DEPARTMENT OF PROCUREMENT SERVICES
NON-COMPETITIVE REVIEW BOARD (NCRB) APPLICATION

Complete this cover form and the **Non-Competitive Procurement Application Worksheet** in detail. Refer to the page entitled "**Instructions for Non-Competitive Procurement Application**" for completing this application in accordance with its policy regarding NCRB. Complete "other" subject area if additional information is needed. Subject areas must be fully completed and responses merely referencing attachments will not be accepted and will be immediately rejected.

Department	Originator Name	Telephone	Date	Signature of Application Author
Aviation	Keith Wisniewski	773-894-0162	June 4, 2019	
Contract Liaison	**Email Contract Liaison**	**Telephone**		
David Bowman	david.bowman@cityofchicago.org	773-686-7089		

List Name of NCRB Attendees/Department

Keith Wisniewski - Aviation-ORD

David Kaufman - Aviation-MDW
David Bowman - Aviation
George Lyman - Aviation- ORD

Request NCRB review be conducted for the product(s) and/or service(s) described herein.

Company: Dynatest North America, Inc.
11415 Old Roswell Road #100
Alpharetta, GA 30009

Contact Person:	Phone:	Email:
Charles Moore	(678)781-1799 x236	cmoore@dynatest.com

Project Description: Inspection, Calibration, Repair, Parts, and Training for Dynatest Runway Friction Testing Equipment

This is a request for:

☒ **New Contract**

Contract Type

☒ **Blanket Agreement** Term: 60 (# of mo)
☐ **Standard Agreement**

☐ **Amendment / Modification**

Type of Modification

☐ **Time Extension** ☐ **Vendor Limit Increase** ☐ **Scope Change**
Contract Number: ____
Specification Number: ____
Modification Number: ____

Department Request Approval	Recommended Approval
DEPARTMENT HEAD OR DESIGNEE — DATE: JUN 18 2019	BOARD CHAIRPERSON — DATE: JUL 29 2019
PRINT NAME: RICK BUTLER	PRINT NAME: Steven M. Lobodo

(FOR NCRB USE ONLY)

Recommend Approval/Date: ____
Return to Department/Date: ____
Rejected/Date: ____

☒ **Approved** ☐ **Rejected**

CHIEF PROCUREMENT OFFICER — DATE: 31 July 2019

DEPARTMENT OF PROCUREMENT SERVICES
NON-COMPETITIVE REVIEW BOARD (NCRB) APPLICATION
JUSTIFICATION FOR NON-COMPETITIVE PROCUREMENT WORKSHEET

All applicable information on this worksheet must be addressed using each question found on the "Instructions for Non-Competitive Procurement Application" in this application.

Justification for Non-Competitive Procurement Worksheet

☐ **PROCUREMENT HISTORY**

1. Describe the requirement and how it evolved from initial planning to its present status.

On March 18,1997, the Federal Aviation Administration (FAA) released Advisory Circular (AC) No. 150/5320-12C concerning the Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces. In the AC, the FAA stated that braking performance on runway surfaces, particularly when wet, had become "a Significant safety consideration." As such, the AC provided guidelines for designing, constructing, and maintaining skid-resistant airport pavement surfaces and for conducting evaluations and surveys of runway friction for pavement maintenance purposes.

Following Change 8 to the AC, dated February 7,2007, which addressed updated information for manufacturers certified by the FAA, CDA contracted with Progressive Industries, Inc. (Progressive), on February 1, 2008, for the purchase of runway friction testing units. PO 16817 was effective 2/1/08 - 1/31/13. These units were installed by Dynatest Consulting, Inc. (Dynatest) as a subconsultant to Progressive. Once the units were purchased, a separate contract with Dynatest was executed for calibration and maintenance of the runway friction testing units. That small order contract, PO 20261 executed in September 2009, expired on August 31, 2014 but was renewed under contract PO 30144 which expires September 15, 2019 and is currently being extended to March 14, 2020.

2. Is this a first time requirement or a continuation of previous procurement from the same source? If so, explain the procurement history.

This is a request for a contract to continue the maintenance of equipment previously installed and maintained by the same vendor. As the equipment is in good repair and of current FAA-approved technology, reference current AC #150/5320-12D, Measurement and Maintenance of Skid-Resistant Airport Pavement Surfaces, it is much more cost effective to continue maintaining the existing equipment than replacing the equipment through competitive bid. Dynatest is the sole source for certification, service, parts and labor for the existing equipment.

3. Explain attempts made to competitively bid the requirement (attach copy of sources contacted.)

Progressive Industries won a competitive bid contract for the purchase of the runway friction testing units when multiple manufacturers' products would have been acceptable. Progressive proposed a Dynatest product, and only Dynatest is authorized to provide maintenance services to the runway friction testing units. Dynatest's equipment is proprietary and no other facilities or organizations are authorized or licensed to provide service, calibration, software or support for the runway friction testing equipment owned by CDA. As such, no formal attempt was made to competitively bid the requirement since no other company would be qualified to respond.

4. Describe in detail all research done to find other sources; list other cities, companies in the industry, professional organizations contacted. List periodicals and other publications used as references.

CDA owns four (4) Dynatest 6875 runway friction testers (two each at O'Hare and Midway). Dynatest has stated in writing that it is the sole manufacturer and service provider for these testers, and CDA referenced FAA Advisory Circular (AC) 150/5320-12C Change 8, dated February 2, 2007, which confirms Dynatest as the only FAA-approved provider and servicer of these testers. CDA has also verified that Change 8 is the most recent update to AC 150/5320-12C.

5. Explain future procurement objectives. Is this a one-time request or will future requests be made for doing business with the same source?

This is a request for a 5-year term contract to maintain existing equipment previously installed by Dynatest. As Dynatest is the only vendor licensed and capable of maintaining its proprietary equipment, future requests will depend on whether continued maintenance and operation of the current equipment is in the best financial and operational

interest of CDA. CDA believes that competitive bidding would be possible for future procurement cycles should Dynatest license parties outside of Dynatest to perform service, support, calibration or other activities that pertain to the manufacture, support, service, and calibration of their runway friction testers. As this equipment is nearing obsolescence, CDA has begun drafting specifications for a competitive bid that will also include a five year maintenance contract. CDA intends to submit this new contract request to DPS before year end. Upon award and securing financing for the purchase of new units CDA will begin the process of buying new equipment and decommissioning the existing equipment.

6. Explain whether or not future competitive bidding is possible. If not, explain in detail.

CDA believes that competitive bidding may be possible for future procurement cycles should Dynatest in the future license third parties to perform service, support, calibration or other activities pertaining to the manufacture, support, service, and calibration of its runway friction testers. Also, should replacement of the runway friction testers become more cost effective or required due to obsolescence, competitive bidding for new testers will be possible. In the meantime, there are no other organizations besides Dynatest that are authorized or licensed to produce Dynatest runway friction testers or its components and there are no authorized organizations outside of Dynatest to service, calibrate, or support their runway friction testers. Dynatest currently has not trained anyone outside of Dynatest to service, calibrate or support their runway friction testers and they currently have no plans to do so.

☐ ESTIMATED COST

1. What is the estimated cost for this requirement or for each contract, if multiple awards are contemplated? What is the funding source?

The total cost of the contract is estimated at $200,000 over five (5) years plus the up to 181 days extension period, based on the Base Year annual cost plus 3% escalation on calibration and labor costs. Shipping, repair parts, and vendor travel costs shall be based on actual expenditures, subject to City-approved limits for vendor travel, food and lodging expenses. Base Year annual cost is calculated as follows:

Item	Unit Cost	Units	Quantity	Total
RFT calibration	$ 1,600.00	Each	4	$ 6,400.00
Travel labor and shop/field repair labor	$ 110.00	Per hour	48	$ 5,280.00
Training labor	$ 1,400.00	Per day	3	$ 4,200.00
Subtotal subject to the annual 3% escalation				$15,880.00
Calibration equipment shipping	$ 1,000.00	Direct cost	1	$ 1,000.00
Per diem food	$ 76.00	Direct cost	2	$ 152.00
Per diem hotel	$ 223.00	Direct cost	2	$ 446.00
Transportation/flight	$ 600.00	Direct cost	1	$ 600.00
Repair parts (See Note1)	$ 600.00	Per vehicle	4	$ 2,400.00
Damage contingency (See Note 2)	$13,850.00	Each	1	$13,850.00
Subtotal based on actual costs and revisions to Price List				$18,448.00
Total (Annual-Base Year)				$34,328.00

Notes:

1. It is unlikely that all four units will require all of the possible repair parts. The Airport will only be billed for parts required and installed.

2. Damage contingency was estimated based on the unlikely event that one transducer (the most expensive unit component at approximately $13,850) would need to be replaced due to damage each year, in addition to other miscellaneous items.

2. What is the estimated cost by fiscal year?

The annual cost will be the Base Year annual cost plus 3% escalation on all items except the per diem food, hotel, and air travel, which will be based on actual expenditures subject to City-approved limits.

Estimated Cost by Fiscal Year

Year 1	Year 2	Year 3	Year 4	Year 5	Up to 181 days ext period
$34,328.00	$34,804.40	$35,295.09	$35,800.50	$36,321.08	$24,450.93

3. Explain the basis for estimating the cost and what assumptions were made and/or data used (i.e., budgeted amount, previous contract price, current catalog or cost proposal from firms solicited, engineering or in-house estimates, etc.)

The costs estimates shown are a direct quotation provided by the contract liaison at Dynatest to CDA. City of Chicago Travel Guidelines were consulted to ensure compliance of per diem limits.

4. Explain whether the proposed Contractor or the City has a substantial dollar investment in original design, tooling or other factors which would be duplicated at City expense if another source was considered. Describe cost savings or other measurable benefits to the City which may be achieved.

In 2008, CDA signed a contract with Progressive Industries, Inc. to furnish truck-mounted runway friction testers for O'Hare and Midway International Airports. Those units were installed by Dynatest as a subconsultant to Progressive at a cost of $532,836 ($133,209 per unit - 4 units were purchased). If replacement of the existing units were to be considered through a competitive bid process, it is likely that this installation cost would be duplicated, with future maintenance contracts subject to the same proprietary service issues being considered in this application. The total 5-year cost of this maintenance contract is anticipated to be far less than the estimated cost of replacement. Though with that being said as this equipment is nearing obsolescence, CDA has begun drafting specifications for a competitive bid that will also include a five year maintenance contract. CDA intends to submit this new contract request to DPS before year end. Upon award and securing of financing for the purchase of new units CDA will begin the process of buying new equipment and decommissioning the existing equipment.

5. Explain what negotiation of price has occurred or will occur. Detail why the estimated cost is deemed reasonable.

The proposal is in line with the previous contract with a 3% annual increase for the labor related items.

☐ SCHEDULE REQUIREMENTS

1. Explain how the schedule was developed and at what point the specific dates were known.

The most recent contract with Dynatest is effective until September 15, 2019, and the CDA is seeking an up to 181 day extension to the current contract effective until March 14, 2020 to implement this new contract for maintenance. The vendor compensation limit on this contract has nearly been reached, and CDA will not be able to accommodate next year's calibration and training requirements without a new contract in place.

2. Is lack of drawings and/or specifications a constraining factor to competitive bidding? If so, why is the proposed Contractor the only person or firm able to perform under these circumstances? Why are the drawings and specifications lacking? What is the lead time required to get drawings and specifications suitable for competition? If lack of drawings and specifications is not a constraining factor to competitive bidding, explain why only one person or

firm can meet the required schedule.

Not applicable. Lack of drawings and/or specifications is not a constraining factor to competitive bidding as we are maintaining existing equipment.

3. Outline the required schedule by delivery or completion dates and explain the reasons why the schedule is critical.

A new agreement with Dynatest is critical to address calibration, maintenance and training requirements for 2020. While the current agreement with Dynatest is effective until September 15, 2019, CDA is seeking an up to 181 day extension to the contract effective until March 14, 2020 to implement this new contract for maintenance. The vendor limit of that agreement has nearly been reached and CDA will not be able to accommodate next year's calibration, maintenance and training requirements without a new contract in place.

4. Describe in detail what impact delays for competitive bidding would have on City operations, programs, costs and budgeted funds.

Dynatest is the only approved manufacturer, service provider, calibration provider and training provider for the 6875 runway friction testers. Without a new agreement with Dynatest, CDA will be unable to meet FAA requirements for runway friction testing in accordance with FAA Advisory Circular (AC) 150/5320-12C Measurement and Maintenance of Skid-Resistant Airport Pavement Surfaces.

☐ EXCLUSIVE OR UNIQUE CAPABILITY

1. If contemplating hiring a person or firm as a Professional Service Consultant, explain in detail what professional skills, expertise, qualifications, and/or other factors make this person or firm exclusively or uniquely qualified for the project. Attach a copy of the cost proposal, scope of services, and Temporary Consulting Services Form.

Dynatest Consulting, Inc., which acquired the Transportation Test Equipment Division of K.J. Law Engineers, Inc. in 2002, is now the sole manufacturer, service provider, calibration provider and training provider for the Dynatest 6875 Runway Friction Tester units owned and operated by CDA. No other facilities or organizations are authorized or licensed to produce 6875 Runway Friction Testers or its components. No other organizations outside of Dynatest are authorized to provide service, calibration, software or support for these Runway Friction Testers. No one outside of Dynatest has been trained to service, calibrate or support 6875 Runway Friction Testers and Dynatest has no plans to train anyone outside of the company to perform such services, calibrations, support, or any other activities pertaining to the manufacture, support, service, calibration, and training of maintenance of the 6875 Runway Friction Testers. Dynatest is therefore an exclusive and unique supplier solely capable of supplying service, parts, calibration and support for these runway friction testers.

2. Does the proposed firm have personnel considered unquestionably predominant in the particular field?

Dynatest personnel are the only licensed and trained experts in the manufacture, service, support, calibration and training of maintenance of the 6875 Runway Friction Testers. No other organization outside of Dynatest is authorized or licensed to produce 6875 Runway Friction Testers or their components. No other organization outside of Dynatest are authorized to provide service, calibration, software or support for the 6875 Runway Friction Testers and Dynatest has no plans to train anyone outside of the company to perform such services, calibrations, support, or any other activities pertaining to the manufacture, support, service, calibration, and training of maintenance of the 6875 Runway Friction Testers.

3. What prior experiences of a highly specialized nature does the person or firm exclusively possess that is vital to the job, project or program?

Dynatest manufactures its own parts and equipment and does not license any other individual or firm to maintain that proprietary equipment. The existing equipment owned by CDA was manufactured and installed by Dynatest and, as such, only Dynatest has the requisite knowledge and experience to maintain CDA's friction testing equipment.

4. What technical facilities or test equipment does the person or firm exclusively possess of a highly specialized nature which is vital to the job?

Dynatest manufactures its own parts and equipment and does not license any other individual or firm to maintain that proprietary equipment. The existing equipment owned by CDA was manufactured and installed by Dynatest and, as such, only Dynatest has the requisite knowledge and experience to maintain CDA's friction testing equipment.

5. What other capabilities and/or capacity does the proposed firm possess which is necessary for the specific job, project or program which makes them the only source who can perform the work within the required time schedule without unreasonable costs to the city?

Dynatest is the sole provider of the 6875 Runway Friction Testers and the only organization authorized or licensed to produce these units and their components. No other organizations other than Dynatest are authorized to provide service, calibration, software or support for theses Runway Friction Testers. Dynatest has not trained anyone outside their company to service, calibrate, or support these Runway Friction Tester units nor do they have plans to do so. Dynatest is the only organization authorized and with properly certified personnel to provide service, calibration, software or support for these Runway Friction Testers and are therefore is the only source that can perform the necessary work.

6. If procuring products or equipment, describe the intended use and explain any exclusive or unique capabilities, features, and/or functions the items have which no other brands or models, possess. Is compatibility with existing equipment critical from an operational standpoint? If so, provide detailed explanation?

N/A - procurement is for service of existing equipment, not new products or equipment.

7. Is competition precluded because of the existence of patent rights, copyrights, trade secrets, technical data, or other proprietary data (attach documentation verifying such)?

Competition is precluded because Dynatest is the sole supplier of the 6875 Runway Friction Testers and the only authorized service provider for these units. No other facilities or organizations are authorized or licensed to produce these Runway Friction Testers or their components. No organization outside of Dynatest is authorized or licensed to provide service, calibration, software or support for these Runway Friction Testers.

8. If procuring replacement parts and/or maintenance services, explain whether or not replacement parts and/or services can be obtained from any other sources? If not, is the proposed firm the only authorized or exclusive dealer/distributor and/or service center? If so, attach a letter from manufacturer on company letterhead.

Dynatest is the sole supplier of the Runway Friction Tester and no other facilities or organizations are authorized or licensed to produce the 6875 Runway Friction Tester or any of its components. Replacement parts and maintenance services for the trucks carrying the friction testers will be obtained through other City contracts that have been competitively bid.

MBE/WBE COMPLIANCE PLAN

A request for No Stated Goals / Full MBE/WBE waiver has been submitted by Dynatest and CDA has submitted its memorandum noting its concurrence with this request package.

☐ OTHER

1. Explain other related considerations and attach all applicable supporting documents, i.e., an approved "ITGB Form" or "Request For Individual Hire Form". Not applicable to this request

DEPARTMENT OF PROCUREMENT SERVICES
NON-COMPETITIVE REVIEW BOARD (NCRB) APPLICATION
INSTRUCTIONS FOR NON-COMPETITIVE PROCUREMENT APPLICATION

INSTRUCTIONS FOR PREPARATION OF NON-COMPETITIVE PROCUREMENT APPLICATION

If a City Department has determined that the purchase of supplies, equipment, work and/or services cannot be done on a competitive basis, a justification must be prepared on this "Justification for Non-Competitive Procurement Application" in which procurement is requested on a or non-competitive basis in accordance with 65 ILCS 5/8-10-4 of the Illinois Compiled Statutes. Using this instruction sheet, all applicable information must be addressed on the worksheet. The information provided must be complete and in sufficient detail to allow for a decision to be made by the Non-Competitive Procurement Review Board. For Amendments, Modifications, describe in detail the change in terms of dollars, time period, scope of services, etc., its relationship to the original contract and the specific reasons for the change. Indicate both the original and the adjusted contract amount and/or expiration date with this change.

Attach a DPS Checklist and any other required documentation; the Board will not consider justification with incomplete information documentation or omissions.

PROCUREMENT HISTORY

1. Describe the requirement and how it evolved from initial planning to its present status.
2. Is this a first time requirement or a continuation of previous procurement from the same source? If so, explain the procurement history.
3. Explain attempts made to competitively bid the requirement (attach copy of sources contacted).
4. Describe in detail all research done to find other sources; list other cities, companies in the industry, professional organizations contacted. List periodicals and other publications used as references.
5. Explain future procurement objectives. Is this a one-time request or will future requests be made for doing business with the same source?
6. Explain whether or not future competitive bidding is possible. If not, explain in detail.

ESTIMATED COST

1. What is the estimated cost for this requirement or for each contract, if multiple awards are contemplated? What is the funding source?
2. What is the estimated cost by fiscal year?
3. Explain the basis for estimating the cost and what assumptions were made and/or data used (i.e., budgeted amount, previous contract price, current catalog or cost proposal from firms solicited, engineering or in-house estimate, etc.)
4. Explain whether the proposed Contractor or the City has a substantial dollar investment in original design, tooling or other factors which would be duplicated at City expense if another source was considered. Describe cost savings or other measurable benefits to the City which may be achieved.
5. Explain what negotiation of price has occurred or will occur. Detail why the estimated cost is deemed reasonable.

SCHEDULE REQUIREMENTS

1. Explain how the schedule was developed and at what point the specific dates were known.
2. Is lack of drawings and/or specifications a constraining factor to competitive bidding? If so, why is the proposed Contractor the only person or firm able to perform under these circumstances? Why are the drawings and specifications lacking? What is the lead time required to get drawings and specifications suitable for competition? If lack of drawings and specifications is not a constraining factor to competitive bidding, explain why only one person or firm can meet the required schedule.
3. Outline the required schedule by delivery or completion dates and explain the reasons why the schedule is critical.
4. Describe in detail what impact delays for competitive bidding would have on City operations, programs, costs and budgeted funds.

EXCLUSIVE OR UNIQUE CAPABILITY

1. If contemplating hiring a person or firm as a Professional Service Consultant, explain in detail what professional skills, expertise, qualifications, and/or other factors make this person or firm exclusively or uniquely qualified for the project. Attach a copy of the cost proposal, scope of services, and **Temporary Consulting Services Form**.
2. Does the proposed firm have personnel considered unquestionably predominant in the particular field?
3. What prior experiences of a highly specialized nature does the person or firm exclusively possess that is vital to the job, project or program?
4. What technical facilities or test equipment does the person or firm exclusively possess of a highly specialized nature which is vital to the job?
5. What other capabilities and/or capacity does the proposed firm possess which is necessary for the specific job, project or program which makes them the only source who can perform the work within the required time schedule without unreasonable costs to the City?
6. If procuring products or equipment, describe the intended use and explain any exclusive or unique capabilities, features and/or functions the items have which no other brands or models, possess. Is compatibility with existing equipment critical from an operational standpoint? If so, provide detailed explanation?
7. Is competition precluded because of the existence of patent rights, copyrights, trade secrets, technical data, or other proprietary data (attach documentation verifying such)?
8. If procuring replacement parts and/or maintenance services, explain whether or not replacement parts and/or services can be obtained from any other sources? If not, is the proposed firm the only authorized or exclusive dealer/distributor and/or service center? If so, attach letter from manufacturer on company letterhead.

MBE/WBE COMPLIANCE PLAN

* All submissions must contain detailed information about how the proposed firm will comply with the requirements of the City's Minority and Women Owned Business program. All submissions must include a completed C-1 and D-1 form, which is available on the Procurement Services page on the City's intranet site. The City Department must submit a Compliance Plan, including details about direct and indirect compliance.

OTHER

1. Explain other related considerations and attach all applicable supporting documents, i.e., an approved "ITGB Form" or "Request For Individual Hire Form".

REVIEW AND APPROVAL

This application must be signed by both Originator of the request and signed by the Department Head. After review and final disposition from the Board, this application will be signed by the Board Chairman. After review and final disposition from the Board, this form will be presented to the Chief Procurement Officer recommending approval.

DEPARTMENT OF PROCUREMENT SERVICES

Attach required forms for each procurement type and detailed scope of services and/or specifications and forward original documents to the Chief Procurement Officer; City Hall, Room 806.

Date: 6/4/2019

Department Name: Aviation

Requisition No:	Specification No:
286604	1181963
PO No:	**Modification No:**

Contract Liaison: David Bowman

Telephone: 773 686-7089

Email:

Project / Program Manager: Keith Wisniewski

Telephone: 773 894-0162

Email:

For Blanket Agreements, the lead department must consult with other departments who may want to participate in the Blanket Agreement. If grant funded, attach copy of the approved grant application and other terms and conditions of the funding source.

Note:
1) Funding: Attach information if multiple funding lines
2) Individual Contract Services: Include approval form signed by all parties
3) ITGB: IT project valued at $100,000.00 or more, attach approval transmittal sheet.

*Contract Liaison Signature

*By signing this form, I attest that all information provided is true and accurate.

Project Title: Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment

Project Description: Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment

Funding:

☐ Corporate	☐ Bond	☑ Enterprise	☐ Grant	☐ Other:
☐ IDOT/Transit	☐ IDOT/Highway	☐ FHWA	☐ FTA	☐ FAA

LINE	FY	FUND	DEPT	ORGN	APPR	ACTV	PROJECT	RPTG	ESTDOLLAR AMOUNT
	19	610	85	4305	0360	0360			$100,000
	19	740	85	4105	0440	0440			$100,000

Check One:

☑ **New Contract Request**

*By signing below, I attest the estimates provided for this contract are true and accurate.

*Project / Program Manager Signature

*Commissioner/Authorized Designee Signature

Purchase Order Type:
- ☑ Blanket/Purchase Order (DUR)
- ☐ Master Consultant Agreement (Task Order)
- ☐ Standard/One-Time Purchase

Procurement Method:
- ☐ Bid ☐ RFP ☐ RFQ ☐ RFI
- ☐ Small Order

Special Approvals Required:
- ☐ Emergency
- ☑ Non-Competitive Review Board (NCRB)
- ☐ *Request for Individual Contract Services*
- ☐ Information Technology Governance Board (ITGB)
- ☐ IDOT Concurrence

Purchase Order Information:

Contract Term (No. of Months): 60

Extension Options (Rate of Recurrence): 1 (181 days)

Estimated Spend/Value: $ 200,000

Grant Commitment / Expiration Date:

Pre-Bid/Submittal Conference: ☐ Yes ☐ No

☐ Mandatory ☐ Site Visit

Contract Type:

☐ Architect Engineering	☐ Commodity	☐ Construction	☐ JOC ☐ SBI
☐ Professional Services	☐ Revenue Generating	☐ Vehicle & Heavy Equipment	
☑ Work Service	☐ Joint Procurement	☐ Reference Contract	

☐ **Modification or Amendment**

Modification Information:

PO Start Date:

PO End Date:

Amount (Increase/Reduction):

Safety Enhancing Vehicle Equipment (MCC 2-92-597) Yes__No___

Modification/Amendment Type:
- ☐ Time Extension
- ☐ Scope Change/Price Increase /Additional Line Item(s)
- ☐ Vendor Limit Increase
- ☐ Requisition Encumbrance Adjustment
- ☐ Other (specify):

MBE/WBE/DBE Analysis: *(Attach MBE/WBE/DBE Goal Setting Memo)*
- ☐ Full Compliance
- ☑ Contract Specific Goals
- ☐ No Stated Goals
- ☑ Waiver Request

☐ **Risk Management / EDS / IDOT**

Insurance Requirements (included)	☑ Yes	☐ No
EDS Certification of Filling (included)	☑ Yes	☐ No
IDOT Concurrence (required)	☐ Yes	☐ No

Vendor Information

Name:	Dynatest North America
Contact:	Charles R. Moore
Address:	11415 Old Roswell Road, Suite 100, Alpharetta, GA 30009
E-mail:	cmoore@dynatest.com
Phone:	678 781-1799

CHICAGO DEPARTMENT OF AVIATION

CITY OF CHICAGO

To: Shannon E. Andrews
Chief Procurement Officer

Attention: Lorel D. Blameuser
Deputy Procurement Officer

Monica Jimenez
First Deputy Procurement Officer

From: _____
Jamie L. Rhee
Commissioner

Date: JUN 18 2019

Subject: **Request for New Non-Competitive Procurement Contract Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment**
Current Vendor: Dynatest Consulting, Inc.
Expiring PO Number: 30144
Expiring Specification Number: 123118
Current Expiration: 9/15/19*
***181 Days extension through 3/14/2020 under requisition 260851 in process**

The Chicago Department of Aviation (CDA) requests approval and assistance in awarding a five (5) year non-competitive procurement contract to Dynatest Consulting, Inc. (Dynatest) for Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment.

