel provides contaminant depth reporting
- Trailer mounted system - requires no dedicated tow vehicle
- Wi-Fi wireless technology - no external tow cables or wiring
- Self-wetting system with 130 gallon tank allows 24,000ft. testing distance
- Displays ambient and surface temperatures
- Uses standard ASTM friction tires
- Up to 300 hours of continuous operation without charging
- Battery powered system with SOLAR & AC recharging
- Rated -45 to +80 degrees Celsius (wetting system not used below freezing)
- Self-calibration system requires no test board, calibration jig, or weights
- Semi-automatic 10-second calibration procedure
- Forward and reverse function without damaging device
- Touch screen technology
- Designed in compliance with FAA/ICAO/CAA CAP 683
- 24/7 technical support
- One year full warranty





Sample Screenshot

AIP Approved

GSA

NAC NEUBERT AERO CORP.
Airport Products & Services

14141 46th Street N., Suite 1206, Clearwater, FL 33762
Phone: 727.538.8744 · Fax: 727.538.8765
www.airportnac.com infor@airportnac.com

NAC DYNAMICS

Specializing in Friction Measurement Technologies

TECHNICAL SPECIFICATION

Continuous Friction Measuring Equipment (CFME)

Dynamic Friction Tester (DFT)™ *(US Patent - 7117716)*

NAC Dynamics, LLC
14141 46th Street North, Suite 1206
Clearwater, Florida, 33762
Tel : +1 727.538.1917
Fax : +1 727.538.8765
Email: info@airportnac.com
Web: www.airportnac.com

Rev: 1/2/2008

NAC DYNAMICS
Specializing in Friction Measurement Technologies

CONTENTS

NAC DYNAMICS
Specializing in Friction Measurement Technologies

SCOPE

The Dynamics Friction Test Vehicle has been specifically designed for winter and summer operations. It's robust construction and innovative design lends itself well to the harsh environments found on modern Airports.

The Dynamics Friction Tester (DFT) measures and records surface friction values in accordance with Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO) requirements.
Reference: http://www.faa.gov/arp/publications/acs/150_5320_12c_chg7.pdf

The DFT is also fitted with a number of sensors that makes this device unique. The DFT is capable of separating the μ_{roll} and the μ_{slip} values.

μ_{roll} is defined as the rolling resistance of the tested surface and μ_{slip} is defined as the skidding resistance of the tested surface. This data can be used to monitor for runway roughness.

The DFT is a trailer mounted system with an integrated water tank and designed to be used with a tow vehicle to accurately measure the surface coefficient of friction.

Deterioration of the surface can be from the polishing action of the aircraft tires rolling and braking on the surface or the introduction of contamination, namely water, snow, slush, ice or rubber on the surface. The DFT is capable of monitoring for this loss of friction in all these conditions.

A 132 gallon (500 liter) capacity stainless steel tank is mounted on the DFT and is sufficient to test more than 27,000 feet (8300m) at 1mm water depth without refilling. The computer system uses USB technology to download the data to a compatible desktop computer system for archive and analysis. Additional on-board sensors also record ground temperature, ambient temperature, optional tire pressure and GPS data.

The DFT comes standard with a front wheel-up feature eliminating unnecessary friction-tire wear when not performing friction tests. This is done remotely via the wireless connection or serial cable.

The chassis is painted with corrosion resistant paint and the complete stainless steel trailer is designed for harsh winter operations.

The DFT is clearly visible from a typical tow vehicle and includes a strobe amber beacon. The DFT can be can be easily reversed for parking.

NAC DYNAMICS
Specializing in Friction Measurement Technologies

SPECIFICATION

Part Number	**NAC1000-0001**		
		(feet)	(mm)
Dimensions	Length	7.2'	2200
	Width	3.2'	1000
	Height to Chassis	2.5'	750
	Height to top of water Tank	4.2'	1300
Measuring Method	Rolling Friction (Mu Slip)	12%	
	Rolling (Mu Roll)	Free Rotation	
Tire Specification	E1551-93a(1998) Standard Specification for Special Purpose, Smooth-Tread Tire.		
Test Speed	Minimum	15 mph	24 kph
	Maximum	60 mph	96 kph
Temperature Rating	Cab Mounted Components	14F to 122F	-10C to +50C
	DFT Mounted Components	-58F to 140F	-50C to +60C
Operating Voltage	On-Board Battery Supply	2 X 12V DC Marine Batteries	100 hours between charges
Data Collecting Computer	Any Microsoft Windows XP computer system can be used to collect and display the data. Contact NAC Dynamics for the latest model used. *DFT software is supplied free of charge to the customer.		
Charging System	Solar Panel	Operating Voltage 16.5V @ 1.94Amps	
	External Source	110 to 240V AC	
Wheel Up System	IP 67 Actuator	Operating Voltage 12V @ 5Amps	

KEY FEATURES

The general outlay of the Friction Equipment is shown in Figure 1.

