ENGINEERING POLICY 99-01

SUBJECT: Pavement Maintenance/Management Policy

PURPOSE: (1) To present guidance for airport pavement maintenance management programs and a recommended work scope for pavement condition index (PCI) data collection, and (2) to provide regional policy on PCI surveys, pavement maintenance, and project priorities.

DISCUSSION: In 1994, Public Law 103-305, section 107, amended Title 49, section 47105, of the United States Code, to require sponsor assurances for preventative maintenance in pavement grants. The provision requires that, for any project to replace or reconstruct pavement, the sponsor assure that the airport has implemented an effective pavement maintenance management program. The amendment also provides that reports on the pavement condition and management program be furnished to the FAA upon request. The "Airport Pavement Maintenance Management Program" outline, provided in Attachment 1, has been developed to assist airport sponsors in complying with the amendment.

Maintenance is the most cost-effective way to extend a pavement's life. Earlier in the life of a pavement, maintenance will retard deterioration and significantly extend its life. Maintenance can be accomplished several times for the cost of future rehabilitation work. The goal of this policy is to use pavement maintenance management programs to ensure proper maintenance and, by doing so, reduce the total cost of system preservation. This should make it possible to preserve lower priority paved areas, such as aprons, without increasing the total expenditures.

POLICY:

PAVEMENT CONDITION INDEX SURVEYS: Airports District Offices (ADO's) should insure that PCI data is available for all eligible airports as soon as possible. State system planning grants should include PCI surveys for general-aviation airports, as well as for those commercial-service airports not conducting surveys. Commercial-service airports may conduct their own PCI surveys, if they are not included in the system plan. An electronic file of the PCI data shall be provided to the FAA Northwest Mountain Regional Office, compatible to Paver 3.2, 4.0, or 4.1 each time it is updated. A suggested scope for PCI data collection and analysis is provided in Attachment 2.

MAINTENANCE: In the past, rehabilitation and reconstruction projects have been funded by the FAA mostly, regardless of how the pavement had been maintained. A pavement maintenance management plan is now required by law to be developed and is included as part of Attachment 1. The ADO's will review the pavement condition and maintenance plans during compliance inspections or prior to approval of Airport Improvement Program or Passenger Facility Charge funds for any pavement project at the

airport. When airports are not providing maintenance, the ADO should review the maintenance plan and work with the airport on implementation.

PAVEMENT PROJECT PRIORITIES: Rehabilitation projects, in the past, have been selected usually as the "worst first." This is not the most economical method to select projects. Priorities are assigned to proposed Airport Improvement Program projects based on many factors, such as pavement usage and airport category. As soon as sufficient PCI data is available to support an accurate comparative analysis, the ADO's should use it as another factor in making project decisions at the semi-annual Airports Capital Improvement Plan meetings. For general-aviation and non-primary commercial-service airport projects, the ADO should strongly encourage states, in cooperation with airport sponsors, to conduct an analysis using PCI data to prioritize rehabilitation projects. The method used should include the scheduled maintenance.

A demonstration project will be conducted during FY-99 using both maintenance and rehabilitation budgets in the analysis to establish an economical prioritization of projects. This demonstration is expected to result in standard procedures for the analysis.

REFERENCES:

- Advisory Circular 150/5380-6, Guidelines and Procedures for Maintenance of Airport Pavements, is to be used for specific guidelines and procedures for maintaining airport pavements and for establishing an effective maintenance program. Specific types of distress, their probable causes, inspection guidelines, and recommended methods of repair are presented.

- Advisory Circular 150/5380-7, Pavement Management System, presents concepts in pavement management, and outlines how it can be used to make cost-effective decisions.

- Public Law 103-305, section 107, amending Title 49, section 47105, of the United States Code, includes requirements for grants to include assurances on preventative maintenance with certain project applications.

- Program Guidance Letter 95-2.1, Assurance on Pavement Maintenance Program, outlines the pavement maintenance program and includes the grant assurance.

APPROVAL: signed
Lowell H. Johnson, Manager, Airports Division
Northwest Mountain Region

DATE: 04/23/99

Attachment 1

AIRPORT PAVEMENT MAINTENANCE MANAGEMENT PROGRAM

(Primarily adopted from guidance provided from FAA headquarters)

General

An effective pavement maintenance management program is one that details the procedures to be followed to assure that proper pavement maintenance, both preventative and reparative, is performed. An airport sponsor may use any form of inspection program it deems appropriate. The program, as a minimum, should include the following:

a. Pavement Inventory. The following should be depicted in an appropriate form and level of detail. (Note: This information is available from FAA Form 5320-1.)

- Location of all runways, taxiways, and aprons.
- Type of pavement.
- Year of construction or most recent major rehabilitation.
- Dimensions.

b. Inspection Schedule.

- Detailed Inspection. A detailed inspection must be performed at least once a year. If a history of recorded pavement deterioration is available, i.e., a Pavement Condition Index (PCI) survey, as set forth in Advisory Circular 150/5380-6, Guidelines and Procedures for Maintenance of Airport Pavements, the frequency of inspections may be extended to 3 years. Many of the airports in the Northwest Mountain Region utilize PCI inspections. Much of the following information and requirements are obtained from these inspections and data evaluations.