CDA owns four (4) Dynatest runway friction testers (2 at each airport), which allow CDA to routinely monitor its runways to ensure they provide adequate friction for aircraft, particularly for those braking in wet conditions. Dynatest holds the existing non-competitively procured contract for calibration and maintenance of the units, and in fact is the only FAA-approved source for certification, calibration, service, parts and labor for the existing equipment. Dynatest has provided excellent service since February 2008 maintaining and calibrating this critical safety equipment at O'Hare and Midway.

The current contract with Dynatest for calibration and maintenance services will expire on September 15, 2019 (an up to 181 days extension through 3/14/20 in process however contract will run out of money before then). CDA is requesting to continue the maintenance of the equipment previously installed and maintained by this vendor. FAA Advisory Circular (AC) 150/5320-12c Change 8, dated February 2, 2007 (the most recent update), confirms that Dynatest is the only FAA-approved provider and servicer of these testers. Dynatest's equipment is proprietary and no other facilities or organizations are authorized or licensed to provide service, calibration, software or support for the runway friction testing equipment owned by CDA. Dynatest manufactures its own parts and equipment and does not license any other individual or firm to maintain that proprietary equipment.

Although the equipment is in good repair and of current FAA-approved technology, it is nearing obsolescence. As such CDA is currently working on a specification for the purchase and maintenance of new units which it intends to submit to Procurement before year end. However, in the interim while the means to procure new equipment is put in place and funding is secured, CDA must continue to maintain the existing equipment. The total cost of this procurement is estimated at approximately $175,000 over five (5) years, based on the base year annual cost plus 3% escalation on all items except the per diem food, hotel, and air travel, which will be based on actual expenditures subject to City-approved limits. Annual costs for the base year generally include calibration of four (4) units at $1,000.00 per unit, three (3) days of labor at $1,400.00 per day to train CDA employees on the use of the equipment, 48 hours of field/repair labor at $110.00 per hour, contingencies for repair parts and labor, plus direct costs for shipping and technician travel/food/lodging expense. Estimated costs by fiscal year are:

Year 1	Year 2	Year 3	Year 4	Year 5	181 day extension period
$34,328.00	$34,804.40	$35,295.09	$35,800.50	$36,321.08	$24,450.93

These cost estimates are based on a direct quotation provided by Dynatest to CDA. City of Chicago Travel Guidelines were consulted to ensure compliance of per diem limits. It is likely that future maintenance contracts will likely be subject to the same proprietary service issues being considered in this application.

As Dynatest is the only vendor licensed and capable of maintaining its proprietary equipment, CDA is requesting a non-competitive procurement for this service. Future requests will depend on whether continued maintenance and operation of the current equipment is in the best financial and operational interest of CDA, and whether other parties become licensed and approved by the FAA to perform service, support, and calibration of Dynatest units.

With the existing contract expiring this year and the current vendor limit having nearly been reached, CDA cannot accommodate necessary calibration and repairs on its existing equipment. As a result, CDA will be unable to meet FAA requirements for runway friction testing without a new agreement. A new non-competitive contract with Dynatest is therefore of critical need in maintaining safety at O'Hare and Midway Airports.

If you have any questions or need additional information regarding this request please contact David Bowman at 773-686-7089.

Thank you for your cooperation.

Procurement Type:	Non-Competitive	
Funding:	610 85 4305 0360 0360 740 85 4105 0440 0440	
Estimated Cost:	$200,000 including 181 day extension period	
Duration:	5 Years plus 181 day extension	
User General Manager of Airport Operations:	David Kaufman Keith Wisniewski	Phone: 773-838-3995 Phone: 773-894-0162
User Deputy:	Costas Simos	Phone: 773-838-0625
User Managing Deputy:	George Lyman	Phone: 773-894-5291

The following CDA employees participated in drafting the Specifications and/or negotiating with the Contractor:

David Kaufman
General Manager of Airport Operations

Date 6/4/19

Keith Wisniewski
General Manager of Airport Operations

Date 6/4/19

David Bowman
Supervisor of Contracts

Date 6/4/19

DYNATEST DETAILED SPECIFICATIONS (2019)

SCOPE

Contractor will furnish and deliver to the Chicago Department of Aviation (CDA) all labor and material necessary for the inspection, calibration, repair and training on four existing City of Chicago-owned Dynatest 6875 Friction Tester units to the Department of Aviation, Airport Maintenance Complex (AMC) Building, 10000 W. Montrose, Chicago, Illinois 60666 and at Airport Maintenance Complex (AMC) Building, 6201 S. Laramie Ave., Chicago, IL 60638 as outlined below in the attached quote and as described herein, all in accordance with the terms and conditions of this specification.

RUNWAY FRICTION TESTER CALIBRATION, SERVICE AND TRAINING

Contractor shall furnish labor, parts, tools, services, transportation, support and all other items required for the inspection, calibration, repair and training on Friction Testing units owned and operated by the City of Chicago Department of Aviation. Pricing for calibration, service, and training is detailed below, and each shall be subject to additional compensation for travel and labor (defined as time spent en route to/from technician's home or office to/from work site or hotel) and administrative labor (scheduling shipping of equipment, obtaining and scheduling shipping for parts, arranging travel, invoice preparation).

UNIT CALIBRATION (LINE 1)

Equipment necessary to perform calibration at each of the two CDA airports will be shipped in advance (at Contractor's cost) to each airport as necessary and stored in a secure garage area until technicians arrive. Inspection and calibration shall be performed on site by Contractor's properly trained and certified personnel. Each unit is expected to take approximately eight hours to inspect and calibrate. The unit cost for calibration includes all labor, equipment, materials, insurance, overhead and profit in performing the calibration. Units will be calibrated to standards set by the contractor as approved by the Federal Aviation Administration (FAA). Certificates of calibration will be provided by the Contractor to the City.

SERVICE TO DYNATEST MANUFACTURED EQUIPMENT (LINE 2)

On site: a technician will review the current status of the Contractor-manufactured equipment and replace any parts the may be deficient or have reached the end of their expected life cycle. Repairs shall be made on site unless Contractor and CDA determine on-site repairs to be infeasible based on cost or availability of personnel or equipment. In addition to time spent on repairs, on site service will be subject to travel time to and from work site (at hourly rate). Travel costs and subsistence will be in accordance with the City of Chicago Travel Guidelines in effect at the time of service. Contractor will be responsible for equipment related to the friction measuring function only and will not be responsible for identifying or repairing any deficiencies with the vehicle or its running gear.

At the factory: in the event that on-site repairs are deemed infeasible by Contractor and CDA, CDA shall be responsible for delivery of equipment to Contractor's facility in Alpharetta, Georgia. Once the equipment arrives at the facility, a technician will review the current status of the Contractor-furnished equipment and replace any parts that may be deficient or have reached the end of their expected life cycle. Contractor will be responsible only for equipment related to the friction measuring function and will not be responsible for identifying or repairing and deficiencies with the vehicle or its running gear. Factory labor will be compensated on an hourly basis for hours actually worked.

SHIPPING (LINE 3)

For repairs that the City or Contractor choose to have made at the Contractor's facility, CDA will be responsible for transportation of equipment between Contractor's facility and O'Hare or Midway International Airport. For equipment and parts needed for on-site calibration and repairs, Contractor will arrange for round trip shipping between the factory and O'Hare or Midway International Airport. Shipping shall be billed at Contractor's reasonable cost as verified by shipping invoices.

When shipping equipment to CDA- O'Hare (ORD), Contractor must notify Keith Wisniewski, 773-894-0162, at least 24 hours prior to shipment.

When shipping equipment to CDA- Midway (MDW), Contractor must notify David Kaufman or Veronica Martinez, 773-838-0677, at least 24 hours prior to shipment.

PARTS (LINE 4)

Contractor has provided a parts list, subject to annual adjustment. Parts will be provided at list price including shipping.

Parts will be shipped to O'Hare International Airport, Airport Maintenance Complex, 10000 W. Montrose, Chicago, Illinois 60666, between the hours of 8 a.m. and 4 p.m. Monday through Friday. Contact person shall be Keith Wisniewski, 773-894-0162.

Parts will be shipped to Midway International Airport, Airport Maintenance Complex, 6201 S. Laramie Ave., Chicago, IL 60638between the hours of 8 a.m. and 4 p.m. Monday through Friday. Contact person shall be David Kaufman or Veronica Martinez, 773-838-0677.

The above noted "contact person" must be notified at least 24 hours prior to delivery of the specified P/S Dynatest Runway Friction Testing Equipment parts.

TRAINING (Line 5)

On an annual basis, and at other times requested by CDA, Contractor will provide hands-on training for up to 35 CDA employees (or fewer if specified by the CDA) across three shifts at both ORD and MDW Airports. This training will be focused on the proper operation and maintenance of the runway friction tester (RFT). The training will be consistent with the outline in Federal Aviation Administration Advisory Circular (AC) 5320-12C as current and amended at the time of training but will not include a classroom session. Training labor time shall be compensated on a daily basis. Travel and subsistence shall be billed in accordance with the City of Chicago Travel Guidelines. Training materials are included in the training costs.

TRAVEL AND PER DIEM COSTS

Travel for Contractor's technician will be billed pursuant of the City of Chicago Travel Guidelines. Contractor must provide detailed receipts with the invoice in order for the City to process payments for travel and per diem costs.

GUARANTEE

The calibration and/or repair/service of the units are guaranteed for one year. Contractor will make any necessary corrections related to the calibration and any repairs/service within one year of the original calibration/repair service at no cost to the City of Chicago.

DYNATEST NORTH AMERICA

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Alpharetta, Georgia 30009 USA
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Fax +1 678 823-9522

Email: dna@dynatest.com
Webpage: www.dynatest.com

Pavement Engineering Specialists
and Equipment

July 17, 2019

Chicago Department of Aviation
5757 S. Cicero Avenue
Chicago, IL 60638
Phone: 773.894.5291
Fax: 773.686.2303

Attn: Mr. Keith T. Wisniewski
Chicago O'Hare International Airport

Attn: Mr. David Kaufman
Chicago Midway International Airport

REF: Runway Friction Testing Equipment Calibration services

Dear Sir:

Further to your request, Dynatest offers the following proposal.

Scope
Dynatest will furnish and deliver all labor and materials necessary for the inspection, calibration, repair and training on existing Dynatest 6810 and 6875 Friction Tester units at O'Hare and Midway International Airports for a (5) year contract period.

Calibration
Our technician will fly into O'Hare International Airport for calibration, and all units will be calibrated at O'Hare. The Chicago Department of Aviation (CDA) will need to provide a secure garage area for our technician to work in. Each unit will be reviewed and calibrated at their respective facility locations. CDA staff will not be required to bring the Midway units to O'Hare.

The calibration equipment will be shipped to O'Hare prior to our technician arriving and then removed when the calibration is complete. The Dynatest technician responsible for the annual service will arrange transport of the required calibration equipment between Midway and O'Hare when necessary.

Calibration cost includes all labor, materials, insurance, overhead, and profit.

Service to Dynatest Manufactured Equipment on site at O'Hare
The technician will review the current status of the Dynatest manufactured equipment and recommend any service items which should be taken care of including, but not limited to, such items as the hydraulic filter, test tire, and printer ink. Any recommended service items or deficiencies found during the calibration will be addressed or repaired upon City authorization on a time and materials basis pursuant to a quote provided by the Contractor in accordance with the rates for same listed in this proposal.

Dynatest will **NOT** review the vehicle nor its running gear for any deficiencies during this work effort. Should any vehicle deficiencies be identified, they will be brought to the attention of the airport staff.

Training
Dynatest will provide hands-on training for CDA staff at both O'Hare and Midway Airports. This training will be in-vehicle training focused on the proper operation and maintenance of the runway friction tester (RFT). While this training will be consistent with the outline in FAA AC 5320-12C, it will not include a classroom session. Certificates of training will be provided after the course for those who have had their training updated. Best efforts will be made to train a minimum of 15 CDA employees (unless such number is reduced by CDA) across three shifts at each Airport.

Pricing
The unit costs for items anticipated in this work effort are shown below:

Item	Unit Cost	Units
RFT calibration	$1,600.00	Each
Field / Shop repair labor	$110.00	Per hour
Training labor	$1,400.00	Per day
Calibration equipment shipping	*	Direct cost
Per diem food	**	Direct cost
Per diem hotel	**	Direct cost
Transportation/flight	**	Direct cost
Repair parts	***	Each

* Shipping of Contractor's equipment and/or repair parts will be billed at Contractor's cost as verified by shipping invoices.

** Food, hotel, and travel for calibration and training will be billed in accordance with City Travel Guidelines.

*** Repair parts will be billed at then-current Dynatest parts price list (See Appendix 1). Parts pricing includes shipping and is subject to annual adjustment by Contractor. It is unlikely that all units will require all of the possible repair parts. CDA will be billed only for parts required and installed, and for actual labor expended. Repairs shall be made on-site unless Contractor determines on-site repairs to be infeasible based on cost or availability of personnel or equipment. In the event that repair cannot be made at a CDA facility, it will be CDA's responsibility to have the equipment delivered to the Contractor's facility in Alpharetta, Georgia. CDA will also be responsible for the delivery of the unit from Contractor's shop to CDA's facility.

Price Adjustment

Labor and calibration pricing will be firm for the first twelve (12) months. Thereafter, annual three percent (3%) increases will be given for the labor rate, calibration, and training. Parts pricing will be governed by the most current price list provided by Dynatest during the course of the contract.

Should you have any questions concerning this quotation please feel free to call me at +1 678-781-1799 extension 236 or email at cmoore@dynatest.com.

Best regards,

DYNATEST NORTH AMERICA, INC.

Charles R. Moore
Client Services Manager
Dynatest North America Inc.

Appendix 1: Parts lists for 6850 and 6875 Runway Friction Testers

The following is a detailed parts list w/pricing for your 6875 RFT. Please note these prices reflect current market rate and are subject to annual adjustment.

NO.	OLD ITEM NO.	DESCRIPTION	Price
2000173	**B6875EV6875E100R00AD**	**6875 RFT Vehicle Electrical**	
1000720	E3116-003128	Con-BusBar-9-141	$ 10.18
1000721	E3116-003129	Con-BusBar-MS-9-141	$ 3.81
1000605	E3100-001929	Con-DB25-S	$ 12.29
1000756	E6101-020886	RELAY-12V-20/30A	$ 10.44
1000755	E6101-004622	Relay-70-914	$ 69.15
1000488	E1001-001431	Diode-GP-1N4004	$ 0.28
1000641	E3102-002044	Con-D Sub-03-06-2041(4 Pin)	$ 9.24
1000730	E3117-002138	Con-Strain Relief-2521-1/2	$ 14.82
1001302	H5400-002505	O Ring-STG50	$ 2.01
1001023	M6001-003017	Fasteners-1/2"LockNut-BL-50	$ 0.82
1000697	E3108-031290	CONNECTOR 192900-0055	$ 35.86
1000701	E3108-031449	CON BACKSHELL 192900-0498	$ 56.72
1000698	E3108-031446	CONNECTOR 192900-0057	$ 35.27
1000700	E3108-031448	CON BACKSHELL 192900-0497	$ 33.59
1000691	E3103-031583	Pin-Female- Lg	$ 0.92
1000690	E3103-031582	Pin-Female-Sm	$ 1.81
1000147	E3100-002142	1-1/4 Conduit Elbow 90o liquid	$ 44.79
1000454	M2200-031343	GoLight Model 2021	$ 355.10
1000455	M9900-031409	Control Box-GoLight	$ 278.30
1000743	E6004-002239	Switch-Tog-8280K127C	$ 21.04
1001194	M4100-008122	Enc-A-1412NF	$ 373.25
1001193	M4200-004257	Enclosure Panel-A-14P12	$ 40.40
1000740	E6001-031793	Switch-Poly.V-Mount Liq-Level	$ 98.71
1000631	E3100-013516	Con-Pin-02-06-6103	$ 1.16
1000640	E3102-002033	Con-D Sub-02-06-5135	$ 1.14
1000591	E3100-001650	Con-207345-1	$ 7.02
1000590	E3100-001635	Con-205980-4	$ 2.20
1000783	E3100-002668	270-020 Power Cable-12in	$ 15.51
1001457	M4101-031756	Panel-Hoffman-A6P4	$ 17.59
1001458	M4101-031757	JIC BOX-Hoffman-A604CHNF	$ 188.26
1000616	E3100-002043	Con-03-06-1041	$ 7.96
1000137	E3104-001748	Con-Mil-973106A-20-15P	$ 54.03
1000654	E3104-001713	Con-Mil-973100A20-15S	$ 74.13
1000732	E3117-002141	Con-Strain Relief-T2523-1/2	$ 12.47
1000729	E3117-002137	T&B 2520-1/2 Strain Relief	$ 12.28
1000786	E3107-003132	Terminal Block-10-140	$ 12.74
1000725	E3117-001708	Con-Clamp-97-3057-12A	$ 10.87
1000476	E7418-001779	Boot-9779-513-12	$ 2.19
1001231	E9101-031677	Transmitter-Temp-EE16-T3A21	$ 304.12
1000507	E6300-032124	50 Amp Flat Fuse	$ 5.94
1000503	E6300-032002	Fuse 150 AMP	$ 4.05
1000504	E6302-032004	Fuse 15 AMP	$ 1.16
1000505	E6302-032005	Fuse 20 AMP	$ 1.52
1001241	E9901-031915	Buss Strip 9290T16	$ 69.85
1000728	E3117-002135	T&B 2269 Strain Relief	$ 22.77
1002085	U-F01-21-61-00-00	FUSE BLOCK 0354-120-005 (VEH/T	$ 172.07
1000516	D9902-031292	Misc-USB Flash Drive-Mini	$ 23.82
1000763	E6302-032007	ATC 6-Way Fuse Block	$ 10.21
1000483	D0601-032035	USB Right Angle Ext. Cable	$ 19.17

1000484	D0601-032036	USB Right Angle Patch Cable	$	11.25
1001228	E9100-032050	Prox Sensor-See Notes	$	72.05
1001229	E9100-032051	Prox Sensor M12 Cable Kit	$	30.10
1000729	E3117-002137	T&B 2520-1/2 Strain Relief	$	12.41
1000728	E3117-002135	T&B 2269 Strain Relief	$	22.77
1001023	M6001-003017	Fasteners-1/2"LockNut-BL-50	$	0.82
1001302	H5400-002505	O Ring-STG50	$	2.01
1000786	E3107-003132	Terminal Block-10-140	$	12.74
1000733	E3117-031992	3/4" 90 Strain Relief	$	15.13
1000648	E3100-002661	Con-T & B 2268	$	23.27
1001617	M9901-032120	Hydraulic Pump Box Mount 6875	$	87.75
1000818	E9101-031731	Omega Temperature Sensor OS552A-V1-1	$	1,379.81
1000819	E9101-031732	Omega Rt. Angle Mounting Bracket	$	88.33
1000820	E9101-031733	Omega Mounting Nut	$	38.72
1000530	E4201-032014	PV375-Inverter	$	129.08
2000172	**B6875031467SWAF**	**6875 RFT Vehicle Hydraulic**		
1000375	H0100-031809	Hydac Cartridge	$	63.61
1000376	H0100-031956	Hydac Coil 12DG	$	42.96
1000377	H0100-031957	Hydac WKO8C-01-C-N-0	$	96.51
1001172	H0100-031743	Schroeder Filter #13	$	535.81
1001254	H0100-031744	Accumulator Oil/Air #10	$	1,063.03
1001259	H0100-031896	Valve-Sun Relief RPCCLBN-FAJ	$	173.43
1001257	H0100-031747	Pressure Gauge 2.5" Liquid	$	66.74
1001252	H0100-031734	Parker Hyd Pump #04	$	1,935.27
1000300	M9901-031758	Hydraulic Tank -6875	$	2,964.50
1000301	M9901-031759	Hydraulic Tank Lid 6875-V2	$	272.25
1001561	M9901-031475	Gauge-Sight Level	$	47.29
1001308	H9901-031453	Misc-Cap-SS-Filler Breather #5	$	71.10
1000832	H1001-003092	Valve-Check-C400-B10	$	92.91
1001258	H0100-031750	6875 Hydraulic Manifold	$	65.95
1001300	H4001-031815	Cylinder-SEF1698	$	1,573.77
1000143	H0100-031612	Bosch/Rexroth Hyd. Pump	$	10,615.06
1000369	M9901-031761	Hydraulic Tank 6875 Fitting 1	$	63.91
1000370	M9901-031762	Hydraulic Tank 6875 Fitting 2	$	54.57
1000371	M9901-031763	Hydraulic Tank 6875 Fitting 3	$	138.93
2000217		Venturi	$	1,046.05
1001307	H6003-031773	Switch-PSensor-DC-4 pin	$	300.78
1000636	E3101-031774	Con-DIN-DC-4 wire	$	48.30
1000350	H3100-031886	Crimp Hose Assy #1 1x26	$	144.45
1000351	H3100-031887	Crimp Hose Assy #2 1x51.5	$	220.53
1000352	H3100-031888	Crimp Hose Assy #3 1x25	$	149.29
1000353	H3100-031899	Crimp Hose Assy #4 1 x 63	$	242.81
1000354	H3100-031900	Crimp Hose Assy #5 1x 60	$	211.41
1000355	H3100-031846	Crimp Hose Assy #6 3/8x12.25	$	64.54
1000356	H3100-031832	Crimp Hose Assy #7 3/8x13.50	$	41.67
1000357	H3100-031831	Crimp Hose Assy #8 3/8x23.50	$	43.58
1000358	H3100-031827	Crimp Hose Assy#9 3/8x22	$	72.45
1000359	H3100-031828	Crimp Hose Assy #10 3/8x24.50	$	50.77
1000360	H3100-031848	Crimp Hose Assy #11 3/8x54	$	66.48
1000361	H3100-031847	Crimp Hose Assy #12 3/8x51	$	68.51
1000362	H3100-031834	Crimp Hose Assy #13 3/8x37"	$	67.75
1000363	H3100-031904	Crimp Hose Assy #14 3/8 x 27	$	80.27
1000364	H3100-031841	Crimp Hose Assy #15 1/4x18	$	45.55
1000365	H3100-031843	Crimp Hose Assy #16 1/4x17	$	42.12
1000366	H3100-031844	Crimp Hose Assy #17 3/8x17	$	44.09
1000367	H3100-031851	Adapter Filter 50925K344	$	22.39
1000368	H3100-031796	Fitting-ST TH Conn 16-12F50X-S	$	11.79
1001268	H3100-031836	Male Elbow Body 16-CTX-S	$	22.32
1001529	M9504-031791	Anchor Flange	$	112.38

1001659	M9901-031884	U-bolt 1/2-13x4.5 O.D.	$	10.32
1000302	M2200-024516	Bracket-Inverter-24516	$	140.36
1001645	P1000-031850	Ball Valve 1"NPT	$	60.31
1000198	P1000-003074	1.25 Ball Valves-70-106-01	$	106.09
1001356	M1401-031819	Rod End-1/2-SS-2059915K486	$	76.03
1001263	H3100-031777	1-1/4 CD STREET L	$	80.22
1001646	P3207-031820	Bulkhead Union 16WTX-WLN-S	$	34.61
1001644	P1000-031822	Ball Valve 1/2"NPT	$	35.43
1001282	H3100-031935	6-8 F50X - Male Conn O-Ring	$	4.16
1001275	H3100-031893	50925 K328 Adapter	$	7.67
1001293	H3100-031959	6 C50X - Straight Thread 90	$	9.72
1001276	H3100-031908	Elbo-Straight Thread 16-C50X	$	31.99
1001286	H3100-031942	6 S6X - Swivel Nut Branch	$	12.05
1001264	H3100-031778	Hex Nipple, 1-1/4x1-1/4NPT	$	35.21
1001271	H3100-031840	4 R6X - Swivel Nut Run	$	10.09
1001272	H3100-031849	Swivel Nut Elbo6 C6X-S	$	9.29
1001273	H3100-031881	Fitting Male Conn 16F50X	$	12.78
1001274	H3100-031890	M Elbow 90* 4-4 CTX	$	4.99
1001288	H3100-031945	4F40MXS - Male Conn Tripl	$	9.80
1001289	H3100-031946	4C40MXS - Male Elbow	$	28.91
1001290	H3100-031953	16-12 C50X Male Elbow	$	27.52
1001291	H3100-031954	6R6X - Swivel Tee	$	12.39
1001292	H3100-031958	1/2CR Male Elbow	$	12.57
1001280	H3100-031932	Adapter 3/4-16X3/8	$	11.09
1000513	D0601-001864	Cable-6ft-230-215	$	51.35
1001279	H3100-031931	16FTX Male Connector	$	7.36
1000257	H3100-032001	Orfice Fitting 6-XHX7-S	$	18.54
1000788	E3105-031889	Connector Bulkhead 6-WTX	$	11.96
1001260	H0100-032061	6875 Oil Level Gage Plug	$	48.40
1001270	H3100-031839	Conn 6-12 F5OX-S	$	21.71
1000279	M9901-032145	NoShok Pressure Transmitter	$	973.76
1000280	M9901-032146	NoShok 4Pin Female Cable	$	114.29
2000102	**B6875MF07031914S00AA**	**300 Gallon Water Tank - Ford**		
1000191	M9504-002216	Fit-CH-IPT-17-126-HoseCap	$	72.09
1000192	M9504-031181	SS-2-1/2 x 5 Pipe Nipple	$	44.24
1000193	H3219-031205	Flange-2.5-SS-NPT	$	70.27
1000194	E6000-031619	Water Centroid CGW-12V-0/5V-5H	$	123.42
1000195	H1001-003094	Check Valve 351x1-1/4, 1/4 tap	$	87.00
1000196	M2400-002866	Spring-72078S	$	38.45
1000197	M9504-031960	1 1/4" NPT Eco Bronze Y-Strain	$	130.63
1000198	P1000-003074	1.25 Ball Valves-70-106-01	$	106.09
1000199	M9502-031879	Fitting1-1/4 Female Swivel 90	$	454.44
1000200	M9003-031207	Tank-Seal-Neoprene1x9.75x6.00	$	62.64
1000201	M9003-031208	Tank-Seal-Neoprene1/2x9.75x2.5	$	46.98
1000202	M9003-031209	Tank-Seal-Neoprene1x9.75x2.5	$	59.00
1000203	M9501-012433	Nozzle-6800M400S30	$	765.33
1000204	M9501-012435	Nozzle Standard	$	417.45
1000206	M9900-031914	300 Gal.Tank 6875-26-01	$	7,199.50
1000205	M9900-031913	300 Gal Water Tank Cover 6875	$	1,645.60
1000148	M9901-031993	Chevy 300 GL Water Tank-Cap	$	232.32
1000207	M9504-002601	ST-Flange 1-1/2 Thrd 125 PSI	$	25.51
1000439	M9504-003287	Fit-SS-Tee-1-1/2	$	34.68
1000444	M9504-002482	Fit-SS- Street Elbow-1-1/2	$	30.49
1000436	M9504-031408	1.25NPTx9" SS Thread One End	$	25.97
2000090	M2601-031168	Canopy Trim Ring	$	212.48
2000175	**B6875MFRFT1.01S00AB**	**6875 Fixed Assembly SW1.01**		
1001326	M0101-031395	Mounting Plate Dwg 01.01	$	338.80
1001423	M2601-031128	Detail-Encoder-Mtg	$	164.56
1001422	M2601-031122	Detail-Adapter-6810	$	72.60