- The DFT is a trailer device pulled by a suitable tow vehicle – *Please specify your tow hitch configuration upon order.*
- A Two-Axis Force Transducer is used to measure the rolling resistance of the pavement surface.
- A Two-Axis Force Transducer is used to measure the Coefficient of Friction (μ) of the pavement surface.
- Ambient and Ground temperature sensors are mounted under the Nose Cone.
- A 6-watt solar panel is used to trickle charge the batteries and is mounted on the Nose Cone.
- A distance sensor is mounted near the rear tire.
- 2 x 12V DC batteries are charged via an on board 110V AC charger.
- A handheld computer is utilized to collect data and located in the tow vehicle with the operator. *Any suitable Windows XP computer can be used. Please specify your requirements upon order.*
- Data is transmitted from the DFT to the computer via Wireless or Serial Cable. *Both systems are supplied as standard.*

NAC DYNAMICS
Specializing in Friction Measurement Technologies

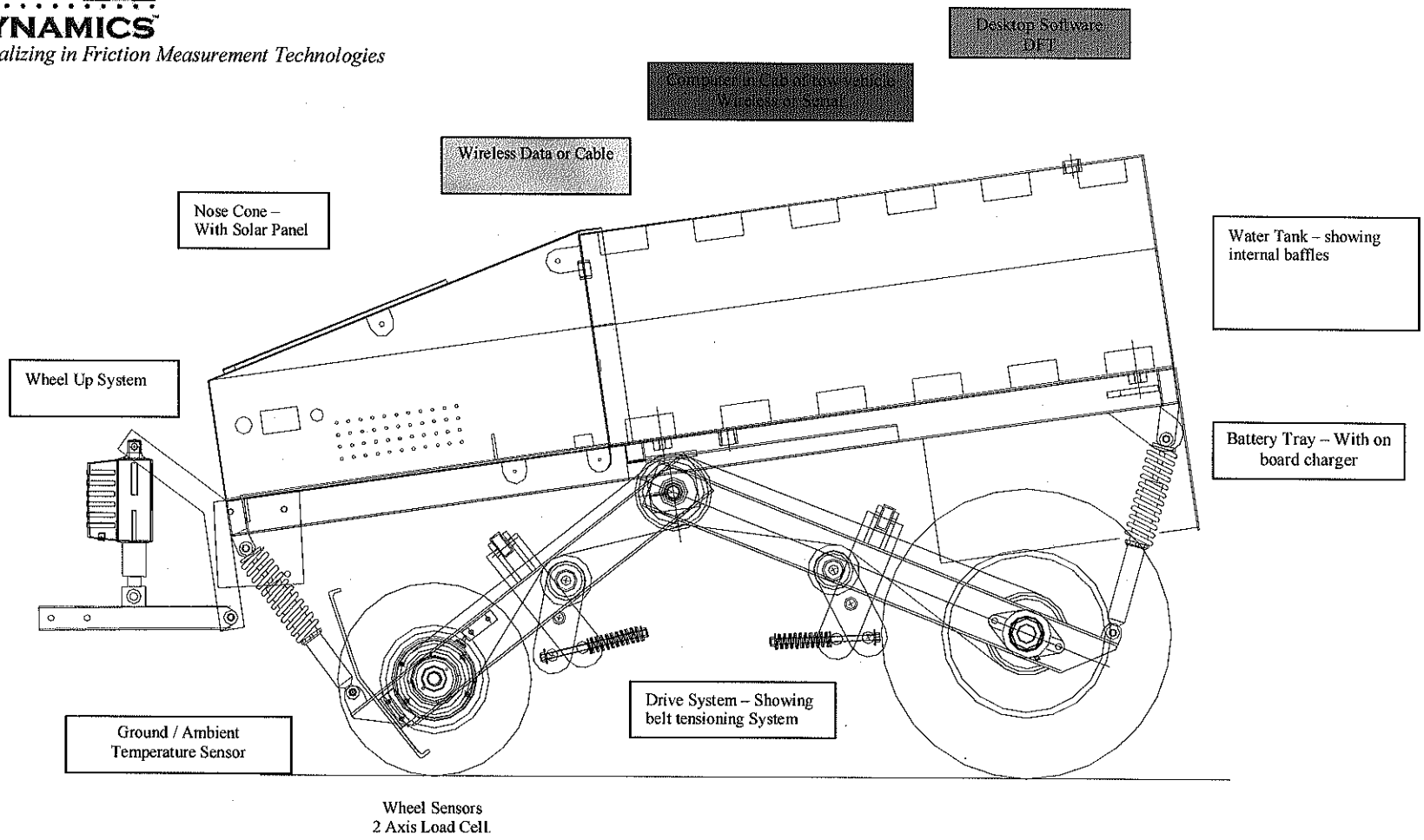


Figure 1. DFT Illustration Side View.

Rev: 1/2/2008

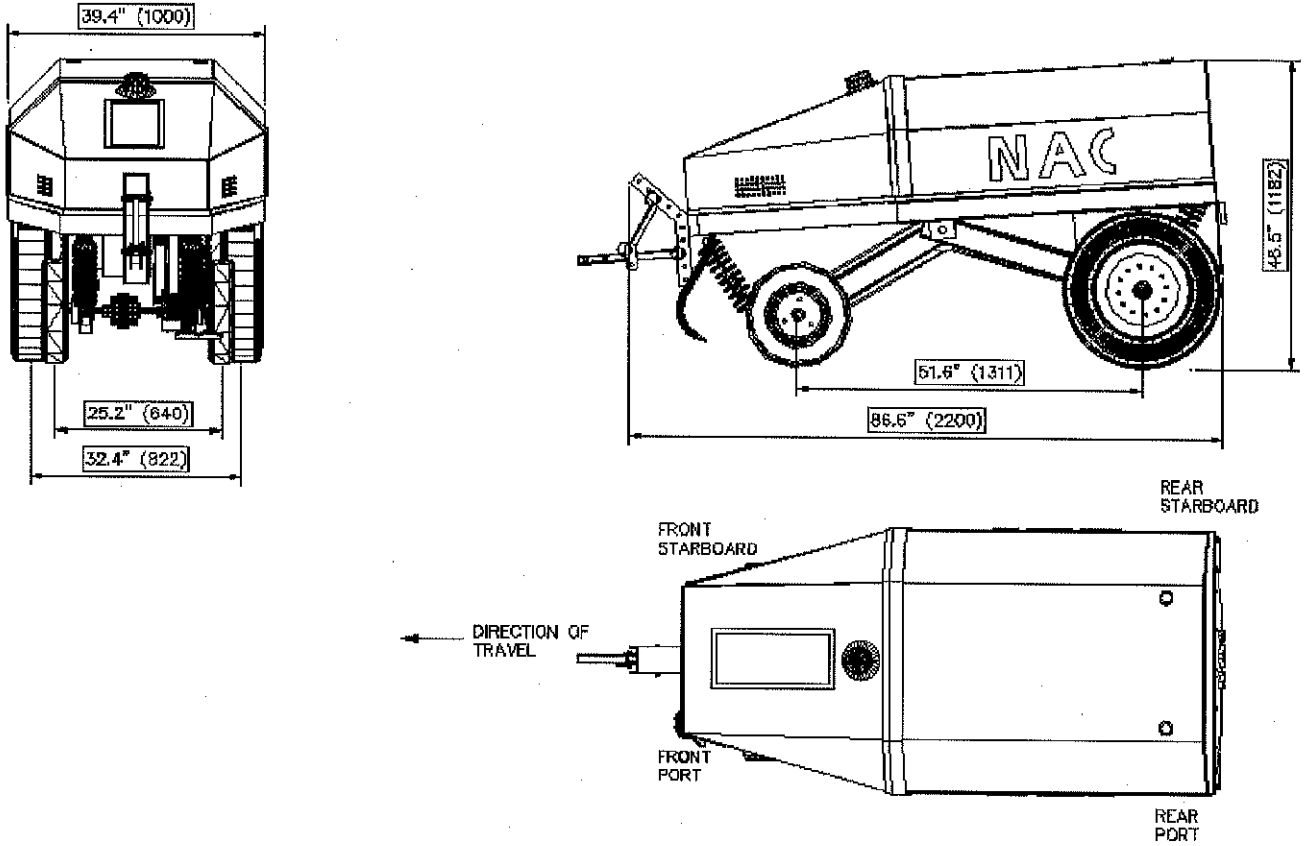


Figure 2. DFT Illustration – Basic Dimensions.