1001486	M7100-002557	Seals-1850	$	12.70
1000406	D0210-031590	Enc-755A18L20480QPP4SSN	$	1,354.72
1001489	M7100-031420	Oil SealCR-90x125x12-CRW1-V	$	56.85
1001490	M7100-031421	Oil SealCR-115x150x12-CRW1-R	$	47.92
1001136	M1401-031418	Bearing-Ball-6016-2Z	$	274.31
1001398	M1601-031393	Encoder Cap Dwg.1.04	$	458.37
1001581	M9901-031863	Pump Adapter 55CC	$	480.32
1001347	M0501-031394	Pivot Left Dwg.1.02	$	622.24
1001583	M9901-031865	Load Cylinder Mt. Rt 6875	$	326.70
1001582	M9901-031864	Load Cylinder Mt. Lt 6875	$	423.50
1001137	M1401-031419	Bearing-Ball-6020-2RS	$	567.38
1001348	M0501-031859	Pivot Right Runway Dwg 01.02	$	683.50
1001324	M0101-031368	Encoder Cover Dwg.6.00	$	182.87
1000091	M1501-002977	Axle Plug-Dorman-570-003	$	4.28
1001608	M9901-032065	6875 RFT Prox Mounting	$	12.10
1001611	M9901-032098	Proximity Switch Dog	$	26.62
2000178	**B6875MF00031575S00AD**	**6875 Control Arms - Ford**		
1001265	M1401-031779	Rod End AM-12-Z	$	155.04
1001574	M9901-031794	U-Bolt SS Extended 1/2-13	$	42.24
1001573	M9901-031780	Control Arm Mtg Axle Ford 06	$	245.01
1001343	M0301-032015	Control Arm '08 Ford	$	232.32
1001586	M9901-031877	Control Arm Mtg 6875 R-4WD	$	485.21
1001587	M9901-031878	Control Arm Mtg 6875 L-4WD	$	485.21
1001592	M9901-031966	Spcr(SS)1-1/8 O x 750 I x370 L	$	31.70
2000190	**B6875RFT7.01S00AD**	**6875 Transducer Assy**		
1001397	M1601-012467	Cap-6800M400S16D58	$	133.58
1001576	M9901-031818	Pivot Ctrl Arm 6875-Dwg 07.02	$	282.37
1001013	M9901-012468	Spacer-6800M400S18	$	83.49
1001025	M6001-003043	Fasteners-Nut-AN-15	$	26.33
1001465	M6001-003039	Fasteners-Nut-NO9	$	5.81
1001472	M6004-003101	Lock Washer W-15	$	3.04
1001045	M6004-003099	Fasteners-Lwash-W-09	$	1.11
1001484	M7100-002553	Seals-472492	$	13.56
1001131	M1401-001519	Bearing-Ball-QJ215	$	821.24
1001135	M1401-001521	Bearing-Ball- 6309-2RSJEM	$	152.38
1001346	M0501-012469	Retainer-6800M400S24	$	158.63
1001157	M3400-001299	Spindle-6900M400 D59	$	1,681.90
1001488	M7100-031398	Seal 6850 DriveTrain 42340 CR	$	42.08
1001027	M6001-003048	Fasteners-Nut-358501	$	1.33
1000952	M2000-002882	Dorman Stud 7/16-20	$	2.08
1001414	M2101-002540	Rod-AM-8Z	$	79.40
1000833	M2501-002345	Hold Down-Clamp-56128	$	10.97
1001650	M0501-012472	Rod-08.01-012472	$	72.36
2000212	**B6875MT00003216S00AB**	**New M6800 Transducer w/Core Fee**	**$**	**25,500.00**
2000214	**B6800MT00003216R00AB**	**Rebuilt M6800 Transducer w/Core Fee**	**$**	**14,350.00**

Core fee of $2,500.00 can be credited with the trade-in of an old transducer core against the purchase of a new or rebuilt unit.

N/A	**N/A**	**Rebuild Chicago Owned Transducer**	**$**	**11,850.00**

If you send in your own unit to be rebuilt and returned a core fee does not apply. Lead Time is approx. 8-10 weeks.

2000187	**B6875MV02.01S00AC**	**6875 RFT Gearbox 32**		
1001074	M9901-031928	Gearbox 6875 RFT 32Teeth	$	7,199.50
1001396	M1601-012466	Cap-6800M400S21D43	$	111.32
1001333	M0201-012438	Spacer-6800M400S25	$	302.50
1000189	M0501-012464	Cup-6800M400S3D4	$	44.53
1001132	M1401-001522	Bearing-Ball-15100	$	40.73
1001133	M1401-001523	Bearing-Ball-15125	$	40.99

1001491	M7100-031427	Sealring-CR-45x85x8-CRW1-R	$	19.58
1001441	M3000-002527	Chain-MasterLink-464205	$	24.55
1001442	M3000-031862	Morse Chain	$	530.51
1001024	M6001-003041	Fasteners-Nut-NT09	$	9.95
1001471	M6004-003100	Lock Washer WT-09	$	7.55
1001139	M1401-001526	Bearing-Ball-SB22209W33	$	323.49
1001119	M2300-002170	Bushing-SNW06X15/16	$	38.15
1001138	M1401-001525	Bearing-Ball-SB22206KW33	$	252.29
1001008	M9901-012439	Spacer-6800M400S20	$	85.95
1001485	M7100-002554	Seals-473214	$	48.96
1001325	M0101-031379	Swing Box Cover Dwg.2.07	$	191.79
1001134	M1401-001524	Bearing-Ball-15245	$	12.02
1001589	M9901-031906	Runway Water Nozzle Mtg-1	$	46.34
1001590	M9901-031907	Runway Water Nozzle Mtg-2	$	282.37
1001146	M9901-031927	Bearing House 012441 32Teeth	$	695.75
1001147	M9901-031926	Sprocket 32 Teeth 001295	$	1,034.55
1001420	M2504-031917	Clamp on Collar 1 5/8" Bore	$	46.73
1001579	M9901-031826	Mount Load Cyl Lower	$	91.36
1001657	M9901-003095	Axle-Vent-8640496	$	5.66
2000070	**B1295MN00031146S00NL**	**Ink Jet Printer**		
1000140	M9001-031161	Weldment Printer Bracket	$	254.10
1000141	M9001-031162	Tray-Printer Paper Storage	$	171.82
1000514	D0601-031279	Cable-USB-15' 2.0 AB Shielded	$	14.67
2000186	**B6875MV00032026S00AA**	**Laptop Mounting 14"**		
1000908	M9901-032032	14" Laptop Tray	$	181.50
1000910	M2200-012322	Bracket-Display-15-Riser	$	131.65
1000911	M2200-012324	Bracket-Keyboard-Holder	$	242.24
1000907	M9901-032031	14" Laptop Shade	$	118.58
1000909	M9901-032033	14" Laptop Holder	$	145.20
1000303	M9901-032016	VCU Mount '08 Ford	$	358.69
1000304	M9901-032017	VCU Rear Foot '08 Ford	$	148.88
1001044	M6003-004379	Fasteners-Wash-TW-100	$	2.12
1001729	N/A	Black 1/4-20 Knob	$	11.18
1001730	N/A	Aluminum 5/16"-18 Knob	$	18.03
2000120	**D6875EV9800E104S00AA**	**6875 Dash Display**		
1000804	E7205-002960	Modtec Disp-Met-BL331302-01	$	276.97
1000559	E0109-002736	Res-Pot-3059Y-1-103LF	$	12.93
1000552	E0101-000475	Res-RN55D1002F	$	0.28
1000551	E0101-000336	RN55D1001F	$	0.16
1000589	E3100-001557	Con-H4M25ST29C	$	11.50
1000488	E1001-001431	Diode-GP-1N4004	$	0.28
1001056	E7401-007655	PC Board 090491	$	48.63
1001570	M9901-031728	RFT Dash Display Front	$	42.35
1001571	M9901-031729	RFT Dash Display Bottom	$	67.05
1001572	M9901-031730	RFT Dash Display	$	163.35
1000693	E3108-003116	Con-Terminal-30.252	$	1.63
1000694	E3108-003117	Con-Terminal-30.253	$	2.29
1000775	E7001-002926	Lamp-Inc-507-3913-1472-600	$	29.04
1000770	E7000-002930	Lamp-Term.Holder-508-7538-504	$	22.20
2000184	**B6875MF031476SWAA**	**6875 RFT Pump Assy - Ford**		
1001519	M9504-031476	Clutch Mount Plate	$	532.40
1001520	M9504-031477	Pump Mounting 21-01-S0-4	$	332.75
1001521	M9504-031478	Pump Mounting 21-03	$	140.36
1001145	M9504-031480	Bearing House	$	177.72
1001523	M9504-031483	Cross Bar SW21-06	$	229.90
1000187	M9500-003055	1.25 Pump Buna Lip Seal 3055	$	2,158.20
1001236	E9400-002541	Clutch 5208-62	$	733.18
1000831	M1402-031136	P2B-DLEZ-100-PCR-Bearing	$	293.33

1001143	M1404-031484	SKF Ball Bearing 6306-2RS1	$	92.23
1001524	M9504-031485	Idle Shaft 21-07	$	242.00
1001525	M9504-031486	Adjusting Plate	$	266.20
1001526	M9504-031487	Dodge Block Spacer 21-09	$	84.70
2000068	**B1295MV00003051S00NL**	**Driveshaft 3.5**		
1000897	M3400-011961	Spin-Pulley Ring-12800M114D	$	288.32
1000898	M3400-011964	Spin-Pulley Sleeve-12800M11	$	676.54
1000899	M1703-011962	Pulleys-Gear-12800M114D2	$	462.07
1000184	M1703-003051	Pulleys-Gear-48LH100	$	254.91
1000900	M1703-011963	Pulleys-Gear-12800M114D3	$	485.52
1000184	M1703-003051	Pulleys-48LH100-3051	$	254.91
1001399	M1703-012452	Pulley-6800M400S5D23	$	101.64
1000184	M1703-003051	Pulleys-48LH100-3051	$	254.91
1000343	M1703-022043	Pulley24LH100	$	101.64
1001071	M2300-002167	Bushing-H-1	$	23.95
1000335	M3101-001530	Belt-Gear-285L100	$	32.67
1000337	M3101-005903	Belt-Gear-322L100	$	39.17
1000435	M9504-002997	Fit-SS-NippleCombo-1.25	$	34.73
1000434	M9504-002996	Fit-SS-Nipple-1 1/4-Clos	$	6.69
1000432	M9504-002479	Fit-SS-Elbo-1 1/4x 90	$	17.55
1001591	M9901-031951	Sideplate Water Pump Mtg.	$	135.52
2000183	**B6875MD00003214S00AA**	**Operator Pendant 6875**		
1001062	E7406-001538	Boards-Multidisp-Ctl	$	131.89
1001020	M6000-022643	Fastener, Retainer 022643	$	22.26
1000799	E6001-002198	46-150BLK Push Button Switch	$	36.40
1000737	E6001-002205	SWITCH-PB 82-101-71	$	11.37
1000676	E3104-001883	Con-Mil-165-13	$	164.89
1000473	E7418-001776	Boards-Boot-9779-513-6	$	1.90
2000257	N/A	Operator Pendant Enclosure - Altered	$	64.58
2000071	**B6875MV00031955S00AA**	**10 Gallon Surge Tank Assy**		
1000305	M9900-031955	10 Gallon Stage Water Tank	$	1,051.58
1000444	M9504-002482	Fit-SS-Elbo-1 1/2 Street	$	31.70
1000446	M9504-003009	Fit-NippleCombo-SS-1.5	$	42.80
1000443	M9504-002483	Fit-SS-Elbo-1 1/2x90	$	24.29
1000445	M9504-003008	Fit-SS-Nipple1.5-Clos	$	8.63
1000442	M9504-002480	Fit-SS-Elbow-1.5 X 45	$	18.71
1000306	M9900-032049	Water Bottle Mtg Brkt+Ford	$	55.66
2000182	**B6875MCF31466SW018AB**	**6875 Test Wheel Mount**		
1001327	M0101-031464	C-Ring Weldment 6875-20-S1-3	$	363.00
1001328	M0101-031465	C- Ring 20-04	$	137.94
1001767	M9901-031816	Sys. Mtg Plate 6875 Ford 06	$	580.80
1001604	M9901-032046	Differntial Mount Ford	$	26.32
2000189	**B6875MV68750001S00AA**	**6875 RFT Vehicle Mechanical**		
1001041	M6001-003052	Fasteners-Nut Wing-6032619	$	24.10
1000281	C0800-002485	Fire Extinguish#5 10800-2231-1	$	183.92
1001467	M6002-002484	3/8-16 Eye Bolt-Plated Steel	$	14.27
1000392	D9904-031669	Decal-Dynatest w/Logo 1.5" Wht	$	12.65
1000395	D9904-031853	Decal RFT - 3" Blue	$	55.66
1000127	P7000-031348	Pressure-Gage-0-100psi	$	31.31
1001261	H1000-003087	1/4 Air Chuck 6146A23	$	6.80
1001627	P1000-002318	B33 Female Socket 1/4NPT	$	4.68
1000265	M1100-003276	E-1551 ASTM Runway Test Tire	$	334.07
1000266	M1101-002491	Split 4.0x8.0 Tire Rim	$	174.24
1000136	M0301-003154	4x8 w/90 Degree Stem Tub	$	27.23
2000164	**B1295MV00009503M00AC**	**1.5 Flow Meter Vehicle Mount**		
1000837	M9504-031175	Fit-SS-Coupling-1.5 304 Thread	$	17.79
1000446	M9504-003009	Fit-NippleCombo-SS-1.5	$	42.79
1000849	M9503-031171	1.5NPT Flow Meter	$	1,197.90

1000850	M9503-032095	Flowmeter Cable	$	191.18
2000176	**B6875MFRT4.01S00AB**	**6875 RFT Shaft Assy 4.21T**		
1001018	M3400-031371	Encoder Drive Pin Dwg.4.02	$	101.64
1001015	M9901-031372	Spacer Dwg.4.03	$	54.84
1001148	M9901-031925	Sprocket 04.05.B1295 21Teeth	$	629.20
1001014	M9901-031370	Spacer Dwg.4.10	$	58.08
1001474	M6004-031429	Lock Washer MB-5	$	4.43
1001466	M6001-031430	Lock Nut-KM 5	$	12.83
1001584	M9901-031867	Shaft Spacer Right-Dwg 18.11	$	48.76
1001443	M3100-031860	Shaft 04.01 Runway	$	1,149.50
1001580	M9901-031858	Sleeve Shaft Spacer-Dwg 18.09	$	115.81
2000131	N/A	SK1947 Coupling Assy	$	89.37
2000112		**Driveshaft Encoder**		
1000399	D0210-032069	Phoenix Encoder/Rotor Combo	$	474.62
1000400	M9901-032070	Driveshaft Encoder Clamp	$	114.95
1000401	M9901-032071	Driveshaft Encoder Shaft	$	592.90
1000402	M9901-032072	Driveshaft Encoder Housing	$	865.15
1000403	M9901-032073	Driveshaft Encoder Cover	$	308.55
1000632	E3100-032077	MS3057-10A-Cable Clamp	$	30.40
1000404	D0210-032074	6010 2RSJEM Stainless Bearing	$	131.54
1000556	D0210-032075	6012 2RSJEM Stainless Bearing	$	150.91
1001447	M3104-031894	Con-Mil-MS3106-F18-1S	$	45.98
1000633	E3100-032080	Con-97-3101A18-1P Encoder	$	55.18
1001359	M1401-032021	3/8" SS Femal Rod End	$	44.17
1001358	M1401-032020	3/8" SS Male Rod End	$	44.17
1000476	E7418-001779	Boot-9779-513-12	$	1.95
1000475	E7418-001778	Rubber Wire Boot-9779-513-10	$	2.48
1000473	E7418-001776	Boards-Boot-9779-513-6	$	2.36
1001710	N/A	Sealcon M10x1.5 Strain Relief	$	13.15
1001173	H0100-032008	9V3 Schroeder Filter Element	$	61.69
2000137	N/A	6875 VCU - Complete w/Build Labor	$	10,271.48
Individual Replacement Components for the VCU (Not Including Labor)				
1000412	U-F01-Q2-07-02-00	VCU BOX LATCH KIT (LOCK)	$	83.36
1000413	M4103-031112	Enc-SS VCU Enclosure w/Lid	$	1,626.24
1000414	E7468-CF-128MB	CompactFlash Memory Card 128Mb	$	71.29
1000417	E0101-DM6810	DIGITAL IO CARD - RTD DM6810	$	896.20
1000418	E7403-DMM-32X-AT	DMM32XAT 3 Ch 16bit PCB	$	1,510.94
1002669	N/A	WinSystems PC/104	$	1,125.23
1000422	E0101-3412NG	Fan	$	49.25
1000930	M4100-030356	SPBSS Hole Seal	$	63.95
1000931	U-F01-08-18-04	Hydraulic Control board 6875	$	1,370.67
1000934	U-F01-6875FACEPANEL	6875 FACE PANEL	$	444.93
1000328	U-V01-60-19-02-00	ROCKER SWITCH	$	3.74
1002670	N/A	Cable Set for WinSystems	$	47.64
1000415	E4201-12D15	12D15 FDC60	$	333.96
1000416	E4201-12S05	12S05 FDC60	$	318.00
1000420	E0101-DIMM168-133-64	64MB DIMM 8M x 64 BIT (Memory)	$	156.99
N/A	EBC-C3-PLUS-SBC	EBC.C3+ Single Board Computer	$	1,650.00

MBE/WBE WAIVER REQUEST

Dynatest®

DYNATEST NORTH AMERICA

11415 Old Roswell Road
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Alpharetta, Georgia 30009 USA
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Fax +1 678 823-9522

Email: dna@dynatest.com
Webpage: www.dynatest.com

Pavement Engineering Specialists and Equipment

May 30, 2019

City of Chicago
O'Hare International Airport
Midway International Airport
Chicago, Illinois 60666

Reference: Dynatest 6810, 6850 and 6875 Runway Friction Testers

To Whom It May Concern.

Dynatest North America Inc. is the sole manufacturer of the FAA approved Runway Friction Tester. See FAA AC 5320-12C Changes 1 thru 9.

Dynatest North America, Inc., having acquired the Transportation Test Equipment Division of K.J. Law in 2002, is now the sole manufacturer, service provider, calibration provider and training provider for the Dynatest 6810, 6850, 6875 Runway Friction Tester units owned by Chicago O'Hare and Midway Airports.

As the manufacturer of this equipment, Dynatest North America, Inc. is the sole source supplier of the Runway Friction Tester. There are no other facilities or organizations authorized or licensed to produce the 6800, 6810, 6850 and 6875 RFT or its components. There are no authorized organizations outside of Dynatest to provide service, calibration, software or support for the Runway Friction Tester in all of its formats.

While there are other companies that are certified for providing and servicing friction testing equipment as included on the approved list of friction testers found in FAA AC150/5320-12c Change 8, each listed company manufactures, services and calibrates its own equipment and none of these other companies is authorized to do this for Dynatest manufactured equipment. Therefore, as this contract is for the maintenance and repair of equipment already owned by the City, Dynatest is the sole source for certification, service, parts and labor. Dynatest manufactures its own parts and equipment, is located out of town, uses its own techs in the field and in its shop to service equipment, and makes its own limited travel arrangements, and as such does not have opportunities for subcontracting City of Chicago certified MBE/WBE firms."

Dynatest has no plans to train anyone outside of the company to perform service, support, calibration or any other activity pertaining to the manufacture, support, service, calibration, training of maintenance of the 6800, 6810, 6850 or 6875 RFT.

Dynatest would ask that we be considered an exclusive and unique supplier solely capable of supplying service, parts, calibration and support for these testers. As such, we request an exemption from MBE/WBE participation.

Should you have any questions concerning this please feel free to contact myself at our office in Alpharetta, GA at 1-678-781-1799 extension 236.

Best Regards,

Charles Moore
Client Services Manager
Dynatest North America, Inc.

CHICAGO DEPARTMENT OF AVIATION

CITY OF CHICAGO

To: Shannon E. Andrews
Chief Procurement Officer

Attention: Monica Jimenez
First Deputy Procurement Officer

Lorel D. Blameuser
Deputy Procurement Officer

From: _____
Jamie L. Rhee
Commissioner

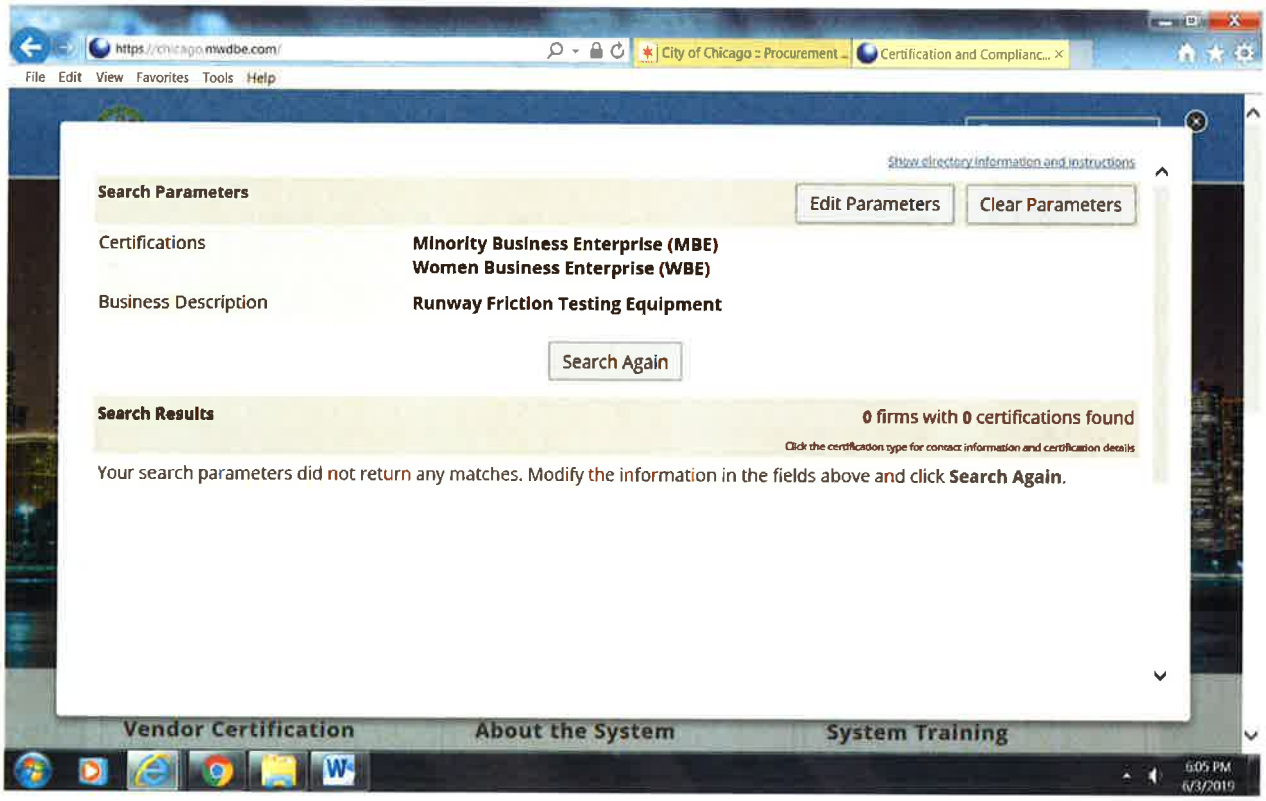
Date: JUN 18 2019

Subject: Concurrence with Contractor's Request for No Stated Goals/Full MBE/WBE Waiver on New Sole Source Contract for Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment
Requisition Number: 286604
Specification Number: 1181963
Expiring PO Number: 30144
Vendor: Dynatest North America, Inc. (Dynatest)

The Chicago Department of Aviation (CDA) is in receipt of a letter from Dynatest dated May 30, 2019 requesting No Stated Goals/Full MBE/WBE waiver and is in concurrence pending review and approval by the Department of Procurement Services.

This request is based on the proprietary nature of the Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment and that there are no other organizations authorized or licensed by Dynatest to produce, service, calibrate or support their runway friction testers.

If you have any questions or need additional information regarding this recommendation, please contact David Bowman at (773) 686-7089.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Certification and Complianc...
File Edit View Favorites Tools Help
Show directory information and instructions
Search Parameters
Edit Parameters
Clear Parameters
Certifications
Minority Business Enterprise (MBE)
Women Business Enterprise (WBE)
Business Description
Runway Friction Testing Equipment
Search Again
Search Results
0 firms with 0 certifications found
Click the certification type for contact information and certification details
Your search parameters did not return any matches. Modify the information in the fields above and click Search Again.
Vendor Certification
About the System
System Training
6:05 PM
6/3/2019

Dynatest®

DYNATEST NORTH AMERICA, INC.

11415 Old Roswell Road, Suite 100
Alpharetta, GA 30009 USA
Telephone +1 678 781-1799
FAX +1 678 823-9952

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

Pavement Engineering Specialists
and Equipment

June 18, 2019

CITY OF CHICAGO DEPARTMENT OF PROCUREMENT SERVICES
City Hall
Room 806
121 North LaSalle Street
Chicago, Illinois
60602

To Whom it may concern:

By this letter, I hereby confirm receipt, accept and agree to the City of Chicago's Standard Terms & Conditions in regards to the pending contract for service and calibration of the City's Runway Frtiction Testers.

Signature Randall G. Milton

Randall G. Milton, Head of Client Services
Name and title of Officer

CERTIFICATE OF LIABILITY INSURANCE

DATE(MM/DD/YYYY) 01/22/2019

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
Aon Risk Services Southwest, Inc. Houston TX Office 5555 San Felipe Suite 1500 Houston TX 77056 USA	PHONE (A/C. No. Ext): (866) 283-7122	FAX (A/C. No.): (800) 363-0105
	E-MAIL ADDRESS:	

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
Dynatest Consulting, Inc. Dynatest North America, Inc. a Georgia Corporation 11415 Old Roswell Rd. #100 Alpharetta GA 30009 USA	INSURER A: Philadelphia Indemnity Insurance Company	18058
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B	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE [ ] [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [X] POLICY [ ] PRO-JECT [ ] LOC OTHER:			PCS00127119	01/01/2019	01/01/2020	EACH OCCURRENCE	$5,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$100,000
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A	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY [ ] SCHEDULED AUTOS HIRED AUTOS ONLY [ ] NON-OWNED AUTOS ONLY			PHPK1923243	01/01/2019	01/01/2020	COMBINED SINGLE LIMIT (Ea accident)	$1,000,000
							BODILY INJURY (Per person)	
							BODILY INJURY (Per accident)	
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							E.L. EACH ACCIDENT	
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C	E&O-PL-Primary			USS1929336 Claims Made	01/01/2019	01/01/2020	Per Claim/Aggregate Deductible	$1,000,000 $35,000

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Matter: Inspection, Calibration, Repair, Parts and Training for Dynatest Runway Friction Testing Equipment
Applicant: Dynatest North America, Inc.
Specification #:
Contract #:

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U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

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

Date: 3/18/97 **AC No:** 150/5320-12C
Initiated by: AAS-100 **Change:**

1. PURPOSE. This advisory circular (AC) contains guidelines and procedures for the design and construction of skid-resistant pavement, pavement evaluation with friction measuring equipment, and maintenance of high skid-resistant pavements.

2. CANCELLATION. AC 150/5320-12B, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*, dated November 12, 1991, is canceled.

3. RELATED READING MATERIAL. Appendix 2 contains a listing of documents containing supplemental material relating to the subject. Information on ordering these documents is also provided.

4. APPLICATION. The guidelines and standards contained herein are recommended by the Federal Aviation Administration (FAA) for applications involving runway friction measurement, construction, and maintenance. For airport projects funded under Federal grant assistance programs, the standards identified by **BOLDFACE CAPITALS** in chapter 2, section 4, paragraphs 2-21 and 2-22 and those in appendix 3 are mandatory.

5. BACKGROUND. With the introduction of turbojet aircraft, braking performance on pavement surfaces has become more critical. Under certain conditions, hydroplaning or unacceptable loss of traction can occur, resulting in poor braking performance and possible loss of directional control. To address this concern, a number of research projects were conducted by the National Aeronautics and Space Administration (NASA), FAA, United States Air Force (USAF), and various foreign governments. These efforts concentrated in two major areas: (a) high skid-resistant pavement surface design and evaluation and (b) application of proper maintenance techniques and procedures. In this circular, guidelines are provided to airport operators on how to locate and restore areas on the pavement surface where friction has deteriorated below acceptable levels for aircraft braking performance. The material contained in this circular summarizes the findings of these research efforts.

6. METRIC UNITS. To promote an orderly transition to metric (SI) units, this circular contains both English and metric dimensions. The metric conversions may not be exact equivalents and, until there is an official changeover to the metric system, the English dimensions will govern.

DAVID L. BENNETT
Director, Office of Airport Safety and Standards

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CHAPTER 1. OVERVIEW

1-1. PURPOSE. This AC provides guidelines for designing, constructing, and maintaining skid-resistant airport pavement surfaces and for conducting evaluations and surveys of runway friction for pavement maintenance purposes. It also contains performance specifications for friction measuring equipment. Guidance on pavement friction measurement for aircraft operational purposes during winter weather and performance standards for decelerometers are found in AC 150/5200-30, *Airport Winter Safety and Operations*.

1-2. BACKGROUND. Since the advent of turbojet aircraft with their greater weight and high landing speeds, braking performance on runway surfaces, particularly when wet, has become a significant safety consideration. A number of research programs by FAA, NASA, and USAF, as well as those performed by foreign governments, have been directed in two major areas: original pavement surface design to maximize skid-resistance with proper materials and construction techniques and effective evaluation and maintenance techniques to detect deterioration of skid-resistance and to restore it to acceptable levels.

1-3. PAVEMENT DESIGN RESEARCH. Pavement grooving was the first major step in achieving safer pavement surfaces for aircraft operations in wet weather conditions. These studies were completed by NASA at the Langley Research Center, Langley, Virginia, in 1968. The FAA, through its Technical Center in Atlantic City, New Jersey, directed a test program on pavement surface treatments at the Naval Air Engineering Center, Lakehurst, New Jersey. The study was completed in 1983. Both the NASA Langley and the FAA Technical Center studies showed that a high level of friction could be achieved on wet pavement by forming or cutting closely spaced transverse grooves on the runway surface, which would allow rain water to escape from beneath tires of landing aircraft. Other research conducted both in the United Kingdom and the United States determined that an open graded, thin hot-mix asphalt (HMA) surface course called "porous friction course" (PFC) also could achieve good results. This permits rain water to permeate through the course and drain off transversely to the side of the runway, preventing water buildup on the surface and creating a relatively dry pavement condition during rainfall. The FAA Technical Center study demonstrated that a high level of friction was maintained on PFC overlays for the entire runway length.

In addition, a number of studies were carried out, and are continuing, on basic skid-resistant behaviors of pavement surfaces, both HMA and Portland cement concrete (PCC). These have led to other noteworthy surface treatments that improve pavement surface texture such as asphaltic chip and aggregate slurry seals. For concrete pavements, wire combing the surface, while the concrete is still in the plastic condition, notably improves pavement surface texture.

1-4. PAVEMENT MAINTENANCE AND EVALUATION RESEARCH. Regardless of pavement type or surface treatment, runway friction characteristics will change over time depending on type and frequency of aircraft activity, weather, environmental issues, and other factors. In addition to ordinary mechanical wear and tear from aircraft tires, contaminants can collect on runway pavement surfaces to decrease their friction properties. Contaminants such as rubber deposits, dust particles, jet fuel, oil spillage, water, snow, ice, and slush all cause friction loss on runway pavement surfaces. Rubber deposits occur in the touchdown areas on runways and can be quite extensive. Heavy rubber deposits can completely cover the pavement surface texture thereby causing loss of aircraft braking capability and directional control when runways are wet.

In October 1978, the FAA embarked on a 2-year program to conduct friction and pavement evaluation surveys at 268 airports (491 runways) within the contiguous United States. The information obtained represented a very broad collection of data on the friction characteristics of runways at airports that have turbojet aircraft operations. Field observations of the runway pavement surface conditions and analysis of the friction test data identified those areas on the runway pavement which were below the minimum acceptable friction level. Test data and surface condition information obtained during this program were given to airport owners so that they could take proper corrective measures to eliminate runway pavement deficiencies.

1-5. FRICTION MEASURING EQUIPMENT RESEARCH. Beginning in the early 1970's, NASA, FAA, and USAF conducted runway traction studies to determine the correlation between various types of aircraft and friction measuring equipment. These studies showed a fair correlation between some of the friction measuring devices, but the tests on correlation between the friction devices and aircraft were inconclusive. The tests did show, however, that friction measuring devices were effective when used to evaluate pavement surface friction properties for engineering and maintenance purposes.

In March of 1990, FAA concluded a test program to evaluate the performance of different tires on approved friction measuring devices and to develop correlation data in order to ensure that devices of different manufacture and design would give comparable results in field use. Appendix 1 summarizes research on qualification and correlation of friction measuring equipment.

1-6. ADDITIONAL BACKGROUND AND INFORMATION. Appendix 2 contains a list of pertinent reading material on design and evaluation of skid-resistant pavements.

CHAPTER 2. DESIGN AND CONSTRUCTION OF SKID-RESISTANT PAVEMENT

Section 1. Basic Design Considerations

2-1. GENERAL. In building new runways, major reconstruction, or adding overlays, the design engineer must choose either HMA or PCC as the basic paving component. The selection is usually based on economics, local preference, and other design factors. These considerations, as well as basic pavement structural design, are covered in AC 150/5320-6, *Airport Pavement Design and Evaluation.* This chapter is limited to discussion only of the surface of the airport pavement, literally "where the rubber meets the runway." All of the techniques discussed in this chapter may be applied during original construction (or reconstruction), and some may be applied to existing pavement to restore or create good friction characteristics.

2-2. SURFACE TEXTURE AND DRAINAGE. In discussing the effects of pavement texture on friction and hydroplaning, two terms commonly used to describe the pavement surface are microtexture and macrotexture. Microtexture refers to the fine scale roughness contributed by small individual aggregate particles on pavement surfaces which are not readily discernible to the eye but are apparent to the touch, i.e., the feel of fine sandpaper. Macrotexture refers to visible roughness of the pavement surface as a whole. Microtexture provides frictional properties for aircraft operating at low speeds and macrotexture provides frictional properties for aircraft operating at high speeds. Together they provide adequate frictional properties for aircraft throughout their landing/takeoff speed range.

The primary function of macrotexture is to provide paths for water to escape from beneath the aircraft tires. This drainage property becomes more important as the aircraft speed increases, tire tread depth decreases, and water depth increases. All three of these factors contribute to hydroplaning. Good microtexture provides a degree of "sharpness" necessary for the tire to break through the residual water film that remains after the bulk water has run off. Both properties are essential in providing skid-resistant pavement surfaces.

Textural appearances, however, can be deceiving. A rough looking surface could provide adequate drainage channels for the water to escape, but the fine aggregate in the pavement may consist of rounded or uncrushed mineral grains that are subject to polishing by traffic, thereby causing the pavement surface to become slippery when wet. Likewise, a less rough looking surface, that may even have a shiny appearance when wet, will not necessarily be slippery if it has good microtextural properties.

All paving should, of course, be constructed with appropriate transverse slope for basic drainage and must have adequate provision for prompt removal of storm runoff. AC 150/5300-13, *Airport Design,* provides guidance in this area.

2-3. PAINTED AREAS ON PAVEMENT SURFACES. Painted areas of wet runway pavement surfaces can be very slippery. In addition, an aircraft with one main gear on a painted surface, and the other on an unpainted surface, may experience differential braking. It is important to keep the skid-resistance properties of painted surfaces as close to that of unpainted surfaces as possible. Usually this means adding a small amount of silica sand to the paint mix to increase the friction properties of the painted surface. Glass beads, while used primarily to increase conspicuity of markings, have been shown to increase friction levels, also.

Section 2. Hot-Mix Asphalt (HMA) Pavement

2-4. CONSTRUCTION TECHNIQUES FOR HMA PAVEMENT. The surface texture of newly constructed HMA pavements is usually quite smooth. This is due to the rolling done during construction to achieve the required compaction and density. Nevertheless, several methods are available to improve surface texture and friction in HMA pavements. These include proper mix design and the use of PFCs, chip seals, and aggregate slurry seals. Saw cut grooves made after final compaction are highly effective. This chapter gives guidance for providing these surface treatments. The construction specification for HMA pavement is contained in AC 150/5370-10, *Standards for Specifying Construction of Airports.*

2-5. HMA PAVEMENT MIXTURES. Several factors concern the pavement designer in selecting the appropriate design mix. These factors include the

blending of aggregate sources, aggregate size and gradation, the relationship between aggregates and binder, and the construction methods to obtain the required surface properties which meet all other requirements.

a. Blending Aggregates. When superior quality aggregates are in limited supply or processing costs are prohibitive, natural aggregates can be combined with synthetic aggregates.

b. Aggregate Size and Gradation. The maximum size aggregate, as well as the mix gradation, may be varied by the pavement designer to produce the desired surface texture and strength. For HMA pavement, the size and properties of the coarse aggregate are critical for good macrotexture. Generally, the larger size aggregates in HMA pavement mixtures provide greater skid-resistance than the smaller ones.

c. Aggregate Characteristics. After size and gradation, the most frequently considered characteristics for skid-resistant aggregates are resistance to polish and wear, texture, and shape of particles.

(1) Resistance to Polish and Wear. The ability of an aggregate to resist the polish and wear action of aircraft traffic has long been recognized as the most important characteristic. Certain aggregates in pavements are more susceptible to wear and polish effects than others, becoming extremely slippery when wet. The presence of coarse grain sizes and gross differences in grain hardness appear to combine and lead to differential wear and breaking off of grains resulting in a constantly renewed abrasive surface. Rocks high in silica content are the most satisfactory performers. Generally, high carbonate rocks are poor performers. Rocks that are generally acceptable are unweathered crushed quartzite, quartz diorite, granodiorite, and granite.

(2) Texture. The surface textures of individual aggregates are governed by the size of the individual mineral grains and the matrix in which they are cemented. For an aggregate to exhibit satisfactory skid-resistant properties, it should contain at least two mineral constituents of different hardness cemented in a matrix that will wear differentially, thus continually exposing new surfaces.

(3) Shape. The shape of an aggregate particle, which is determined by crushing, significantly affects its skid-resistant properties. Aggregate shape depends on many of the same factors that influence texture. The angularity of an aggregate contributes to its skid-resistant quality. Flat, elongated particles are poor performers.

d. Asphalt Cement. The characteristics and percentages of the asphalt cement used should be in accordance with standard HMA pavement design practice.

2-6. PFC. One method used to improve runway pavement skid-resistance and mitigate hydroplaning is a thin HMA surface course overlay that ranges from 3/4 inch to 1-1/2 inches (25 mm to 40 mm) thick, characterized by its open graded matrix.

a. Pavement Suitability for PFC. Prior to constructing this type of surface course, the existing pavement surface should be evaluated to determine its structural integrity. Strengthening of the existing pavement, if needed, should be accomplished before laying the PFC. Also, the pavement should be in good condition; that is, it should have proper longitudinal and transverse grades and a watertight surface that is free of major cracks, significant depressions, or any other surface irregularities. For minor cracks, normal maintenance procedures should be followed as given in AC 150/5380-6, *Guidelines and Procedures for Maintenance of Airport Pavements*. If there are rubber deposits on the runway pavement surface, these areas should be cleaned prior to constructing the PFC overlay. The PFC should be constructed only on HMA pavements. It has been shown that a longer life, as well as better adhesion and bond, can be achieved by adding rubber particles during the preparation of the mix. The specification for the PFC is given in AC 150/5370-10. Figure 2-1 shows an edge view of a typical PFC overlay.

b. Restrictions to PFC Construction. On PFC constructed runway surfaces that have high aircraft traffic operations, rubber accumulation can become a serious problem if not closely monitored. If the rubber deposits are not removed before they completely cover the pavement surface and plug up the void spaces in the matrix of the overlay, water can no longer drain internally through the structure of the overlay. When this condition occurs, it is impossible to remove the rubber deposits without causing serious damage to the structural integrity of the overlay. Therefore, the FAA

recommends that PFC overlays not be constructed on airport runways that have high aircraft traffic operations (over 91 turbojet arrivals per day per runway end).

2-7. CHIP SEAL. Temporary improvement of surface friction can be achieved by constructing a chip seal. Latex added to the chip seal extends its life and provides better bond and adhesion to the existing pavement surface. A fog seal added on top of the chip seal will help minimize loose chips and prevent aircraft damage.

2-8. AGGREGATE SLURRY SEAL. Temporary improvement of skid-resistance for pavement surfaces can be gained by constructing an aggregate slurry seal, either gradation type II or type III, as given in the specification in AC 150/5370-10. Aggregate slurry seats are recommended only as an interim measure until an overlay is constructed. This type of construction is usually adequate for 2 to 5 years. Figure 2-2 shows a typical type II aggregate slurry seal. Experience has shown that slurry seals do not hold up well in cold climates where snow removal occurs. A life cycle cost analysis should be conducted to determine the long term benefits.

Section 3. Portland Cement Concrete (PCC) Pavement

2-9. CONSTRUCTION TECHNIQUES FOR PCC PAVEMENT. Several methods are available to the paving contractor for constructing skid-resistant PCC pavement surfaces. When PCC pavement is still in the plastic condition, it is strongly recommended that some type of textural finish be constructed in the pavement surface prior to grooving. Such texturing can be accomplished by using either a brush or broom finish or a heavy burlap drag finish. Wire combed or wire tined construction provides an excellent textural finish to the surface. Also, plastic grooves can be constructed in the pavement before it has hardened. For PCC pavements that have hardened, grooves can be saw cut in the pavement. The textural and grooving construction techniques are briefly described in the following paragraphs. The basic construction specifications for PCC pavement are given in AC 150/5370-10. Quality concrete is a prerequisite to the retention of pavement skid-resistance. The physical properties of the fine aggregates and effectiveness of curing are important factors in improving wear resistance.

2-10. TIMING AND CURING. Timing in applying the curing compound is as important as timing the final finishing operations to assure long lasting, nonskid pavement surface texture. The timing of the texturing operation is critical because PCC pavements rarely lose surface moisture evenly or set at a uniform rate, especially during warm weather paving operations. The best time to texture a PCC pavement during construction is when the water spots have dried enough to reasonably hold the texture but before the drier spots have dried too much to texture at all. This is one of the toughest decisions for the paving contractor. After texturing of the pavement surface has been completed, immediate application of the curing compound assures that the pavement surface will not lose water and cure too rapidly. If the pavement cures too quickly, the ridges of mortar left by the finishing technique will not set properly and their durability will be greatly reduced, resulting in a faster rate of diminishing skid-resistance. Therefore, extreme care must be taken in this process to assure an effective cure.

2-11. BRUSH OR BROOM FINISH. If the pavement surface texture is to be a type of brush or broom finish, it should be applied when the water sheen has practically disappeared. The equipment should operate transversely across the pavement surface, providing corrugations that are uniform in appearance and approximately 1/16 inch (1-1/2 mm) deep. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. Any imperfections resulting from the texturing operation should be corrected immediately after application before the concrete becomes too stiff to work. Figure 2-3 shows the texture formed by the broom finish.

2-12. BURLAP DRAG FINISH. Burlap used to texture the pavement surface should be at least 15 ounces/square yard (355 gm/square m). To produce a rough textured surface, the transverse threads of the burlap should be removed from approximately 1 foot (0.3 m) of the trailing edge and grout should be allowed to accumulate and harden on the trailing burlap threads. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface. The aggregate particles form the corrugations which should be uniform in appearance and approximately 1/16 inch

(1-1/2 mm) deep. A runway pavement constructed with a burlap drag finish is shown in Figure 2-4.

2-13. WIRE COMBING. The wire comb technique uses rigid steel wires to form a deep texture in the plastic concrete pavement. An excellent example of this method is the runway constructed at Patrick Henry Airport in Virginia, where the spacing of the ridges is approximately 1/2 inch (13 mm) center to center (see Figure 2-5). The spring steel wires which were used had an exposed length of 4 inches (100 mm), thickness of 0.03 inch (0.7 mm), and width of 0.08 inch (2 mm). The wire comb equipment should provide grooves that are approximately 1/8 inch x 1/8 inch (3 mm x 3 mm) spaced 1/2 inch (13 mm) center to center. It is not necessary to provide preliminary texturing before constructing the wire comb texture. Because of the closeness of the spaced grooves, the preliminary texturing of the remaining land areas would not be effective. The wire comb technique should be constructed over the full pavement width. **This technique is not to be confused with saw cut or plastic grooved runway pavements**. Wire combing is a texturing technique and cannot be substituted for saw cut or plastic grooves because it does not prevent aircraft from hydroplaning.

2-14. WIRE TINING. Flexible steel wires are used to form deep texture in the plastic concrete pavement. The flexible steel bands are 5 inches (125 mm) long, approximately 1/4 inch (6 mm) wide, and spaced 1/2 inch (13 mm) apart. The appearance of this technique is quite similar to the wire comb method. **This technique is not to be confused with saw cut or plastic grooved runway pavements.** Wire tining is a texturing technique and cannot be substituted for saw cut or plastic grooved because it does not prevent aircraft from hydroplaning.

Section 4. Runway Grooving

2-15. GENERAL GROOVING TECHNIQUES. Cutting or forming grooves in existing or new pavement is a proven and effective technique for providing skid-resistance and prevention of hydroplaning during wet weather. In existing pavement (both HMA and PCC), grooves must be saw cut; in new PCC pavement, grooves may be formed while the concrete is still plastic. Grooves in HMA pavement must be saw cut whether new or existing pavement is to be treated.

2-16. DETERMINING NEED FOR GROOVING. Grooving of all runways, serving or expected to serve turbojet aircraft, is considered high priority safety work and should be accomplished during initial construction. Such existing runways without grooving should be programmed as soon as practicable. For other runways, the following factors should be considered:

a. Historical review of aircraft accidents and incidents related to hydroplaning at the airport.

b. Wetness frequency (review of annual rainfall rates and intensity).

c. Transverse and longitudinal grades, flat areas, depressions, mounds, or any other surface abnormalities that may impede water runoff.

d. Surface texture quality as to slipperiness under dry or wet conditions. Polishing of aggregate, improper seat coating, inadequate micro-macrotexture, and contaminant buildup are some examples of conditions that may cause the loss of surface friction.

e. Terrain limitations such as dropoffs at the ends of the runway safety areas.

f. Adequacy of number and length of available runways.

g. Crosswind effects, particularly when low friction factors prevail at the airport.

h. The strength and condition of the runway pavements at the facility.

2-17. SUITABILITY OF EXISTING PAVEMENTS FOR GROOVING. Existing pavements may have surfaces that are not suitable for sawing grooves. A survey should be conducted to determine if an overlay or rehabilitation of the pavement surface is required before grooving.

a. Reconnaissance. A thorough survey should be made of the entire width and length of the runway. Bumps, depressed areas, bad or faulted joints, and badly cracked and/or spalled areas in the pavement should not be grooved until such areas are adequately repaired or replaced. To verify the structural condition

of the pavement, tests should be taken in support of the visual observations.

b. Tests. The strength and condition of the runway pavement should be evaluated and tested according to the procedures specified in ACs 150/5320-6 and 150/5370-10. Future aircraft loads and activity levels should be considered when making the evaluation. Core samples should be taken in HMA pavement to determine stability. The American Society for Testing and Materials (ASTM) Standard D 1559, *Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus*, provides methods for testing the resistance to plastic flow of HMA pavements. Engineering judgment should be exercised when employing these methods in determining the stability readings. These tests are recommended to be used for guidance only. Other factors should be considered in determining how long grooves will remain effective in HMA pavements, such as maximum operational pavement surface temperature, effective tire pressure, frequency of braking action in given areas, mix composition, and aggregate properties. If, in the judgment of the person evaluating the existing pavement, any of the above conditions are not met, the pavement should not be grooved.

2-18. OVERLAYS. If the evaluation shows that the existing pavement is not suitable either because of surface defects or from a strength standpoint, an overlay, flexible or rigid, will be required. The new overlay may then be grooved according to the instructions given in the following paragraphs:

2-19. HMA PAVEMENT GROOVING. Construction specifications for grooving are given in paragraph 2-21. Grooving should not commence until the HMA pavement has sufficiently cured to prevent displacement of the aggregate (usually 30 days). Figure 2-6 shows a saw-grooved HMA pavement surface.

2-20. PCC Pavement Grooving. There are two acceptable methods for grooving PCC pavements: plastic grooving and saw cut grooving.

a. Plastic Grooving.

(1) Vibrating Ribbed Plate. One method to form grooves in the concrete while in the plastic state uses a vibrating ribbed plate attached to the bridge that spans across the pavement slab. The plate is vibrated to help redistribute the aggregate in the concrete. This prevents tearing and shearing as the plate proceeds transversely across the pavement slab. The grooves formed in the pavement are approximately 1/4 inch x 1/4 inch (6 mm x 6 mm) width and depth, spaced 1-1/2 inch (40 mm) center to center. Figure 2-8 shows the grooving operations.

(2) Ribbed Roller. Another method uses a roller with protrusions or ribs which form the grooves in the plastic concrete. This method does not give the same finish as the method using the vibrating ribbed plate. The roller is not vibrated and, therefore, does not consistently penetrate to the required depth of 1/4 inch (6 mm). Figure 2-9 shows the results of this technique.

b. Saw Grooving. For existing or new PCC pavements that have hardened, transverse grooves can be saw cut in the pavement. The timing should be as directed by the engineer. Construction specifications for providing saw grooves in PCC pavements are given in paragraph 2-21. Figure 2-7 shows a saw-grooved PCC pavement surface.