OPERATION

The DFT is a four-wheeled trailer vehicle. The two rear wheels are 24" diameter, fitted with standard tires with tread depth of ¼". The two front wheels are fitted with ASTM E1551 friction test tires.

To generate the slip required at the front friction measuring wheel, the drive from the rear port wheel is taken through a set of pulleys and belts to the front wheel axle. The specific ratio of pulleys in combination with the different tire diameters (front and rear) gives a system ratio of 12%. Zero slip is allowed in the pulley system. The belts have an automatic belt tensioning system, reducing maintenance.

The starboard rear wheel is not restrained and is allowed to rotate freely. An inductive sensor is mounted near the starboard rear wheel which monitors wheel rotation. This gives distance and speed information to resolution and accuracy of +-1.5% of the indicated speed.

Each of the four wheels is supported via a swinging arm with coil-over-shock damping system. This is mounted from a stainless steel chassis that supports the electronics, stainless steel water tank and associated water delivery system.

A battery pack is situated under the chassis. The batteries are marine grade batteries to ensure durability. The electrical capacity of the batteries gives 100 hours of operational use between charging. In addition, there is a solar panel mounted to the nose cone which is used to trickle charge the system batteries.

Located under the nose cone is a four stroke engine with an integrated water pump. When operated on dry runways, water is pumped through a digital flow meter and diverted back to the water tank. Manual operation of a valve adjusts the flow to the required rate and is shown on the computer display for accuracy. When activated, a solenoid valve is switched via the computer to divert the water to a nozzle in front of the friction-measuring tire. The water delivery system is capable of applying water at a rate of 1mm depth while traveling at 60mph (95kmph) as required by FAA, CAA and ICAO regulations.

An adjustable tow hitch is mounted on the DFT to suit different tow vehicles. The tow hitch is pivoted therefore eliminating any fluctuations in tow vehicle ride height during tests, while maintaining a constant down load force on to the measuring wheels. A 12 V DC linear actuator lifts the front of the DFT off the ground when not in use, eliminating tire wear. A jockey wheel is also supplied which enables the DFT to be moved manually.

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DATA RECORDING AND DISPLAY

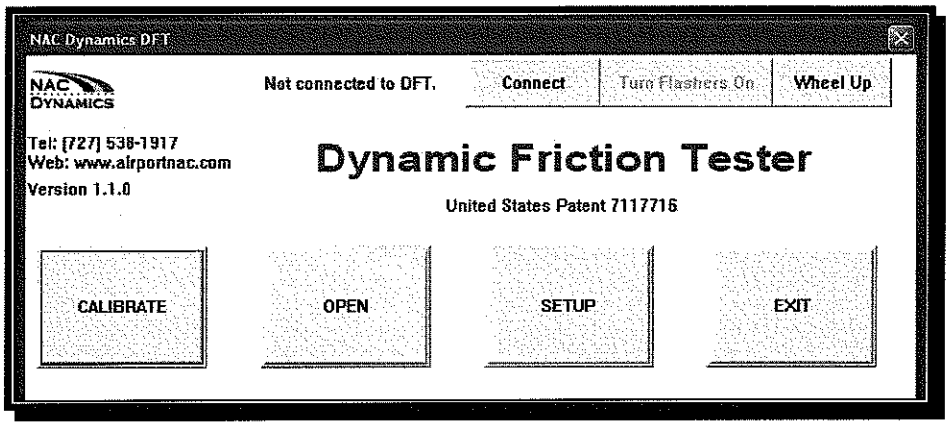
The DFT onboard computer automatically processes speed, distance, friction, temperature and flow rate, and sends this data via a wireless 802.11b/g network to the computer system, located in the tow vehicle. Because of the unique wireless connection and standard tow hitch arrangement, any vehicle can be used to tow the DFT.

Resolution of data collected on the computer is one reading every 3.3 feet (1 meter) and is stored to the computers hard drive. A typical runway test uses approximately 200kb of memory. Contact NAC Dynamics to requests latest computer specification. Alternatively customers can specify / supply their own computer system.