2-21. FAA SPECIFICATIONS FOR RUNWAY GROOVING.

a. THE FAA STANDARD GROOVE CONFIGURATION IS 1/4 INCH (±1/16 INCH) IN DEPTH BY 1/4 INCH (+1/16 INCH, -0 INCH) IN WIDTH BY 1 1/2 INCH (- 1/8 INCH, + 0 INCH) CENTER TO CENTER SPACING).

THE FAA STANDARD GROOVE CONFIGURATION IN METRICS IS 6 MM (±1.6 MM) IN DEPTH BY 6 MM (+1.6 MM, -0 MM) IN WIDTH BY 38 MM (- 3 MM, + 0 MM) CENTER TO CENTER SPACING).

b. THE DEPTH OF 60 PERCENT OR MORE OF THE GROOVES SHALL NOT BE LESS THAN 1/4 INCH (6 MM).

c. THE GROOVES SHALL BE CONTINUOUS FOR THE ENTIRE RUNWAY LENGTH AND TRANSVERSE (PERPENDICULAR) TO THE DIRECTION OF AIRCRAFT LANDING AND TAKEOFF OPERATIONS.

d. THE GROOVES SHALL BE TERMINATED WITHIN 10 FEET (3 M) OF THE

RUNWAY PAVEMENT EDGE TO ALLOW ADEQUATE SPACE FOR OPERATION OF THE GROOVING EQUIPMENT.

e. THE GROOVES SHALL NOT VARY MORE THAN 3 INCHES (8 CM) IN ALIGNMENT FOR 75 FEET (23 M) ALONG THE RUNWAY LENGTH, ALLOWING FOR REALIGNMENT EVERY 500 FEET (150 M) ALONG THE RUNWAY LENGTH.

f. GROOVES SHALL NOT BE CLOSER THAN 3 INCHES (8 CM) OR MORE THAN 9 INCHES (23 CM) FROM TRANSVERSE JOINTS IN CONCRETE PAVEMENTS.

g. WHERE LIGHTING CABLES ARE INSTALLED, GROOVING THROUGH LONGITUDINAL OR DIAGONAL SAW KERFS SHALL BE AVOIDED. Grooves may be continued through longitudinal construction joints.

h. Extreme care must be exercised when grooving near in-pavement light fixtures and subsurface wiring. **GROOVES SHALL BE SAWED NO LESS THAN 6 INCHES (15 CM) AND NO MORE THAN 18 INCHES (46 CM) FROM IN-PAVEMENT LIGHT FIXTURES.**

i. Bidding should be based on the square yard of the grooved area, using the two-dimensional method of measure with no deduction for areas skipped next to joints and fixtures as specified.

j. Clean-up is extremely important and should be continuous throughout the grooving operations. The waste material collected during the grooving operation must be disposed of by flushing with water, by sweeping, or by vacuuming. If waste material is flushed, the specifications should stipulate the following:

(1) Whether or not the airport owner or contractor is responsible for furnishing water for clean-up operations.

(2) That the waste material should not be flushed into the storm or sanitary sewer system.

(3) That the waste material should not be allowed to drain onto the grass shoulders adjacent to the runway or left on the runway surface. Failure to remove the material from all paved and shoulder areas can create conditions hazardous to aircraft operations.

2-22. GROOVING RUNWAY INTER-SECTIONS AND ANGLED EXIT TAXIWAYS.

a. IN ALL CASES, THE ENTIRE LENGTH OF THE PRIMARY RUNWAY WILL BE GROOVED. THE SECONDARY RUNWAY INTERSECTING THE PRIMARY RUNWAY SHALL BE SAW CUT IN A STEP PATTERN AS SHOWN IN FIGURE 2-10.

b. HIGH SPEED OR ANGLED EXIT TAXIWAYS SHALL BE SAW CUT IN A STEP PATTERN AS SHOWN IN FIGURE 2-11. Since grooving machines vary in cutting width, it is suggested that the step pattern width start at the projecting pavement edge, not exceeding 40 inches (102 cm) in width.

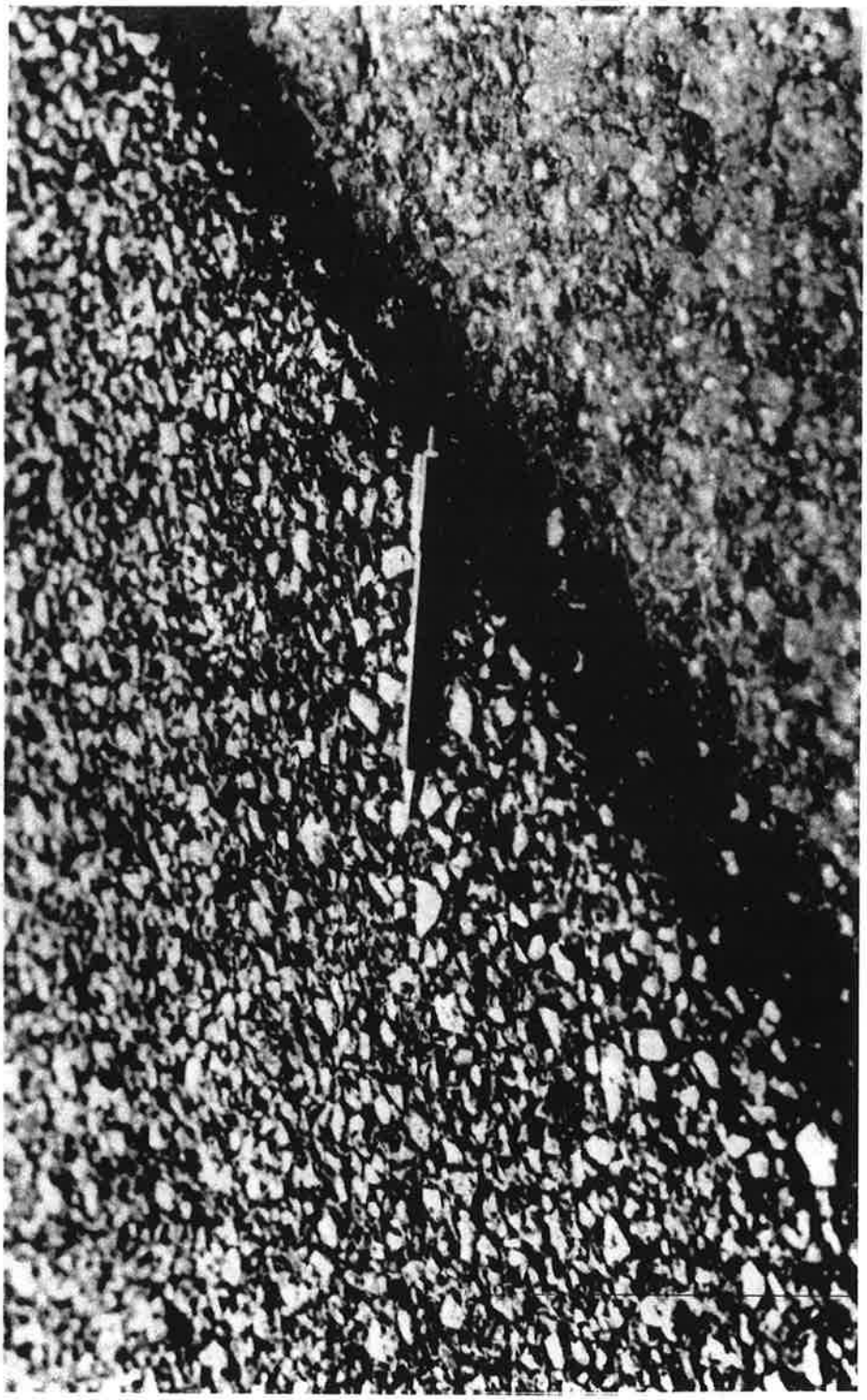

FIGURE 2-1. EDGE VIEW OF PFC OVERLAY

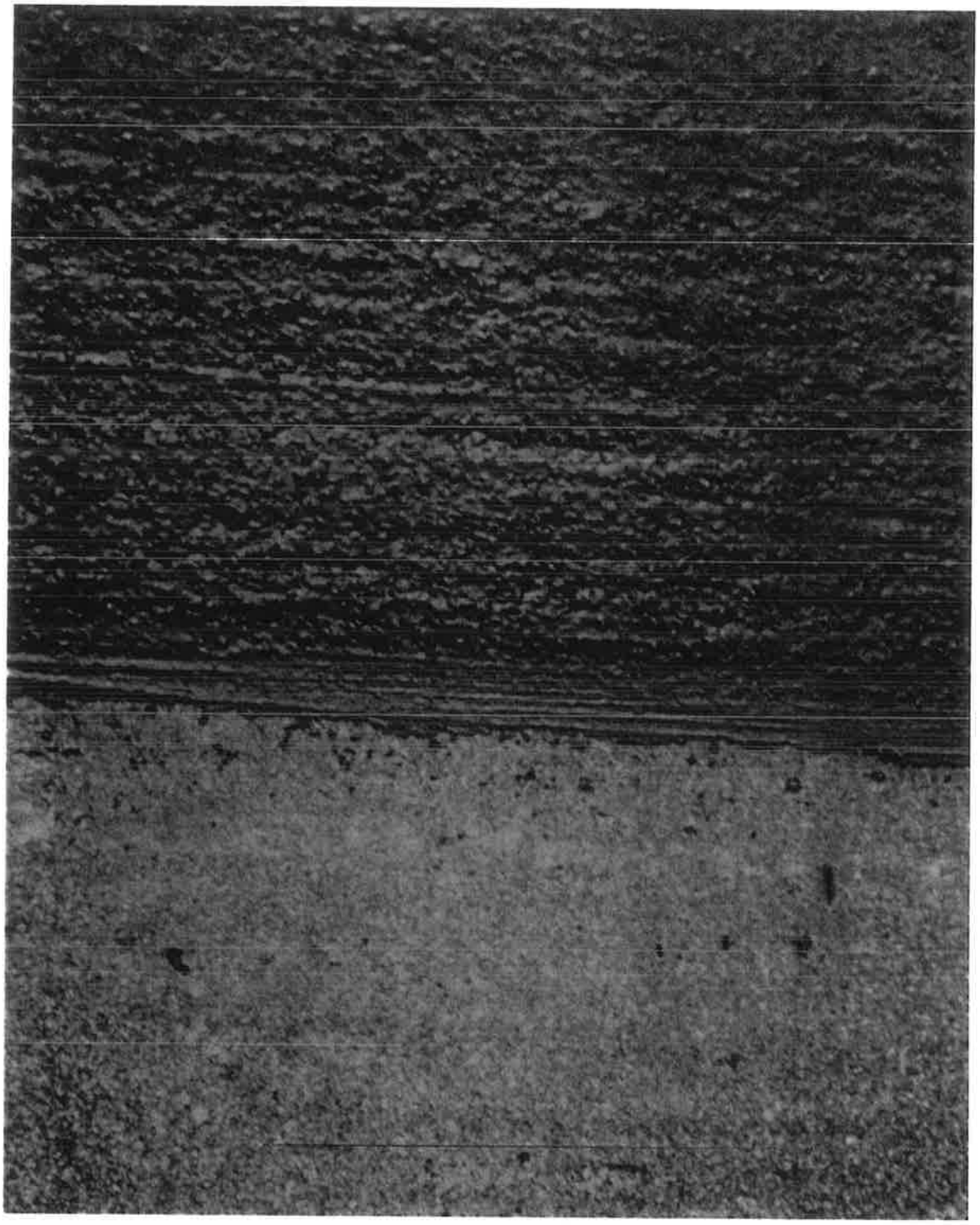

FIGURE 2-2. AGGREGATE SLURRY SEAL

FIGURE 2-3. HEAVY PAVING BROOM FINISH

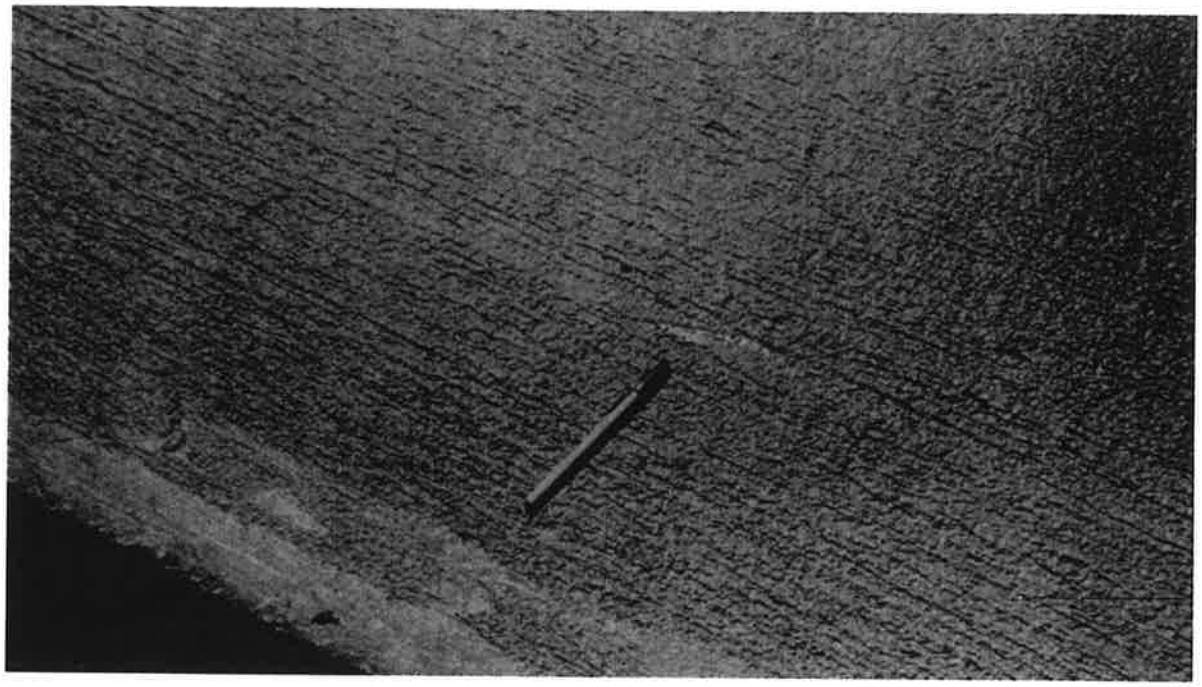

FIGURE 2-4. HEAVY BURLAP DRAG FINISH

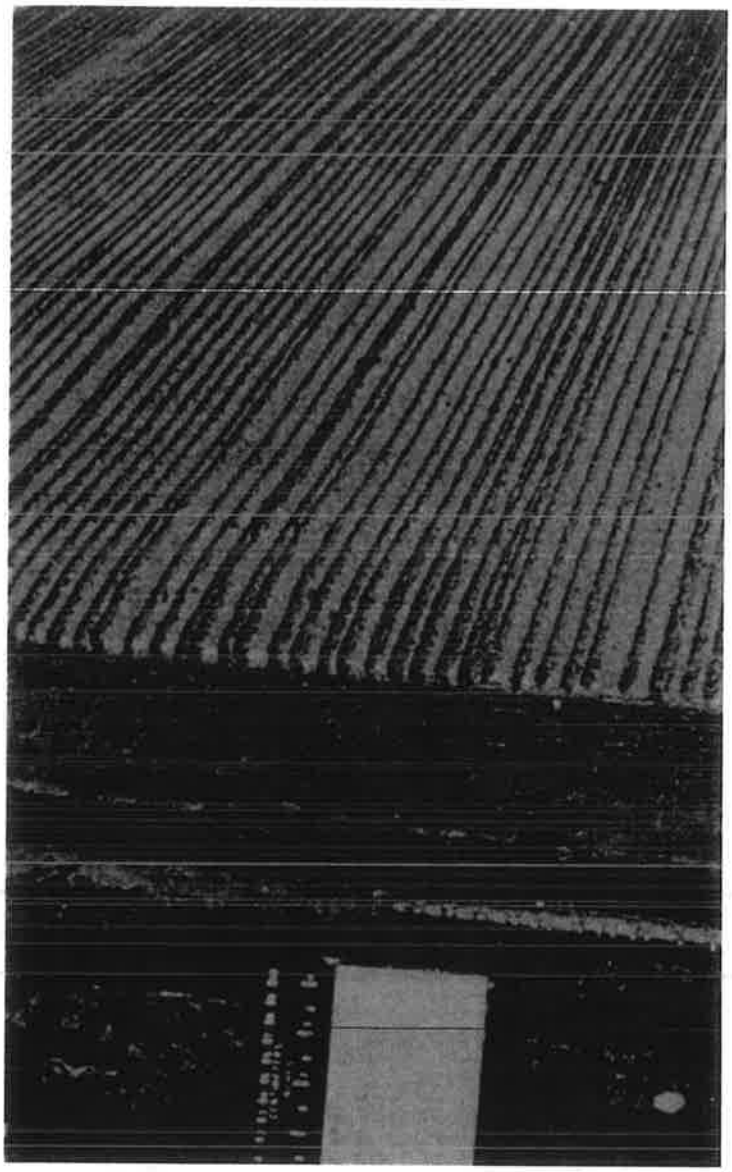

FIGURE 2-5. WIRE COMB TECHNIQUE CONSTRUCTED AT PATRICK HENRY AIRPORT, VIRGINIA, USING A 1/8 INCH X 1/8 INCH X 1/2 INCH CONFIGURATION

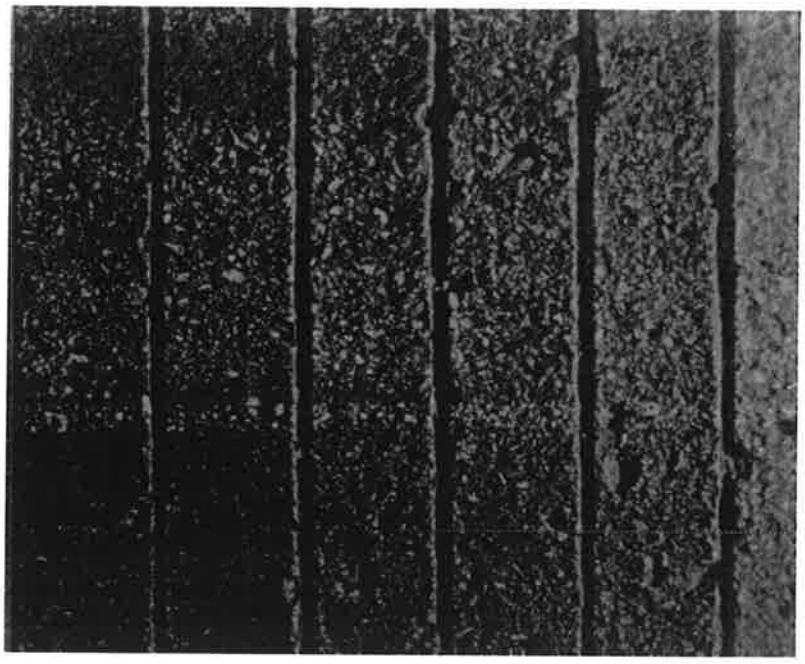

FIGURE 2-6. SAWED GROOVES IN HMA PAVEMENT

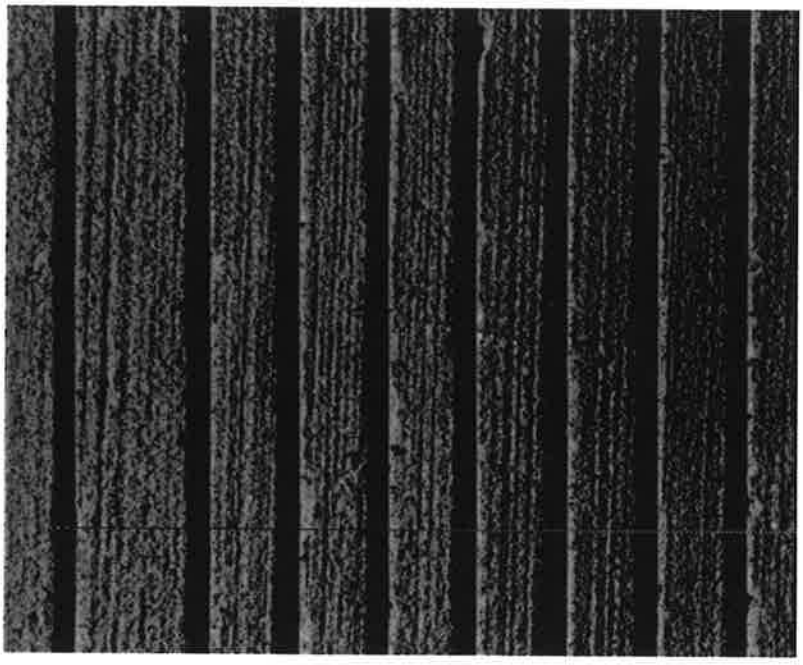

FIGURE 2-7. SAWED GROOVES IN PCC PAVEMENT

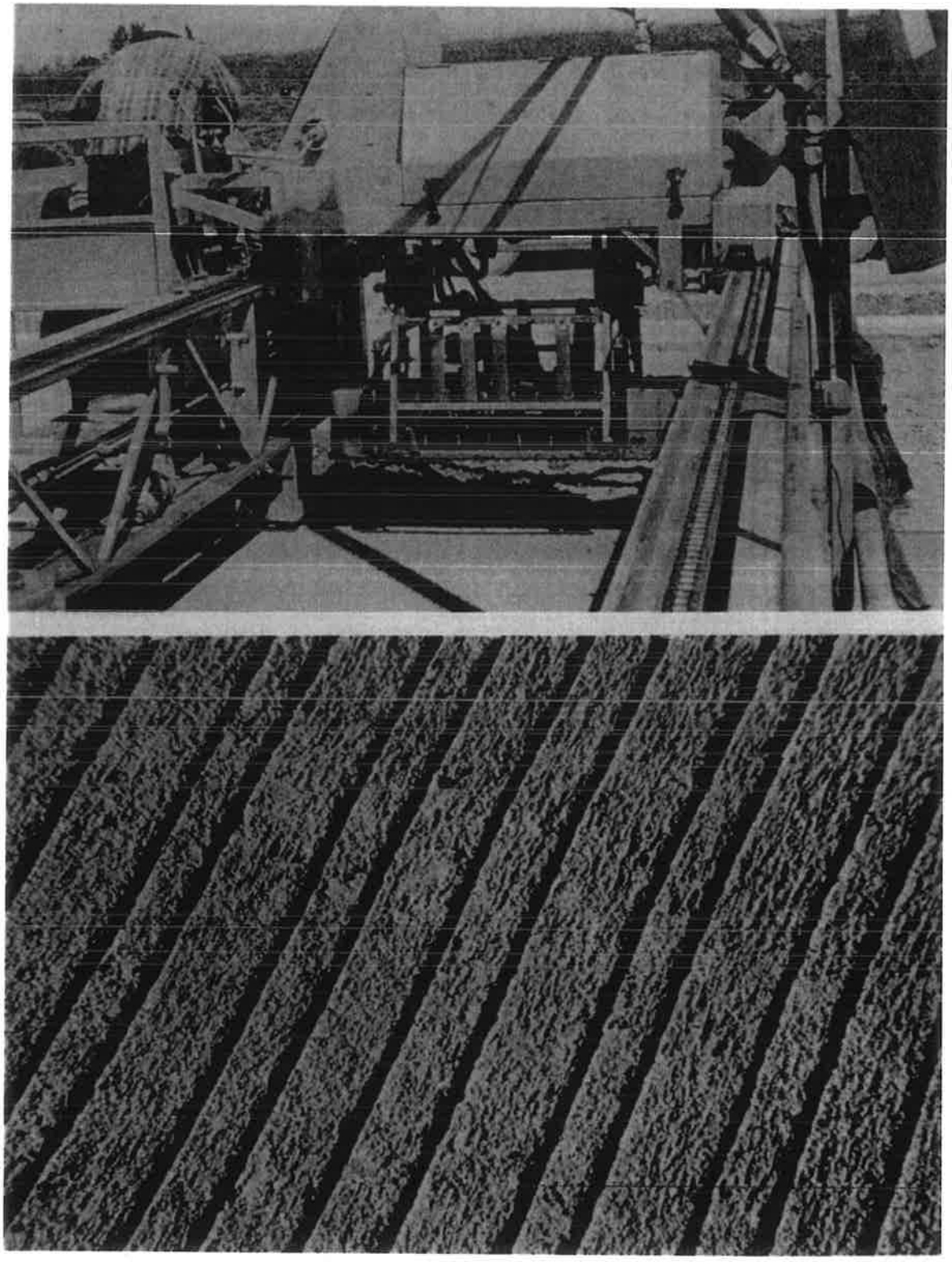

FIGURE 2-8. PLASTIC GROOVING TECHNIQUE USING A VIBRATING RIBBED PLATE

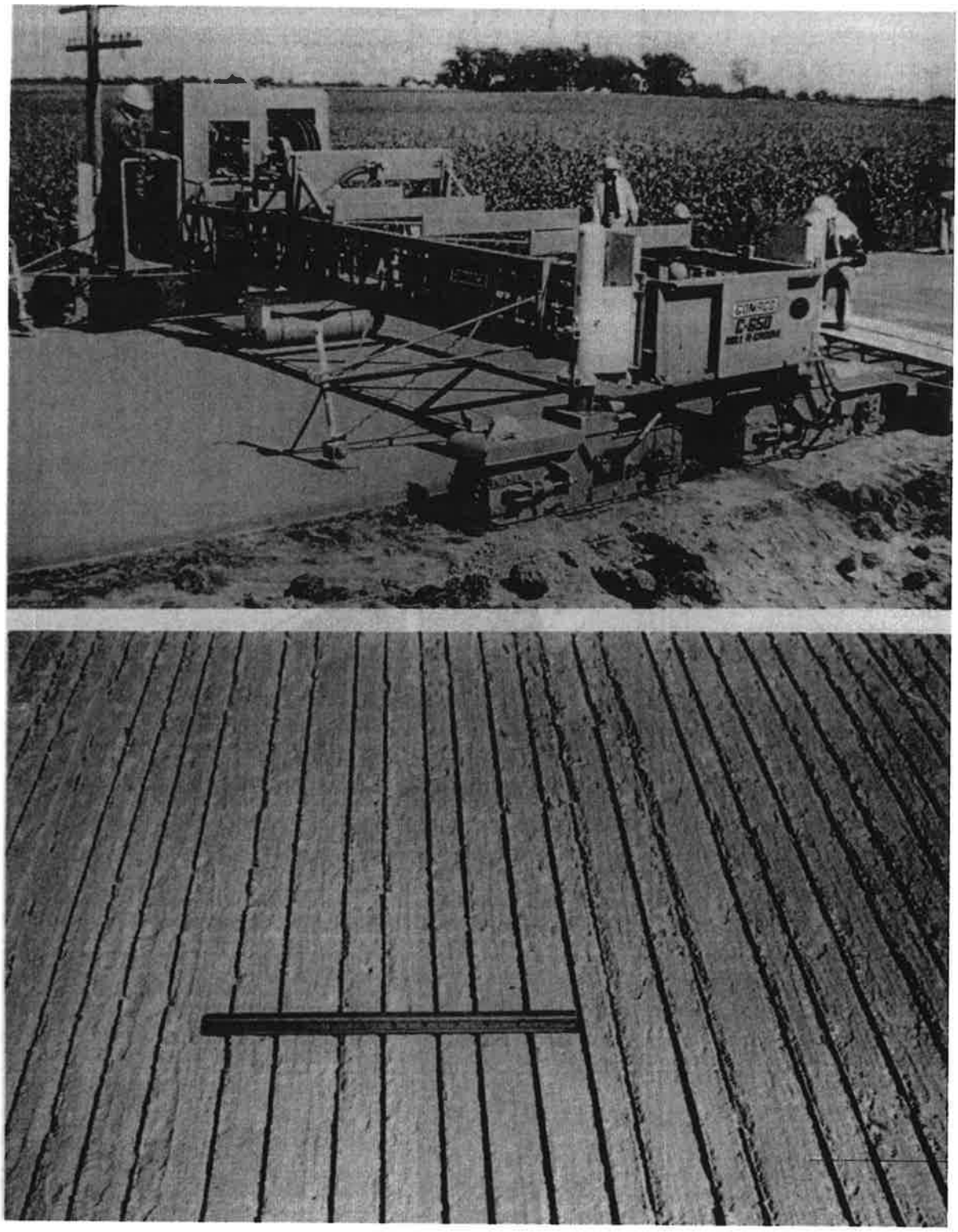

FIGURE 2-9. PLASTIC GROOVING TECHNIQUE USING A RIBBED ROLLER TUBE

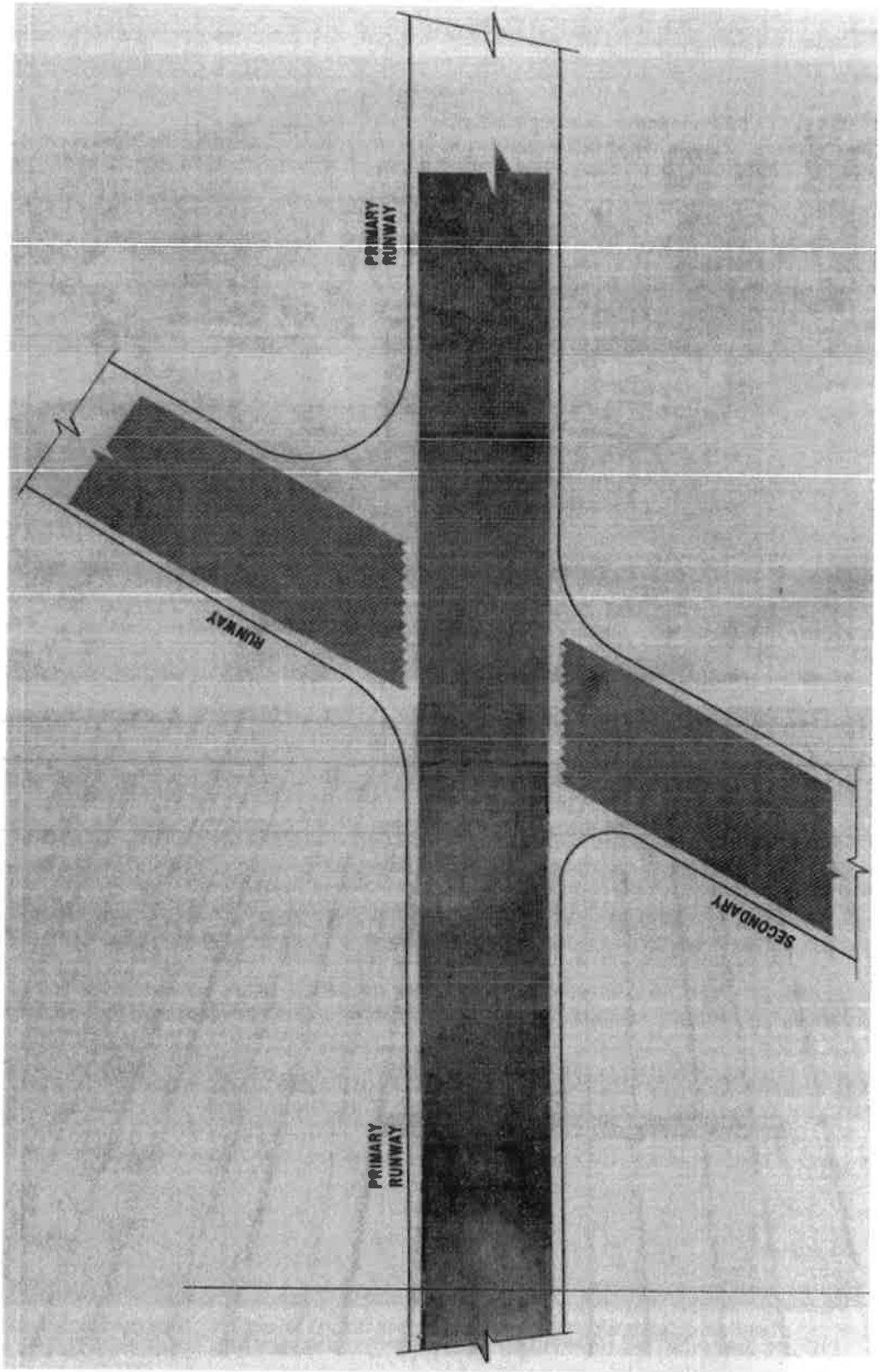

FIGURE 2-10. GROOVING INTERSECTIONS OF PRIMARY AND SECONDARY RUNWAYS

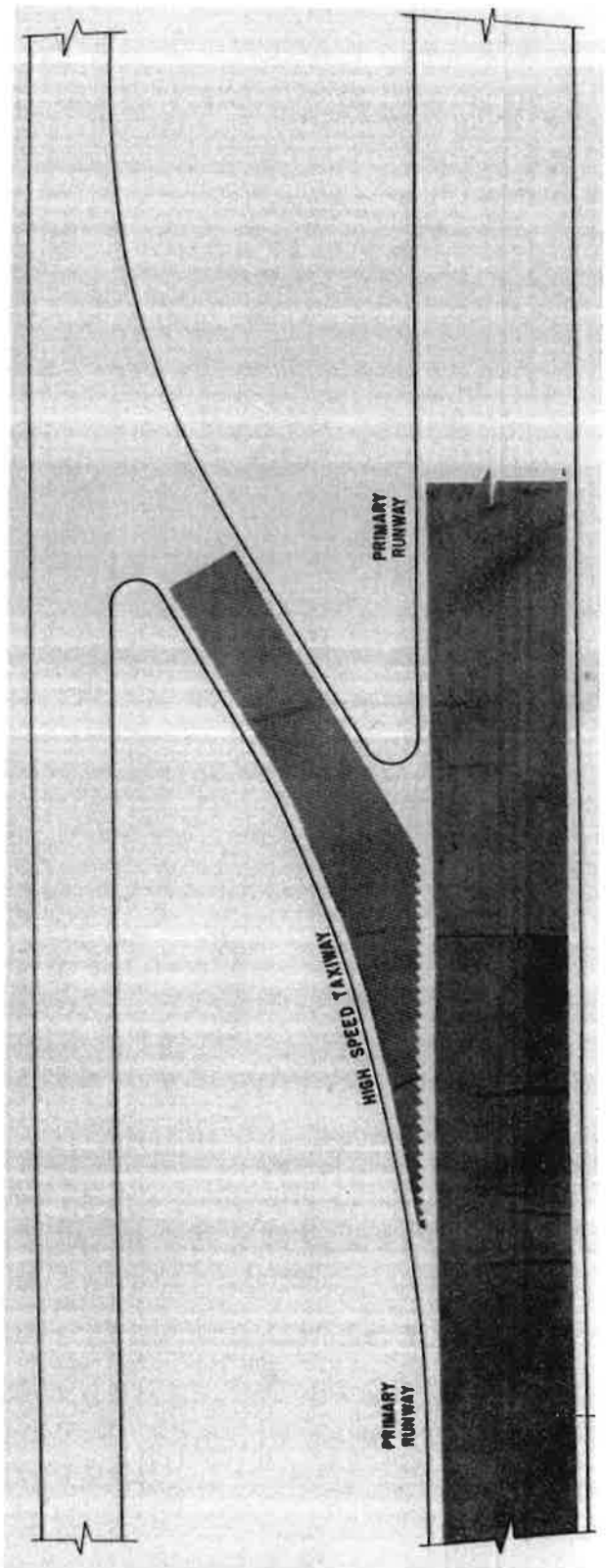

FIGURE 2-11. GROOVING OF HIGH SPEED OR ANGLED EXIT TAXIWAYS

CHAPTER 3. PAVEMENT EVALUATION

Section 1. Need for and Frequency of Evaluation

3-1. FRICTION DETERIORATION. Over time, the skid-resistance of runway pavement deteriorates due to a number of factors, the primary ones being mechanical wear and polishing action from aircraft tires rolling or braking on the pavement and the accumulation of contaminants, chiefly rubber, on the pavement surface. The effect of these two factors is directly dependent upon the volume and type of aircraft traffic. Other influences on the rate of deterioration are local weather conditions, the type of pavement (HMA or PCC), the materials used in original construction, any subsequent surface treatment, and airport maintenance practices.

Structural pavement failure such as rutting, raveling, cracking, joint failure, settling, or other indicators of distressed pavement can also contribute to runway friction losses. Prompt repair of these problems should be undertaken as appropriate. Guidance on corrective action may be found in chapter 2 and AC 150/5380-6.

Contaminants, such as rubber deposits, dust particles, jet fuel, oil spillage, water, snow, ice, and slush, all cause friction loss on runway pavement surfaces. Removal and runway treatment for snow, ice, and slush are covered in AC 150/5200-30. The most persistent contaminant problem is deposit of rubber from tires of landing jet aircraft. Rubber deposits occur at the touchdown areas on runways and can be quite extensive. Heavy rubber deposits can completely cover the pavement surface texture causing loss of aircraft braking capability and directional control, particularly when runways are wet.

3-2. SCHEDULING PAVEMENT EVALUATIONS. The operator of any airport with significant jet aircraft traffic should schedule periodic friction evaluations of each runway that accommodates jet aircraft. These evaluations should be carried out in accordance with the procedures outlined in either Section 2 or 3 of this chapter, depending upon the availability to the airport operator of continuous friction measuring equipment (CFME). Every runway for jet aircraft should be evaluated at least once each year. Depending on the volume and type (weight) of traffic on the runways, evaluations will be needed more frequently, with the most heavily used runways needing evaluation as often as weekly, as rubber deposits build up. Runway friction measurements take time, and while tests are being conducted, the runway will be unusable by aircraft. Since this testing is not time critical, a period should be selected which minimizes disruption of air traffic. Airport operations management should work closely with air traffic control, fixed base operations, and/or airlines.

3-3. MINIMUM FRICTION SURVEY FREQUENCY. Table 3-1 should be used as guidance for scheduling runway friction surveys. This table is based on an average mix of turbojet aircraft operating on any particular runway. Most aircraft landing on the runway are narrow body, such as the DC-9, BAC-111, B-727, B-737, etc. A few wide body aircraft were included in the mix. When any runway end has 20 percent or more wide body aircraft (L-1011, B-747, DC- 10, MD-11, C-5, etc.) of the total aircraft mix, it is recommended that the airport operator should select the next higher level of aircraft operations in Table 3-1 to determine the minimum survey frequency. As airport operators accumulate data on the rate of change of runway friction under various traffic conditions, the scheduling of friction surveys may be adjusted to ensure that evaluators will detect and predict marginal friction conditions in time to take corrective actions.

TABLE 3-1. FRICTION SURVEY FREQUENCY

NUMBER OF DAILY MINIMUM TURBOJET AIRCRAFT LANDINGS PER RUNWAY END	MINIMUM FRICTION SURVEY FREQUENCY
LESS THAN 15	1 YEAR
16 TO 30	6 MONTHS
31 TO 90	3 MONTHS
91 TO 150	1 MONTH
151 TO 210	2 WEEKS
GREATER THAN 210	1 WEEK

NOTE: Each runway end should be evaluated separately, e.g., Runway 18 and Runway 36.

3-4. SURVEYS WITHOUT CFME. Research has shown that visual evaluations of pavement friction are not reliable. An operator of an airport that does not support turbojet operations who suspects that a runway may have inadequate friction characteristics should arrange for testing by CFME. Visual inspections are essential, however, to note other surface condition

inadequacies such as drainage problems, including ponding and groove deterioration, and structural deficiencies.

3-5. GROOVE DETERIORATION. Periodically, the airport operator should measure the depth and width of a runway's grooves to check for wear and damage. When 40 percent of the grooves in the runway are equal to or less than 1/8 inch (3 mm) in depth and/or width for a distance of 1,500 feet (457 m), the grooves' effectiveness for preventing hydroplaning has been considerably reduced. The airport operator should take immediate corrective action to reinstate the 1/4 inch (6 mm) groove depth and/or width.

3-6. MEASUREMENT OF PAVEMENT SURFACE TEXTURE. When a friction test identifies a pavement surface with inadequate friction characteristics, the cause, such as rubber accumulation, is often obvious. When the cause is not obvious, the following guidance may be helpful in determining if the deficiency is a result of a deterioration in surface texture depth. Such deterioration may be caused by weather influences, wear/polishing effects of aircraft traffic, and contaminants including but not limited to rubber deposits. Visual inspections cannot be relied upon to identify pavement surfaces with poor texture. Pavement texture depths can only be determined by direct measurements. Even direct measurements may be affected by the operator of the equipment, so they should be used as only part of an overall pavement friction evaluation.

Section 2. CFME - General

3-7. GENERAL REQUIREMENTS FOR CFME. All airports with turbojet traffic should own or have access to use of CFME. Not only is it an effective tool for scheduling runway maintenance, it can also be used in winter weather to enhance operational safety (see AC 150/5200-30). Airports that have few turbojet traffic operations may be able to borrow the CFME from nearby airports for maintenance use, share ownership with a pool of neighboring airports, or hire a qualified contractor.

3-8. FAA PERFORMANCE STANDARDS FOR CFME. Appendix 3 contains the performance specifications for CFME. These standards should be used by airport operators in procuring CFME and replacement tires for the equipment.

3-9. FAA QUALIFIED PRODUCT LIST. The equipment listed in Appendix 4 has been tested and meets the FAA standards for CFME for use in conducting maintenance friction tests.

3-10. USE OF DECELEROMETER. Since decelerometers are not capable of providing continuous friction measurements and do not give reliable results on wet pavement surfaces, they are not approved for conducting runway maintenance surveys as discussed in this AC. However, the devices are approved for conducting friction surveys on runways during winter operations (reference AC 150/5200-30).

3-11. FEDERAL FUNDING OF CFME. The Airport and Airway Improvement Act of 1982 (AAIA) includes friction measuring equipment as an eligible item for airport development. However, before programming or procuring this equipment, airport operators should contact their FAA Regional or Airports District Office for guidance.

3-12. TRAINING OF PERSONNEL. The success of friction measurement in delivering reliable friction data depends heavily on the personnel who are responsible for operating the equipment. Adequate professional training on the operation, maintenance, and procedures for conducting friction measurement should be provided either as part of the procurement package or as a separate contract with the manufacturer. Also, recurrent training is necessary for review and update to ensure that the operator maintains a high level of proficiency. Experience has shown that unless this is done, personnel lose touch with new developments on equipment calibration, maintenance, and operating techniques. A suggested training outline for the manufacturers is given in Appendix 5. Airport personnel should be trained not only in the operation and maintenance of the CFME but also on the procedures for conducting friction surveys. These procedures are provided in Section 4 below. At airports where friction tests are performed less frequently than quarterly, and CFME is not used for winter operations, consideration should be given to hiring a qualified contractor to perform tests.

3-13. CALIBRATION. All CFME should be checked for calibration within tolerances given by the manufacturer before conducting friction surveys.

CFME furnished with self-wetting systems should be calibrated periodically to assure that the water flow rate is correct and that the amount of water produced for the required water depth is consistent and applied evenly in front of the friction measuring wheel(s) for all test speeds.

Section 3. Conducting Friction Evaluations with CFME

3-14. PRELIMINARY STEPS. Friction measurement operations should be preceded by a thorough visual inspection of the pavement to identify deficiencies as outlined in paragraph 3-4. Careful and complete notes should be taken not only of the CFME data but of the visual inspection as well. The airport operator should assure that appropriate communications equipment and frequencies are provided on all vehicles used in conducting friction surveys and that all personnel are fully cognizant of airport safety procedures. Personnel operating the equipment should be fully trained and current in all procedures. The CFME should be checked for accurate calibration and the vehicle checked for adequate braking ability.

3-15. LOCATION OF FRICTION SURVEYS ON THE RUNWAY. The airport operator, when conducting friction surveys on runways at 40 mph (65 km/h), should begin recording the data 500 feet (152 m) from the threshold end to allow for adequate acceleration distance. The friction survey should be terminated approximately 500 feet (152 m) from the opposite end of the runway to allow for adequate distance to safely decelerate the vehicle. When conducting friction surveys at 60 mph (95 km/h), the airport operator should start recording the survey 1,000 feet (305 km) from the threshold end and terminate the survey approximately 1,000 feet from the opposite end of the runway. Where travel beyond the end of the runway could result in equipment damage or personal injury, additional runway length should be allowed for stopping. The lateral location on the runway for performing the test is based on the type of aircraft operating on the runway. Unless surface conditions are noticeably different on either side of the runway centerline, a test on one side of the centerline in the same direction the aircraft lands should be sufficient. However, when both runway ends are to be evaluated, vehicle runs can be made to record data on the return trip (both ways).

The lateral location on the runway for performing friction surveys is based on the type and/or mix of aircraft operating on the runway:

a. Runways Serving Only Narrow Body Aircraft. Friction surveys should be conducted 10 feet (3 m) to the right of the runway centerline

b. Runways Serving Narrow Body and Wide Body Aircraft. Friction surveys should be conducted 10 and 20 feet (3 and 6 m) to the right of the runway centerline to determine the worst case condition. If the worst case condition is found to be consistently limited to one track, future surveys may be limited to this track. Care should be exercised, however, to account for any future and/or seasonal changes in aircraft mix.

3-16. VEHICLE SPEED FOR CONDUCTING SURVEYS. All of the approved CFME in Appendix 4 can be used at either 40 mph (65 km/h) or 60 mph (95 km/h). The lower speed determines the overall macrotexture/contaminant/drainage condition of the pavement surface. The higher speed provides an indication of the condition of the surface's microtexture. A complete survey should include tests at both speeds.

3-17. USE OF CFME SELF-WETTING SYSTEM. Since wet pavement always yields the lowest friction measurements, CFME should routinely be used on wet pavement which gives the "worst case" condition. CFME is equipped with a self-wetting system to simulate rain wet pavement surface conditions and provide the operator with a continuous record of friction values along the length of the runway. The attached nozzle(s) are designed to provide a uniform water depth of 1 mm (0.04 inch) in front of the friction measuring tire(s). This wetted surface produces friction values that are most meaningful in determining whether or not corrective action is required.

3-18. FRICTION SURVEYS DURING RAINFALL. One limitation in using the self-wetting system on a friction measuring device is that it cannot by itself indicate the potential for hydroplaning. Some runways have depressed areas which pond during periods of moderate to heavy rainfall. These areas may exceed considerably the water depth used by the self-wetting system of the friction measuring device. Therefore, it

is recommended that the airport owner periodically conduct visual checks of the runway surface during rainfall, noting the location, average water depth, and approximate dimensions of the ponded areas. If the average water depth exceeds 1/8 inch (3 mm) over a longitudinal distance of 500 feet (152 m), the depressed area should be corrected to the standard transverse slope. If possible, the airport owner should conduct periodic friction surveys during rainfall through the ponded areas.

3-19. FRICTION LEVEL CLASSIFICATION. Mu numbers (friction values) measured by CFME can be used as guidelines for evaluating the surface friction deterioration of runway pavements and for identifying appropriate corrective actions required for safe aircraft operations. Table 3-2 depicts the friction values for three classification levels for FAA qualified CFME operated at 40 and 60 mph (65 and 95 km/h) test speeds. This table was developed from qualification and correlation tests conducted at NASA's Wallops Flight Facility in 1989.

TABLE 3-2. FRICTION LEVEL CLASSIFICATION FOR RUNWAY PAVEMENT SURFACES

	40 mph			60 mph		
	Minimum	Maintenance Planning	New Design/ Construction	Minimum	Maintenance Planning	New Design/ Construction
Mu Meter	.42	.52	.72	.26	.38	.66
Dynatest Consulting, Inc. Runway Friction Tester	.50	.60	.82	.41	.54	.72
Airport Equipment Co. Skiddometer	.50	.60	.82	.34	.47	.74
Airport Surface Friction Tester	.50	.60	.82	.34	.47	.74
Airport Technology USA Safegate Friction Tester	.50	.60	.82	.34	.47	.74
Findlay, Irvine, Ltd. Griptester Friction Meter	.43	.53	.74	.24	.36	.64
Tatra Friction Tester	.48	.57	.76	.42	.52	.67
Norsemeter RUNAR (operated at fixed 16% slip)	.45	.52	.69	.32	.42	.63

3-20. EVALUATION AND MAINTENANCE GUIDELINES. The following evaluation and maintenance guidelines are recommended based on the friction levels classified in Table 3-2. These guidelines take into account that poor friction conditions for short distances on the runway do not pose a safety problem to aircraft, but long stretches of slippery pavement are of serious concern and require prompt remedial action.

a. Friction Deterioration Below the Maintenance Planning Friction Level (500 ft). When the average Mu value on the wet runway pavement surface is less than the Maintenance Planning Friction Level but above the Minimum Friction Level in Table 3-2 for a distance of 500 feet (152 m), and the adjacent 500 foot (152 m) segments are at or above the Maintenance Planning Friction Level, no corrective action is required. These readings indicate that the pavement friction is deteriorating but the situation is still within an acceptable overall condition. The airport operator should monitor the situation closely by conducting periodic friction surveys to establish the rate and extent of the friction deterioration.

b. Friction Deterioration Below the Maintenance Planning Friction Level (1000 ft). When the averaged Mu value on the wet runway pavement surface is less than the Maintenance Planning Friction Level in Table 3-2 for a distance of 1000 feet (305 m) or more, the airport operator should conduct extensive evaluation into the cause(s) and extent of the friction deterioration and take appropriate corrective action.

c. Friction Deterioration Below the Minimum Friction Level. When the averaged Mu value on the wet pavement surface is below the Minimum Friction Level in Table 3-2 for a distance of 500 feet (152 m), and the adjacent 500 foot (152 m) segments are below the Maintenance Planning Friction Level, corrective action should be taken immediately after determining the cause(s) of the friction deterioration. Before undertaking corrective measures, the airport operator should investigate the overall condition of the entire runway pavement surface to determine if other deficiencies exist that may require additional corrective action.

d. New Design/Construction Friction Level for Runways. For newly constructed runway pavement surfaces (that are either saw cut grooved or have a PFC overlay) serving turbojet aircraft operations, the averaged Mu value on the wet runway pavement surface for each 500 foot (152 m) segment should be no less than the New Design/Construction Friction Level in Table 3-2.

3-21. COMPUTER EVALUATION OF FRICTION TEST DATA. A manual evaluation of friction test data as required by the criteria above can be tedious and prone to human error. An IBM PC-compatible computer program which performs this evaluation is available free of charge. The computer program may be downloaded from the FAA Airports Internet web site at http://www.faa.gov/arp/software.htm.

Section 4. Conducting Texture Depth Measurements

3-22. RECOMMENDED TESTING. When friction values meet the criteria in paragraphs 3-20.(a), 3-20.(b), and 3-20.(c), no texture depth measurements are necessary. When friction values do not meet the criteria in paragraphs 3-20.(a), 3-20.(b), or 3-20.(c), and the cause is not obvious (e.g. rubber deposits), the airport operator should perform texture depth measurements.

3-23 RECOMMENDED TEXTURE DEPTHS.

a. Newly Constructed Pavements. The recommended average texture depth to provide good skid-resistance for newly constructed concrete and asphalt pavements is 0.045 inch (1.14 mm). A lower value indicates a deficiency in macrotexture that will require correction as the surface deteriorates.

b. Existing Pavements.

(1) When the average texture depth measurement in a runway zone (i.e., touchdown, midpoint, and rollout) falls below 0.045 inch (1.14 mm), the airport operator should conduct texture depth measurements each time a runway friction survey is conducted.

(2) When the average texture depth measurement in a runway zone is below 0.030 inch (0.76 mm) but above 0.016 inch (0.40 mm), the airport operator should initiate plans to correct the pavement texture deficiency within a year.

(3) When the average texture depth measurement in a runway zone (i.e., touchdown, midpoint, and rollout) falls below 0.010 inch (0.25 mm), the airport operator should correct the pavement texture deficiency within 2 months.

c. Retexturing. Retexturing of the pavement surface should improve the average texture depth to a minimum of 0.030 inch (0.76 mm).