Below is a selection of screen shots taken from the DFT software. Each screen is designed for finger touch control and ease of use for the operator:

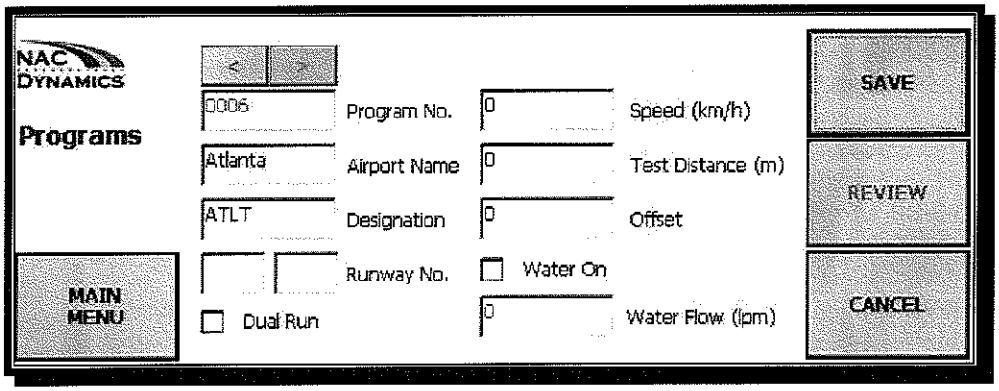
Main Menu and Start Up Screen

From the main menu the operator can navigate to any area within the software.



Open Program Screen

A simple menu structure shows a cyclic list of the Programs or allows the operator to create new programs specific to the Airport.



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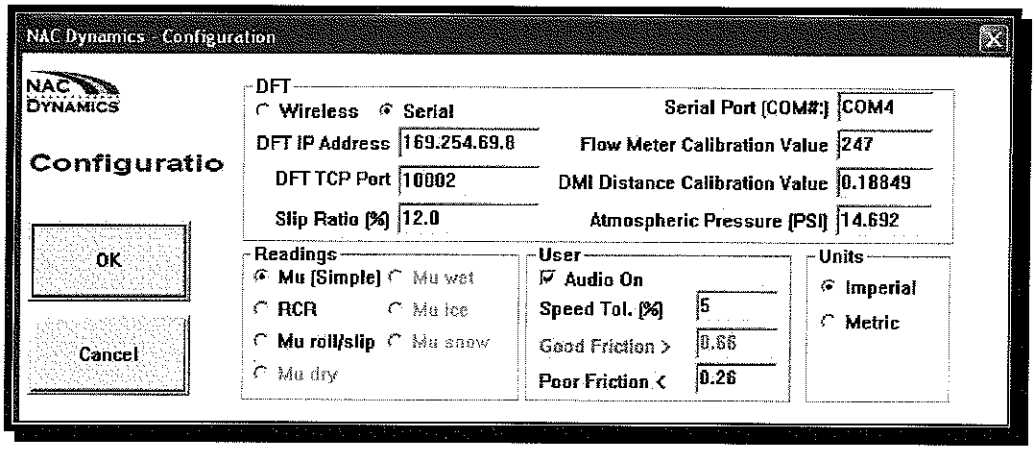
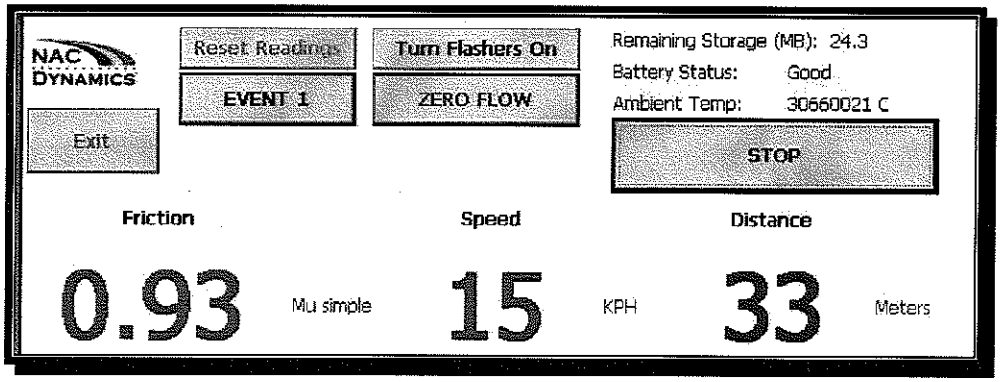
Configuration Screen

Simple set-up screen allows the operator to change measuring units and other parameters.



Capture Screen

Friction, Speed and Distance are clearly displayed during the survey. The Ground and ambient temperature is also displayed and logged.



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DFT IN OPERATION