3-24. LOCATION OF MEASUREMENTS. Groove depths are never included in texture depth measurements. For grooved runway pavements, texture depth measurements should always be located in nongrooved areas, such as near transverse joints or light fixtures, but as close as possible to heavily trafficked areas.

3-25. TEST METHODS. A minimum of three texture depth measurements should be taken in any area noted as deficient. More measurements should be taken when obvious textural changes in the pavement surface

are observed. An average texture depth should be computed for each area. Descriptions of the equipment and methods used and the computations involved in determining texture depths are as follows:

a. Equipment. The NASA Grease Smear Method is used to determine the macrotexture of the pavement surface by measuring the average distance between the peaks and valleys in the pavement texture. This method cannot be used to evaluate the pavement microtexture. On the left in Figure 3-1 is shown the tube which is used to measure the 1 cubic inch (15 cc) volume of grease. On the right is shown the tight-fitting plunger which is used to expel the grease from the tube, and in the center is shown the rubber squeegee which is used to work the grease into the voids in the runway surface.

The sheet rubber on the squeegee is cemented to a piece of aluminum for ease in use. Any general purpose grease can be used. As a convenience in the selection of the length of the measuring tube, Figure 3-2 gives the relation between the tube inside diameter and tube length for an internal tube volume of one cubic inch (15 cu cm). The plunger can be made of cork or other resilient material to achieve a tight fit in the measuring tube.

b. Measurement. The tube for measuring the known volume of grease is packed full with a simple tool, such as a putty knife, with care to avoid entrapped air, and the ends are squared off as shown in Figure 3-3. A general view of the texture measurement procedure is shown in Figure 3-4. The lines of masking tape are placed on the pavement surface about 4 inches (10 cm) apart. The grease is then expelled from the measuring tube with the plunger and deposited between the previously placed lines of masking tape. It is then worked into the voids of the runway pavement surface with the rubber squeegee, with care that no grease is left on the masking tape or the squeegee. The distance along the lines of masking tape is then measured and the area that is covered by the grease is computed.

3-26. COMPUTATION. After the area is completed, the following equations are used to calculate the average texture depth of the pavement surface:

$$\text{Texture depth (inches)} = \frac{\text{Volume of Grease (cu. in.)}}{\text{Area Covered by Grease (sq. in.)}}$$

$$\text{Average Texture Depth} = \frac{\text{Sum of individual Tests}}{\text{Total Number of Tests}}$$

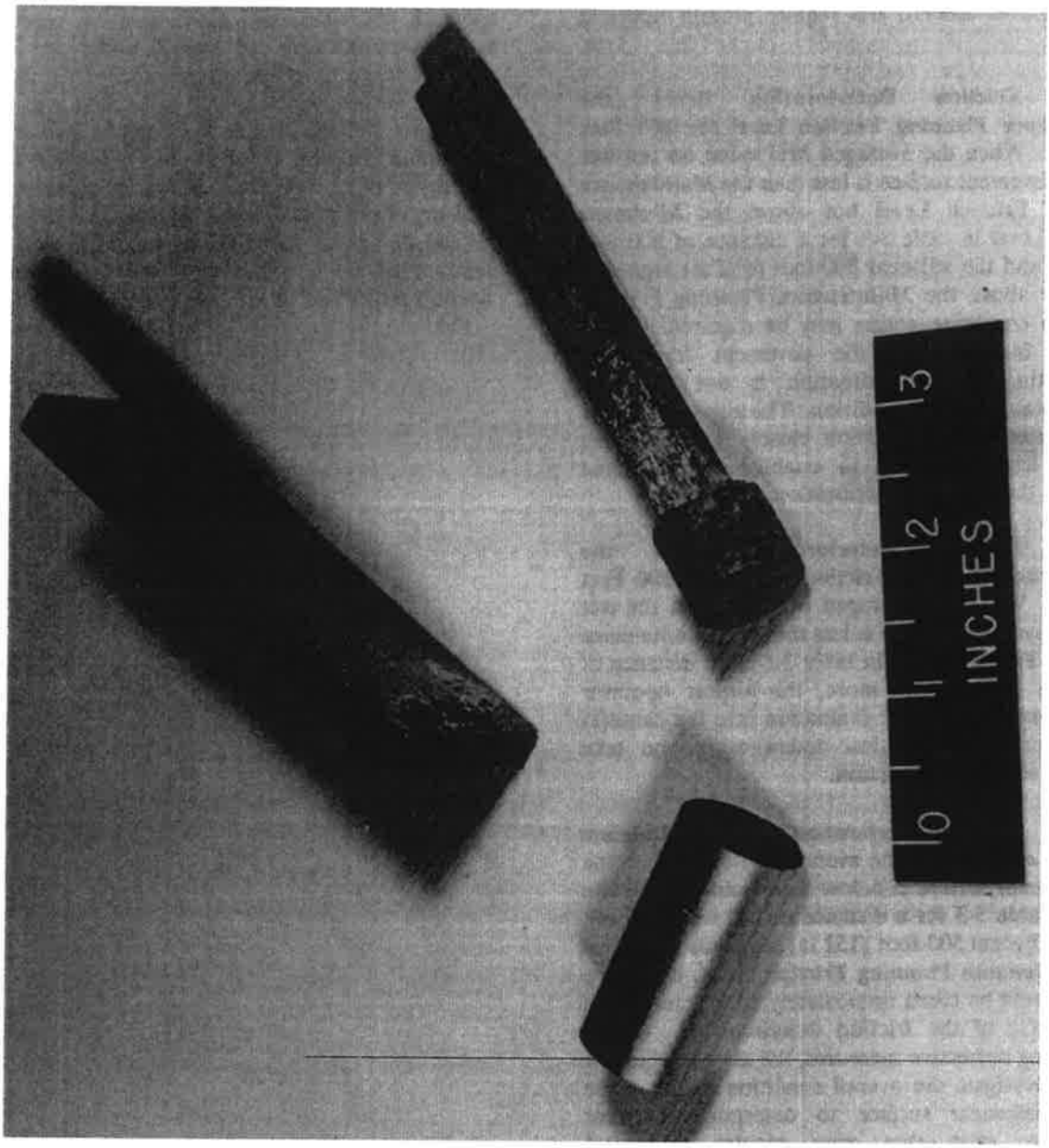

FIGURE 3-1. GREASE-VOLUME MEASURING TUBE, PLUNGER, AND RUBBER SQUEEGEE

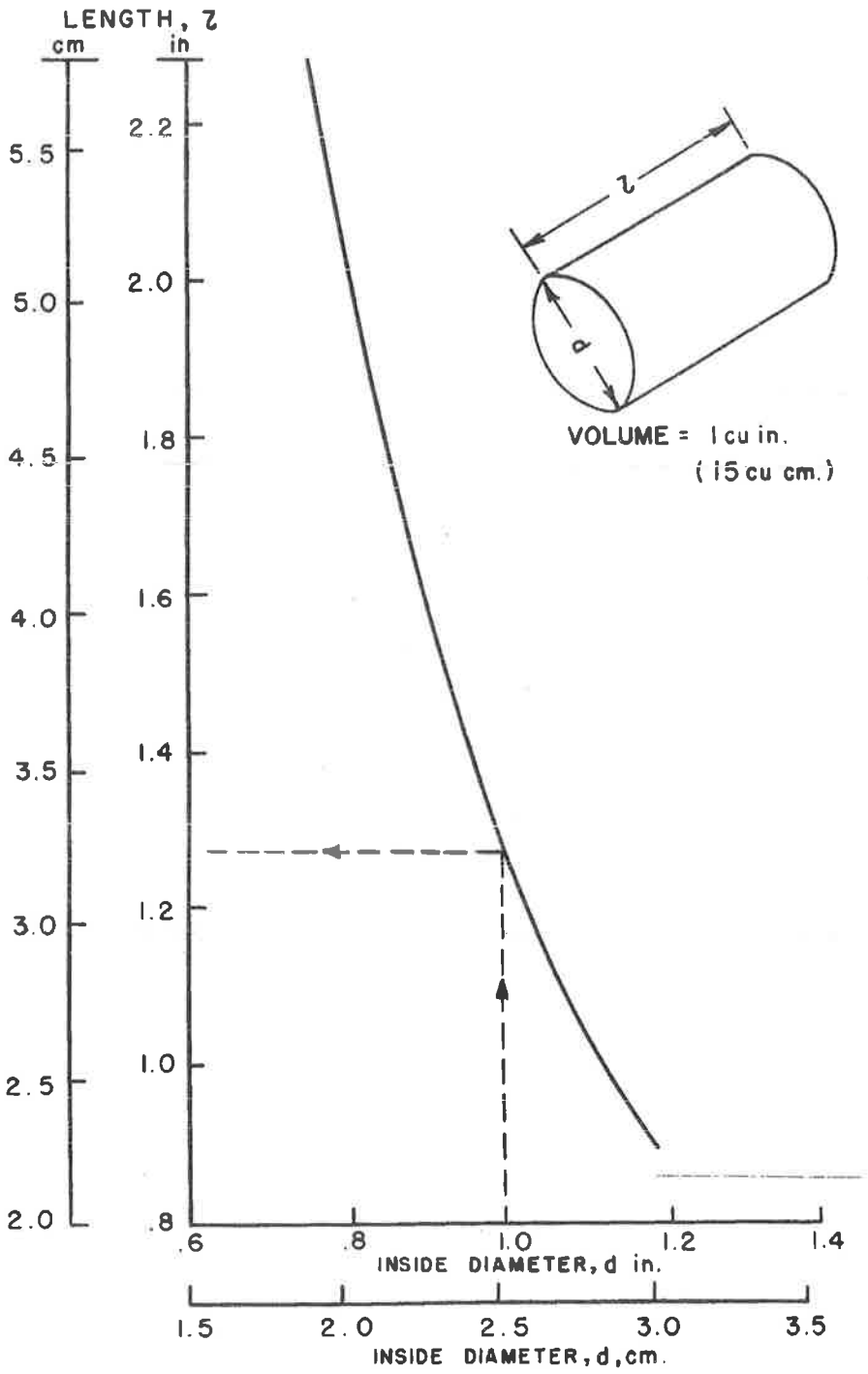

FIGURE 3-2. MEASURING TUBE DIMENSIONS TO MEASURE

ONE CUBIC INCH OR FIFTEEN CUBIC CENTIMETERS

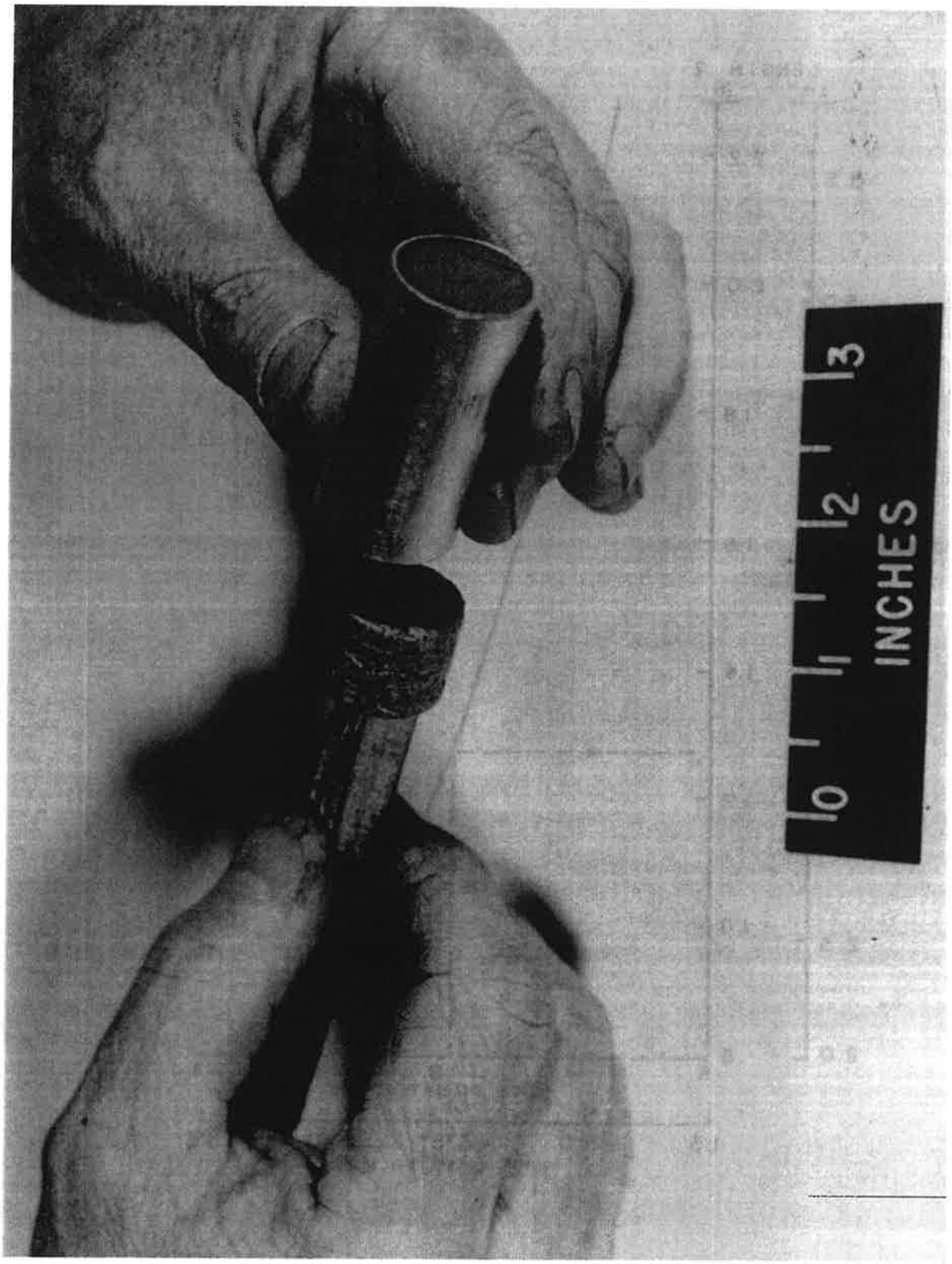

FIGURE 3-3. MEASURING TUBE FILLED WITH GREASE

FIGURE 3-4. ILLUSTRATION OF APPARATUS USED IN GREASE APPLICATION TECHNIQUE FOR MEASURING PAVEMENT SURFACE TEXTURE DEPTH

CHAPTER 4. MAINTAINING HIGH SKID-RESISTANCE

Section 1. Maintenance Considerations

4-1. NEED FOR MAINTENANCE. As traffic mechanically wears down microtexture and macrotexture and as contaminants build up on runway pavements, friction will decrease to a point where safety may be diminished. At joint use airports, where high numbers of military aircraft operations occur, the venting of excess fuel can lead to serious loss of friction by either causing contaminant buildup or an oil film on the pavement surface. Also, fog seal treatment of HMA surfaces can substantially reduce the pavement's coefficient of friction during the first year after application. Surfaces which already have marginally acceptable friction can become unacceptable when given this type of surface treatment.

When the measured coefficient of friction values approach or drop below the Maintenance Planning Level as shown in Table 3-2 in chapter 3. Table 4-1 may be used as a tool for budgeting for and scheduling appropriate and timely maintenance for removal of contaminants and restoration of good friction characteristics. As stated in chapter 3, the average aircraft mix was based on mostly narrow body aircraft with a few wide body aircraft operations included. Rubber accumulation is dependent on the type and frequency of aircraft landing operations; e.g., weight of aircraft, the number of wheels that touchdown on the surface, climate, runway length, and runway composition. When more than 20 percent of the total aircraft mix landing on any one runway end are wide body aircraft, it is recommended that the airport operator select the next higher level of aircraft operations in Table 4-1 to determine the rubber removal frequency. Experience and the use of CFME will allow the airport operator to develop a schedule specific to each runway.

TABLE 4-1. RUBBER DEPOSIT REMOVAL FREQUENCY

NUMBER OR DAILY TURBOJET AIRCRAFT LANDING PER RUNWAY END	SUGGESTED RUBBER DEPOSIT REMOVAL FREQUENCY
LESS THAN 15	2 YEARS
16 TO 30	1 YEAR
31 TO 90	6 MONTHS
91 TO 150	4 MONTHS
151 TO 210	3 MONTHS
GREATER THAN 210	2 MONTHS

Note: Each runway end should be evaluated separately, e.g. Runway 18 and Runway 36.

Section 2. Methods for Removing Contaminants

4-2. RECOMMENDED CONTAMINANT REMOVAL TECHNIQUES. Several methods are available for cleaning rubber deposits, other contaminants, and paint markings from runway surfaces. They include high pressure water, chemical, high velocity impact, and mechanical grinding. After the contaminants have been removed from the runway surface by any of these methods, the airport operator should conduct friction measurements to assure that the Mu values have been restored to within 10 percent of those on the uncontaminated center portion of the runway and that both measurements are well within the acceptable friction levels for safe aircraft operations. The effectiveness of rubber deposit removal procedures cannot be evaluated by visual inspection. It is highly recommended that rubber deposit removal contracts base payments on final tests by CFME. A brief description follows for each of the contaminant removal techniques. None of the techniques should be used unless the runway is free of standing water, snow, slush, and/or ice. Also, chemical or water impact removal methods should not be used if there is a danger of the fluids freezing.

The ultimate success of any method will depend on the expertise of the equipment operator. Results can vary from completely ineffective to a situation where all rubber deposits are removed, but the underlying pavement is significantly damaged. It is recommended that airport operators require that a test section be cleaned by the contractor to demonstrate that rubber deposits will be removed without damage to the underlying pavement.

a. Removal by High Pressure Water. A series of high pressure water jets is aimed at the

pavement to blast the contaminants from the surface, allowing the water to transport the rubber particles to the edge of the runway. The technique is economical, environmentally clean, and effectively removes deposits from the pavement surface with minimal downtime to the airport operator. High-pressure water blasting also may be used to improve the surface texture of smooth pavements. Water pressures used vary significantly. There are so many other parameters that vary from one contractor's equipment to another, however, that the pressure of the water used is not a good indication of the potential for either effectiveness or pavement damage. The airport operator should rely on the contractor's experience, demonstrated expertise, and references.

b. Removal by Chemicals. Chemical solvents have been used successfully for removal of contaminants on both PCC and HMA runways. Any chemicals used on runways must meet Federal, state, and local environmental requirements. For removal of rubber deposits on PCC runways, chemicals are used which have a base of cresylic acid and a blend of benzene, with a synthetic detergent for a wetting agent. For removal of rubber deposits on HMA runways, alkaline chemicals are generally used. Because of the volatile and toxic nature of such chemicals, extreme care must be exercised during and after application. If the chemicals remain on the pavement too long, the painted areas on the runway and possibly the surface itself could be damaged. It is also very important to dilute the chemical solvent that is washed off the pavement surface so that the effluent will not harm surrounding vegetation or drainage systems or pollute nearby streams and wildlife habitats. Detergents made of metasilicate and resin soap can be used effectively to remove oil and grease from PCC runway surfaces. For HMA pavements, an absorbent or blotting material such as sawdust or sand combined with a rubber alkaline degreaser may be used.

c. High Velocity Impact Removal. This method employs the principle of throwing abrasive particles at a very high velocity at the runway pavement surface, thus blasting the contaminants from the surface. Additionally, the machine that performs this operation can be adjusted to produce the desired surface texture, if so required. The abrasive is propelled mechanically from the peripheral tips of radial blades in a high speed, fan like wheel. The entire operation is environmentally clean in that it is self-contained; it collects the abrasive particles, loose contaminants, and dust from the runway surface; it separates and removes the contaminants and dust from the abrasive; and it recycles the abrasive particles for repetitive use. The machine is very mobile and can be removed rapidly from the runway if required by aircraft operations.

d. Mechanical Removal. Mechanical grinding that employs the corrugating technique has been successfully used to remove heavy rubber deposits from both PCC and HMA runways. It has also been used to remove high areas such as bumps on pavement surfaces or at joints where slabs have shifted or faulted. This method greatly improves the pavement surface friction characteristics. Pavement surfaces that are either contaminated (rubber buildup or bleeding) or worn can have their surface friction coefficient greatly increased by a thin milling operation. This technique removes a surface layer between 1/8 and 3/16 inch (3.2 and 4.8 mm) in depth.

APPENDIX 1. QUALIFICATION PROCESS FOR CFME

1. FRICTION EQUIPMENT CORRELATION PROGRAM. From 1982 through 1985, the FAA conducted a series of tests to determine the correlation of the Mu Meter with the Saab Friction Tester, Skiddometer, and the Runway Friction Tester, using the equipments' self-wetting systems on dry pavement surfaces at NASA's Wallops Right Facility. Correlation values were established for the Saab Friction Tester, the Runway Friction Tester, the Skiddometer, and the Mu Meter. Reference Appendix 2, Report No. DOT/FAA/AS-90-1, which shows the results of the correlation trials conducted at NASA's Wallops Flight Facility in August 1989. Additional devices have since been found to meet FAA specifications. All devices found to meet FAA specifications are listed in appendix 4.

2. FRICTION/SPEED RELATIONSHIPS FOR PAVEMENT SURFACES. The relationship of speed to friction has a profound influence on aircraft braking performance when pavements have little or no microtextural properties. According to the Unified Mechanism of Rubber/Pavement Friction, the adhesion component of friction, which is governed mainly by the shear force between the tire and the pavement surface, is high at lower speeds of up to about 100 mph. The rubber couples well with a good microtextured surface to provide high friction at the lower speeds. At speeds over 100 mph, the hysteresis component of friction governs. This component is the effect of damping or reacting elastic pressure of rubber when deformed around aggregate particles. The deformation is produced best by good macrotextured surfaces. In essence, the Unified Mechanism simply states that a good macro/microtexture surface will provide relatively high friction and flat friction speed gradient on wet pavement surfaces. As speed increases, macrotextured surfaces will provide good drainage to keep the hydrodynamic pressure low and the tire in contact with the pavement surface for a low friction/speed gradient. However, a poor macrotextured pavement surface cannot provide sufficient drainage for good tire/pavement contact. Thus, the friction speed gradient decreases rapidly.

The relationship of the friction/speed gradient was determined at NASA's Wallops Flight Facility by conducting friction surveys on several types of pavement surfaces that represented a wide range of friction values at speeds of 20, 40, 60, and 80 mph. Testing operational runways at 20 mph is not practicable, since a test of a 10.000' runway would take approximately 6 minutes. Likewise, the distance required to accelerate to and decelerate from 80 mph would preclude testing most of a typical touchdown zone. Therefore, a compromise is made and tests are conducted at only two speeds, 40 and 60 mph. These two speeds will provide an adequate representation of the friction/speed gradient for the various textured pavement surfaces encountered.

3. DEVELOPMENT OF PERFORMANCE SPECIFICATION FOR FRICTION EQUIPMENT. The following paragraphs discuss the qualification process used to develop the performance specification for the friction equipment and friction measuring tires.

a. Development of the Friction Equipment Performance Specification. To qualify for Federal funds, friction equipment performance standards had to be developed. Friction tests were conducted at NASA's Wallops Flight Facility to develop the performance specification for friction measuring equipment. The specification was developed to assure the airport operator that the friction measuring equipment would perform with reliability and consistency on all types of pavement surface conditions.

b. Development of the Tire Performance Specification. Prior to 1989, only one friction measuring tire was available for friction measuring devices. During 1988, the E-17 committee of ASTM requested the FAA to conduct tire performance tests on two tires manufactured according to ASTM specifications E-524, *Specification for Standard Smooth Tire for Pavement Skid-resistance Tests*, and E-670, *Standard Test Method for Side Force Friction on Paved Surfaces Using the Mu-Meter*, and compare these tires with the performance of the then FAA standard tire. A tire performance specification was developed for the test program. The tests were conducted at NASA's Wallops Flight Facility in August 1989. The tires are manufactured in the United States by the McCreary Tire & Rubber Company of Indiana, Pennsylvania and Dico Tire, Inc. of Clinton, Tennessee.

APPENDIX 2. RELATED READING MATERIAL

1. The latest issues of the following free publications may be obtained from the U.S. Department of Transportation, Warehousing and Subsequent Distribution Section, SVC-121.23, Washington, DC 20590. AC 00-2, *Advisory Circular Checklist*, current edition, contains the listing of all current issues of circulars and changes thereto.

a. AC 150/5200-28, *Notices to Airman (NOTAMS) for Airport Operators.*

b. AC 150/5200-30, *Airport Winter Safety and Operation.*

c. AC 150/5320-6, *Airport Pavement Design and Evaluation.*

2. Copies of the following publications may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Send check or money order with your request made payable to the Superintendent of Documents in the amount stated. No C.O.D. orders are accepted.

a. AC 150/5300-13, *Airport Design* ($15.00).

b. AC 150/5370-10, *Standards for Specifying Construction of Airports*, current edition ($18.00).

c. AC 150/5380-6, *Guidelines and Procedures for Maintenance of Airport Pavements* ($7.00).

3. Copies of Part 15, *Road, Paving, Bituminous Materials, Skid-resistance, and Skid-resistance of Highway Pavements, STP 530*, may be obtained from the American Society For Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

4. Copies of the following publications may be obtained from the National Technical Information Service, Springfield, Virginia 22151.

a. *Pavement Grooving and Traction Studies*, Report No. NASA SP-5073, 1969.

b. *A Comparison of Aircraft and Ground Vehicle Stopping Performance on Dry, Wet, Flooded, Slush, and Ice-covered Runways*, Report No. NASA TN D-6098, November 1970.

c. *Runway Friction Data for 10 Civil Airports as Measured with a Mu Meter and Diagonal Braked Vehicle*, Report No. FAA-RD-72-61, July 1972.

d. *Effects of Pavement Texture on Wet Runway Braking Performance*, Report No. NASA TN D-4323, January 1969.

e. *Porous Friction Surface Courses*, Report No. FAA-RD-73-197, February 1975.

f. *Laboratory Method for Evaluating Effect of Runway Grooving on Aircraft Tires*, Report No. FAA-RD-74-12, March 1974.

g. *Investigation of the Effects of Runway Grooves on Wheel Spin-up and Tire Degradation*, Report No. FAA-RD-71-2, April 1971.

h. *Environmental Effects on Airport Pavement Groove Patterns*, Report No. FAA-RD-69-37, June 1969.

i. *The Braking Performance of an Aircraft Tire on Grooved Portland Cement Concrete Surfaces*, Report No. FAA-RD-80-78, January 1981.

j. *Braking of an Aircraft Tire on Grooved and Porous Asphaltic Concrete*, Report No. DOT-FAA-RD-82-77, January 1983.

k. *Analytical and Experimental Study of Grooved Pavement Runoff*, Report No. DOT-FAA-PM-83/84, August 1983.

l. *Surveys of Grooves in Nineteen Bituminous Runways*, Report No. FAA-RD-79-28, February 1979.

m. *Modified Reflex-Percussive Grooves for Runways*, Report No. DOT-FAA-PM-82-8, March 1984.

n. *Reliability and Performance of Friction Measuring Tires and Friction Equipment Correlation*, Report No. DOT/FAA/AS-90-1, March 1990.

5. Copies of *MS-16, Asphalt in Pavement Maintenance*, may be obtained from the Asphalt Institute Building, College Park, Maryland 20740.

6. Copies of *Maintenance Practices for Concrete Pavements*, may be obtained from the Portland Cement Association, Old Orchard Road, Skokie, Illinois 60076.

7. Copies of the following publications may be obtained from the Highway Research Board, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418.

a. *Skid-resistance, National Cooperative Highway Research Program (NCHRP) Synthesis of Highway Practice 14*, 1972.

b. *Pavement Rehabilitation - Materials and Techniques, National Cooperative Highway Research Program (NCHRP) Synthesis of Highway Practice 9*, 1972.

c. *Factors Affecting Skid-resistance and Safety of Concrete Pavements*, Special Report No. 101, 1969.

d. *Road Surface Texture and the Slipperiness of Wet Roads*, Record No. 214, 1968.

e. *Pilot Field Study of Concrete Pavement Texturing Methods*, Record No. 389, 1972.

f. *Prediction of Skid-resistance Gradient and Drainage Characteristics of Pavements*, Record No. 131, 1966.

g. *Standard Nomenclature and Definitions for Pavement Components and Deficiencies*, Special Report No. 113, 1970.

h. *Development of Specifications for Skid-Resistant Asphalt Concrete*, Record No. 396, 1972.

i. *Skid-resistance of Screenings for Seal Coats*, Record No. 296, 1968.

8. Copies of the following technical bulletins may be purchased from the American Concrete Paving Association, Suite 490, 3800 N. Wilke Rd., Arlington Heights, Illinois, 60004-1268.

a. *Texturing of Concrete Pavements*, Bulletin No. 1.

b. *Interim Recommendations for the Construction of Skid-Resistant Concrete Pavement*, Bulletin No. 6.

c. *Guideline for Texturing of Portland Cement Concrete Highway Pavements*, Bulletin No. 19.

9. Copies of *Evaluation of Two Transport Aircraft and Several Ground Test Vehicle Friction Measurements Obtained for Various Runway Surface Types and Conditions*, NASA Technical Paper 2917, February 1990, may be obtained from NASA, under the Code NTT-4, Washington, DC 20546-0001.

10. Copies of ASTM Specifications can be obtained from ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103.

APPENDIX 3. PERFORMANCE SPECIFICATIONS FOR CFME

1. FRICTION EQUIPMENT PERFORMANCE STANDARD. The friction measuring equipment may be self-contained or towed. If towed, the tow vehicle will be considered an integral part of the device. The vehicles and/or trailers shall meet all applicable Federal and state laws and/or regulations for vehicles and/or trailers for use on public highways. The side force friction measuring device, the Mu Meter, shall meet the Standard Test Method given in ASTM E 670. The Standard Test Method for the fixed brake slip devices is under preparation by the ASTM Committee.

a. The Friction Measuring Equipment shall do the following:

(1) provide fast, continuous, accurate, and reliable friction measurements for the entire length of the runway, less the differences required for accelerating and decelerating the vehicle at the runway ends.

(2) be designed to sustain rough usage and still function properly and provide efficient and reliable methods of equipment calibration.

(3) be capable of automatically providing the operator with a selection of average friction values for both a 500 foot (150 m) and one-third segment of runway length. In addition, it shall be capable of providing data, whereby, the average friction value for any length of runway can be manually calculated.

(4) be capable of producing a permanent trace of friction measurements versus pavement length at a scale of at least one inch (25 mm) equals 300 feet (90 m).

(5) be capable of consistently repeating friction averages throughout the friction range on all types of pavement surfaces. Friction averages for each 500 foot (150 m) segment located on the pavement surface must be within a confidence level of 95.5 percent, or two standard deviations of ±.06 Mu numbers.

(6) contain a self-wetting system that distributes water in front of the friction measuring wheel(s) at a uniform depth of 0.04 inch (1 mm). The manufacturer shall provide documentation to show that the flow rate is within a tolerance of ±10 percent for both test speeds.

(7) be able to conduct friction surveys at speeds of 40 and 60 mph (65 and 95 km/hr), within a tolerance of ±3 mph (±5 km/hr).

(8) include a complete set of the latest operation and maintenance manuals including guidelines for training airport personnel. The training manuals shall include the current copy of this AC.

(9) have electronic instrumentation (solid-state electronics), including a keyboard for data entry, that will enhance the information gathering and analysis capability of the equipment, and provide the operator more convenience in equipment operation and performance. The information gathered during a friction survey should be stored in an internal microprocessor memory and be readily visible to the operator of the vehicle. This will allow for the examination of data, printouts, and calculation of average friction values over all or any portion of the test run. Each printout of the chart produced by the microprocessor unit shall include the following recorded information: runway designation and date; time of friction survey; a continuous trace of the friction values obtained for the entire runway length minus the acceleration/deceleration distances; printed marks depicting each 100 foot (30 m) increment of the runway length so easy reference can be made by the operator in identifying specific areas on the runway pavement surface; average friction value for 500 foot (150 m) and one-third segments of the runway length as preselected by the operator; and average vehicle speed for that segment.

b. The vehicle shall:

(1) be able to conduct friction surveys at speeds of 40 and 60 mph (65 and 95 km/hr), within a tolerance of ±3 mph (±5 km/hr). The vehicle, when fully loaded with water, shall be capable of accelerating to these speeds within 500 and 1000 feet (150 and 300 m) from the starting position, respectively.

(2) be equipped with electronic speed control.

(3) conform to the requirements of AC 150/5210-5, *Painting, Marking, and Lighting of Vehicles Used on an Airport*, for airfield service vehicles.

(4) be equipped with transceiver(s) necessary for communication with airport operations and air traffic control.

(5) be equipped with a water tank constructed of strong lightweight material, of sufficient capacity to complete a friction survey on a 14,000 foot (4,267 m) runway in one direction and all necessary appurtenances to deliver the required water flow rate to the friction measuring wheel(s).

(6) be equipped with appropriate heavy duty shock absorbers and heavy duty suspension to adequately handle imposed loads.

(7) be equipped with a device that will regulate the water flow within the confines of the vehicle near the driver's position. Where flow regulation is automatic, no device is required in the vehicle.

(8) be equipped with internally controlled spot lights on each side of the vehicle. For trailer mounted equipment, the tow vehicle shall also be equipped with at least two floodlights mounted such that the friction measuring device and rear portion of the tow vehicle is illuminated to a level of at least 20 foot-candles within an area bounded by lines 5 feet (2 m) on either side of the friction measuring device and 5 feet (2 m) in front of and behind the friction measuring device.

(9) be equipped with an air conditioner when specified by the purchaser.

2. TIRE PERFORMANCE STANDARD. The friction measuring equipment shall be furnished with measuring tires which are designed for use in conducting friction surveys and which meet ASTM standard E670, E-5551, or E-1844, as appropriate. Nonribbed (blank) tire(s) shall be used to eliminate the effect of tire tread wear and provide greater sensitivity to variations in pavement surface texture. The tires shall be furnished with split rims and the tubes shall have curved valve stems. The manufacturer of the friction equipment shall provide the airport user with a calibrated pressure dial gauge.

APPENDIX 4. FAA-APPROVED CFME

AIRPORT SURFACE FRICTION TESTER AB PL 2217 S-761 92 Norrtalje SWEDEN	**AIRPORT SURFACE FRICTION TESTER** +46 1 766 96 90 FAX +46 1 766 98 80
AIRPORT TECHNOLOGY USA Six Landmark Square - Fourth Floor Stamford, CT 06901-2792	**SAFEGATE FRICTION TESTER** (203) 359-5730 FAX (202) 378-0501
BISON INSTRUMENTS, INC. 5610 Rowland Road Minneapolis, MN 55343-8956	**MARK 4 MU METER** (612) 931-0051 FAX (612) 931-0997
INTERTECH ENGINEERING 726 South Mansfield Avenue Los Angeles, CA 90036	**TATRA FRICTION TESTER** (213) 939-4302 FAX (213) 939-7298
DYNATEST CONSULTING, INC. (FORMERLY K. J. LAW ENGINEERS, INC.) 13953 US Highway 301 South Starke, FL 32091	**RUNWAY FRICTION TESTER (M 6800)** (904) 964-3777 FAX (904) 964-3749
AEC, AIRPORT EQUIPMENT CO. P.O. Box 20079 S-161 02 BROMMA SWEDEN	**BV-11 SKIDDOMETER** +46 8 295070 FAX +46 8 6275527 E-mail aec@aec.se
FINDLAY, IRVINE, LTD. Bog Road, Penicuik Midlothian EH 26 9BU SCOTLAND	**GRIPTESTER FRICTION TESTER** +44 1968 672111 FAX +44 1968 672596
NORSEMETER P.O. Box 42 Olav Ingstads vei 3 1351 Rud NORWAY	**RUNAR RUNWAY ANALYSER AND RECORDER** +47 67 15 17 00 FAX +47 67 15 17 01

APPENDIX 5. TRAINING REQUIREMENTS OUTLINE FOR CFME

1. GENERAL DISCUSSION. The following paragraph lists the major items which should be considered in developing a training program for airport personnel responsible for operating and maintaining CFME. Whenever a major change in equipment design occurs, the training and instruction manuals should be revised. A document titled *Training and Instruction Manual* should always be provided to the airport personnel by the manufacturer and kept updated.

2. TRAINING REQUIREMENTS OUTLINE.

a. Classroom Instruction.

(1) Purpose of Training Program.

(2) General Discussion on Pertinent Federal Aviation Regulations.

(3) General Discussion on Pertinent ACs.

(4) General Discussion on Pertinent ASTM Standards.

(5) General Overview of Program.

(6) Review of Requirements in AC 150/5320-12.

(i) Coefficient of Friction Definition.

(ii) Factors Affecting Friction Conditions.

(iii) ASTM Standards for CFME.

(iv) ASTM Standards for Friction Measuring Tires.

(v) Operation of CFME.

(vi) Programming the Computer for FAA and ICAO Formats.

(vii) Maintenance of CFME.

(viii) Procedures for Reporting Friction Numbers.

(ix) Preparation and Dissemination of NOTAMS.

(7) Orientation to the Calibration, Operation, and Maintenance of CFME.

b. Field Experience. Operation and Maintenance of CFME.

c. Testing. Solo Test and Written Examination on All Items Covered in Course.

d. Award Of Training Certificate.

U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Change 8 to MEASUREMENT, CONSTRUCTION, AND MAINTENANCE OF SKID-RESISTANT AIRPORT PAVEMENT SURFACES

Date: 2/7/07
Initiated by: AAS-100

AC No: 150/5320-12C
Change: 8

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)	12/05/05	Appendix 4 pg. 1 (and 2)	02/07/07

DAVID L. BENNETT
Director, Office 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. 42-44 Bog Road, Penicuik Midlothian EH 26 9 BU SCOTLAND	**GRIPTESTER FRICTION TESTER** +44 1968 672111 FAX +44 1968 671237 www.findlayirvine.com
INTERTECH ENGINEERING NO LONGER AVAILABLE	**TATRA FRICTION TESTER**
NEUBERT AERO CORP. 4105 West De Leon Street Tampa, FL 33609	**NAC DYNAMIC FRICTION TESTER** +(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 P.O. Box 18 Vammaksentie FIN-38201 Vammala FINLAND	**BV-11 SKIDDOMETER** +358 20 4694041 FAX +358 20 4694250 www.patria.fi
SCANDINAVIAN AIRPORT AND ROAD SYSTEMS AB Box 31, Sjoviksvagen 4 23121 Trelleborg SWEDEN US/Canada Tradewind Scientific Ltd.	**SARSYS FRICTION TESTER (SFT)** **SARSYS TRAILER FRICTION TESTER (STFT)** **SARSYS SUV FRICTION TESTER (SSUV)** +46 410 46 110 FAX +46 410 46 111 www.tradewindscientific.com

APPENDIX 2. RELATED READING MATERIAL

1. The latest issues of the following free publications may be obtained from the U.S. Department of Transportation, Warehousing and Subsequent Distribution Section, SVC-121.23, Washington, DC 20590. AC 00-2, *Advisory Circular Checklist*, current edition, contains the listing of all current issues of circulars and changes thereto.

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b. AC 150/5200-30, *Airport Winter Safety and Operation.*

c. AC 150/5320-6, *Airport Pavement Design and Evaluation.*

2. Copies of the following publications may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Send check or money order with your request made payable to the Superintendent of Documents in the amount stated. No C.O.D. orders are accepted.

a. AC 150/5300-13, *Airport Design* ($15.00).

b. AC 150/5370-10, *Standards for Specifying Construction of Airports*, current edition ($18.00).

c. AC 150/5380-6, *Guidelines and Procedures for Maintenance of Airport Pavements* ($7.00).

3. Copies of Part 15, *Road, Paving, Bituminous Materials, Skid-resistance, and Skid-resistance of Highway Pavements, STP 530*, may be obtained from the American Society For Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

4. Copies of the following publications may be obtained from the National Technical Information Service, Springfield, Virginia 22151.

a. *Pavement Grooving and Traction Studies*, Report No. NASA SP-5073, 1969.

b. *A Comparison of Aircraft and Ground Vehicle Stopping Performance on Dry, Wet, Flooded, Slush, and Ice-covered Runways*, Report No. NASA TN D-6098, November 1970.

c. *Runway Friction Data for 10 Civil Airports as Measured with a Mu Meter and Diagonal Braked Vehicle*, Report No. FAA-RD-72-61, July 1972.

d. *Effects of Pavement Texture on Wet Runway Braking Performance*, Report No. NASA TN D-4323, January 1969.

e. *Porous Friction Surface Courses*, Report No. FAA-RD-73-197, February 1975.

f. *Laboratory Method for Evaluating Effect of Runway Grooving on Aircraft Tires*, Report No. FAA-RD-74-12, March 1974.

g. *Investigation of the Effects of Runway Grooves on Wheel Spin-up and Tire Degradation*, Report No. FAA-RD-71-2, April 1971.

h. *Environmental Effects on Airport Pavement Groove Patterns*, Report No. FAA-RD-69-37, June 1969.

i. *The Braking Performance of an Aircraft Tire on Grooved Portland Cement Concrete Surfaces*, Report No. FAA-RD-80-78, January 1981.

j. *Braking of an Aircraft Tire on Grooved and Porous Asphaltic Concrete*, Report No. DOT-FAA-RD-82-77, January 1983.

k. *Analytical and Experimental Study of Grooved Pavement Runoff*, Report No. DOT-FAA-PM-83/84, August 1983.

l. *Surveys of Grooves in Nineteen Bituminous Runways*, Report No. FAA-RD-79-28, February 1979.

m. *Modified Reflex-Percussive Grooves for Runways*, Report No. DOT-FAA-PM-82-8, March 1984.

n. *Reliability and Performance of Friction Measuring Tires and Friction Equipment Correlation*, Report No. DOT/FAA/AS-90-1, March 1990.

5. Copies of *MS-16, Asphalt in Pavement Maintenance*, may be obtained from the Asphalt Institute Building, College Park, Maryland 20740.

6. Copies of *Maintenance Practices for Concrete Pavements*, may be obtained from the Portland Cement Association, Old Orchard Road, Skokie, Illinois 60076.

7. Copies of the following publications may be obtained from the Highway Research Board, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418.

a. *Skid-resistance, National Cooperative Highway Research Program (NCHRP) Synthesis of Highway Practice 14*, 1972.

b. *Pavement Rehabilitation - Materials and Techniques, National Cooperative Highway Research Program (NCHRP) Synthesis of Highway Practice 9*, 1972.

c. *Factors Affecting Skid-resistance and Safety of Concrete Pavements*, Special Report No. 101, 1969.

d. *Road Surface Texture and the Slipperiness of Wet Roads*, Record No. 214, 1968.

e. *Pilot Field Study of Concrete Pavement Texturing Methods*, Record No. 389, 1972.

f. *Prediction of Skid-resistance Gradient and Drainage Characteristics of Pavements*, Record No. 131, 1966.

g. *Standard Nomenclature and Definitions for Pavement Components and Deficiencies*, Special Report No. 113, 1970.

h. *Development of Specifications for Skid-Resistant Asphalt Concrete*, Record No. 396, 1972.

i. *Skid-resistance of Screenings for Seal Coats*, Record No. 296, 1968.

8. Copies of the following technical bulletins may be purchased from the American Concrete Paving Association, Suite 490, 3800 N. Wilke Rd., Arlington Heights, Illinois, 60004-1268.

a. *Texturing of Concrete Pavements*, Bulletin No. 1.

b. *Interim Recommendations for the Construction of Skid-Resistant Concrete Pavement*, Bulletin No. 6.

c. *Guideline for Texturing of Portland Cement Concrete Highway Pavements*, Bulletin No. 19.

9. Copies of *Evaluation of Two Transport Aircraft and Several Ground Test Vehicle Friction Measurements Obtained for Various Runway Surface Types and Conditions*, NASA Technical Paper 2917, February 1990, may be obtained from NASA, under the Code NTT-4, Washington, DC 20546-0001.

10. Copies of ASTM Specifications can be obtained from ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103.

APPENDIX 3. PERFORMANCE SPECIFICATIONS FOR CFME

1. FRICTION EQUIPMENT PERFORMANCE STANDARD. The friction measuring equipment may be self-contained or towed. If towed, the tow vehicle will be considered an integral part of the device. The vehicles and/or trailers shall meet all applicable Federal and state laws and/or regulations for vehicles and/or trailers for use on public highways. The side force friction measuring device, the Mu Meter, shall meet the Standard Test Method given in ASTM E 670. The Standard Test Method for the fixed brake slip devices is under preparation by the ASTM Committee.

a. The Friction Measuring Equipment shall do the following:

(1) provide fast, continuous, accurate, and reliable friction measurements for the entire length of the runway, less the differences required for accelerating and decelerating the vehicle at the runway ends.

(2) be designed to sustain rough usage and still function properly and provide efficient and reliable methods of equipment calibration.

(3) be capable of automatically providing the operator with a selection of average friction values for both a 500 foot (150 m) and one-third segment of runway length. In addition, it shall be capable of providing data, whereby, the average friction value for any length of runway can be manually calculated.

(4) be capable of producing a permanent trace of friction measurements versus pavement length at a scale of at least one inch (25 mm) equals 300 feet (90 m).

(5) be capable of consistently repeating friction averages throughout the friction range on all types of pavement surfaces. Friction averages for each 500 foot (150 m) segment located on the pavement surface must be within a confidence level of 95.5 percent, or two standard deviations of ±.06 Mu numbers.

(6) contain a self-wetting system that distributes water in front of the friction measuring wheel(s) at a uniform depth of 0.04 inch (1 mm). The manufacturer shall provide documentation to show that the flow rate is within a tolerance of ±10 percent for both test speeds.

(7) be able to conduct friction surveys at speeds of 40 and 60 mph (65 and 95 km/hr), within a tolerance of ±3 mph (±5 km/hr).

(8) include a complete set of the latest operation and maintenance manuals including guidelines for training airport personnel. The training manuals shall include the current copy of this AC.

(9) have electronic instrumentation (solid-state electronics), including a keyboard for data entry, that will enhance the information gathering and analysis capability of the equipment, and provide the operator more convenience in equipment operation and performance. The information gathered during a friction survey should be stored in an internal microprocessor memory and be readily visible to the operator of the vehicle. This will allow for the examination of data, printouts, and calculation of average friction values over all or any portion of the test run. Each printout of the chart produced by the microprocessor unit shall include the following recorded information: runway designation and date; time of friction survey; a continuous trace of the friction values obtained for the entire runway length minus the acceleration/deceleration distances; printed marks depicting each 100 foot (30 m) increment of the runway length so easy reference can be made by the operator in identifying specific areas on the runway pavement surface; average friction value for 500 foot (150 m) and one-third segments of the runway length as preselected by the operator; and average vehicle speed for that segment.

b. The vehicle shall:

(1) be able to conduct friction surveys at speeds of 40 and 60 mph (65 and 95 km/hr), within a tolerance of ±3 mph (±5 km/hr). The vehicle, when fully loaded with water, shall be capable of accelerating to these speeds within 500 and 1000 feet (150 and 300 m) from the starting position, respectively.

(2) be equipped with electronic speed control.

(3) conform to the requirements of AC 150/5210-5, *Painting, Marking, and Lighting of Vehicles Used on an Airport*, for airfield service vehicles.

(4) be equipped with transceiver(s) necessary for communication with airport operations and air traffic control.

(5) be equipped with a water tank constructed of strong lightweight material, of sufficient capacity to complete a friction survey on a 14,000 foot (4,267 m) runway in one direction and all necessary appurtenances to deliver the required water flow rate to the friction measuring wheel(s).

(6) be equipped with appropriate heavy duty shock absorbers and heavy duty suspension to adequately handle imposed loads.

(7) be equipped with a device that will regulate the water flow within the confines of the vehicle near the driver's position. Where flow regulation is automatic, no device is required in the vehicle.

(8) be equipped with internally controlled spot lights on each side of the vehicle. For trailer mounted equipment, the tow vehicle shall also be equipped with at least two floodlights mounted such that the friction measuring device and rear portion of the tow vehicle is illuminated to a level of at least 20 foot-candles within an area bounded by lines 5 feet (2 m) on either side of the friction measuring device and 5 feet (2 m) in front of and behind the friction measuring device.

(9) be equipped with an air conditioner when specified by the purchaser.

2. TIRE PERFORMANCE STANDARD. The friction measuring equipment shall be furnished with measuring tires which are designed for use in conducting friction surveys and which meet ASTM standard E670, E-5551, or E-1844, as appropriate. Nonribbed (blank) tire(s) shall be used to eliminate the effect of tire tread wear and provide greater sensitivity to variations in pavement surface texture. The tires shall be furnished with split rims and the tubes shall have curved valve stems. The manufacturer of the friction equipment shall provide the airport user with a calibrated pressure dial gauge.

APPENDIX 4. FAA-APPROVED CFME

AIRPORT SURFACE FRICTION TESTER AB PL 2217 S-761 92 Norrtalje SWEDEN	**AIRPORT SURFACE FRICTION TESTER** +46 1 766 96 90 FAX +46 1 766 98 80
AIRPORT TECHNOLOGY USA Six Landmark Square - Fourth Floor Stamford, CT 06901-2792	**SAFEGATE FRICTION TESTER** (203) 359-5730 FAX (202) 378-0501
BISON INSTRUMENTS, INC. 5610 Rowland Road Minneapolis, MN 55343-8956	**MARK 4 MU METER** (612) 931-0051 FAX (612) 931-0997
INTERTECH ENGINEERING 726 South Mansfield Avenue Los Angeles, CA 90036	**TATRA FRICTION TESTER** (213) 939-4302 FAX (213) 939-7298
DYNATEST CONSULTING, INC. (FORMERLY K. J. LAW ENGINEERS, INC.) 13953 US Highway 301 South Starke, FL 32091	**RUNWAY FRICTION TESTER (M 6800)** (904) 964-3777 FAX (904) 964-3749
AEC, AIRPORT EQUIPMENT CO. P.O. Box 20079 S-161 02 BROMMA SWEDEN	**BV-11 SKIDDOMETER** +46 8 295070 FAX +46 8 6275527 E-mail aec@aec.se
FINDLAY, IRVINE, LTD. Bog Road, Penicuik Midlothian EH 26 9BU SCOTLAND	**GRIPTESTER FRICTION TESTER** +44 1968 672111 FAX +44 1968 672596
NORSEMETER P.O. Box 42 Olav Ingstads vei 3 1351 Rud NORWAY	**RUNAR RUNWAY ANALYSER AND RECORDER** +47 67 15 17 00 FAX +47 67 15 17 01

APPENDIX 5. TRAINING REQUIREMENTS OUTLINE FOR CFME

1. GENERAL DISCUSSION. The following paragraph lists the major items which should be considered in developing a training program for airport personnel responsible for operating and maintaining CFME. Whenever a major change in equipment design occurs, the training and instruction manuals should be revised. A document titled *Training and Instruction Manual* should always be provided to the airport personnel by the manufacturer and kept updated.

2. TRAINING REQUIREMENTS OUTLINE.

a. Classroom Instruction.

(1) Purpose of Training Program.

(2) General Discussion on Pertinent Federal Aviation Regulations.

(3) General Discussion on Pertinent ACs.

(4) General Discussion on Pertinent ASTM Standards.

(5) General Overview of Program.

(6) Review of Requirements in AC 150/5320-12.

(i) Coefficient of Friction Definition.

(ii) Factors Affecting Friction Conditions.

(iii) ASTM Standards for CFME.

(iv) ASTM Standards for Friction Measuring Tires.

(v) Operation of CFME.

(vi) Programming the Computer for FAA and ICAO Formats.

(vii) Maintenance of CFME.

(viii) Procedures for Reporting Friction Numbers.

(ix) Preparation and Dissemination of NOTAMS.

(7) Orientation to the Calibration, Operation, and Maintenance of CFME.

b. Field Experience. Operation and Maintenance of CFME.

c. Testing. Solo Test and Written Examination on All Items Covered in Course.

d. Award Of Training Certificate.