- Drive-by Inspection. A drive-by inspection should be performed a minimum of once per month to detect unexpected changes in the pavement condition.

c. Record Keeping. Complete information on the findings of all detailed inspections and maintenance performed should be recorded and kept on file for a minimum of 5 years. The types of distress, their locations, and remedial action, scheduled or performed, should be documented. The minimum information to be recorded is listed below:

- Inspection date.
- Location.
- Distress types.
- Maintenance scheduled or performed.

For drive-by inspections, the date of inspection and any maintenance performed should be recorded.

d. Information Retrieval. An airport sponsor may use any form of record keeping it deems appropriate, so long as the information and records produced by the pavement survey can be retrieved to provide a report to the FAA as required.

Planning Airport Pavement Maintenance

Maintenance of airport pavements consist of two distinct categories. The most commonly performed and easiest to understand is remedial maintenance. Remedial maintenance is simply the repair of deteriorated pavement. The more important and often overlooked is preventative maintenance. Preventative maintenance requires obtaining a history of pavement performance and planning for future pavement needs. Proper preventative maintenance can extend the serviceable life of the pavement and reduce the amount of remedial maintenance. A sample plan is included at the end of this attachment.

There are several necessary steps to begin a preventative and remedial pavement maintenance program. By following these steps, a maintenance program can be constructed to forecast maintenance needs and determine when rehabilitation outside of normal daily maintenance is required and justified.

Pavement Inventory

a. Mapping and Categorization. Develop a system of maps, whereby the condition and special requirements of given pavement areas can be recorded. Not all pavement structures are constructed alike, nor do all pavement structures perform identically. Therefore, it is necessary to monitor the maintenance requirements of each general type of pavement. By monitoring the performance of pavement sections of similar construction and usage, sufficient information can be developed to forecast maintenance requirements.

It may not be necessary to monitor all pavement sections if several sections are representative of the grouping. Inspection of all sections may require considerable cost and effort. Sampling plans should be devised so that an adequate portion of a pavement is inspected and the results are representative of the entire group.

Pavement categories and groupings should be determined with respect to the following:

(1) Pavement type.
(2) Pavement material.
(3) Base characteristics - depth, material type, soil type.
(4) Drainage characteristics - edge drains, subdrains.
(5) Age of the pavement.
(6) Pavement usage.
(7) Allowable pavement loading (pavement strength).

Pavement type refers to the stress distribution mechanism provided by the pavement structure. Typically, pavement types can be categorized in three classes: rigid, flexible, and overlays. Rigid pavements are normally constructed of Portland Cement concrete, and use the stiffness of the concrete slab to distribute the applied loads. Flexible pavements are usually constructed using bituminous products, and depend upon the bearing capacity of the structural layers to distribute the applied load. Overlays are simply combinations of pavement types.

All pavement structures are designed in layers of progressively stronger materials. These layers usually consist of the subgrade, subbase(s), base, and surface course. The surface course is defined as the uppermost layer that makes direct contact with wheel loads. The layer of material directly under the surface course is considered as the base course. Under the base course is the subbase, and under the subbase is the subgrade (natural soils). The type of material in each layer and the thickness of the layer will directly affect the strength of the pavement. Sections of pavement that have an identical surface course, but different base materials may perform differently and should not be categorized together, unless additional information is available to indicate that the pavement structures are similar. Likewise, different subgrade soils may perform differently and should be considered when categorizing pavement sections.

The amount of moisture within a pavement layer will greatly affect the strength, and thereby, the performance of the layer. As the moisture content of a layer increases, the strength decreases. If subsurface drainage is provided, the overall strength of the pavement section will be higher. Some pavement sections have drainable layers built into the structure for additional drainage capacity. These drainage features should be strongly considered when grouping pavement sections.

Due to variations in construction and material quality, the age of a pavement structure may not accurately indicate the condition or the performance of the pavement. However, the age of the pavement may be used to further categorize pavement sections and may provide a relative condition of those sections.

Other than deterioration from the adverse affects of weathering, the loads applied to a pavement are the most destructive forces that the pavement must withstand. Areas of high and low usage will ultimately determine areas requiring the most or least maintenance. Additionally, areas of high usage readily indicate critical pavements that should receive a high priority in the maintenance schedule.

b. Initial Condition Survey. After the pavement sections have been grouped together, an initial condition survey should be conducted to determine the extent of distress, and the amount of deterioration for each pavement group. This initial survey should be a detailed observation of the pavement with specific types of distress noted and probable causes given. An accepted pavement rating method is recommended, but it is not necessary. If a

widely accepted rating system is used, the values assigned to the pavement can be compared to pavements at other locations.

In addition to the present condition of the pavement, a history of any maintenance, repair, or reconstruction should be determined. The history should gather as much information as possible about the initial construction of the pavement and its performance.

c. Economic Analysis and Prioritization System. The cost of maintenance for each pavement group should be tracked over time. As the condition of the pavement deteriorates, the cost of doing maintenance will increase. Eventually, it will be more cost effective to rehabilitate or reconstruct a section of pavement than to perform continual maintenance. Cost comparisons should include both initial and anticipated costs of the alternatives throughout the expected life of the pavement.

Since maintenance dollars are often limited, a fair and comprehensive prioritizing system should be outlined. Areas of high traffic should receive a higher priority, since the additional traffic will cause additional damage and the additional traffic indicates user needs. Areas of low traffic may not deteriorate as rapidly and may require less overall maintenance. This does not imply that areas of low usage can be ignored. The maintenance performed on any section of pavement should meet the preventative maintenance requirements for that section.

A detailed inspection should be done annually unless a PCI survey is being accomplished on a 3-year frequency. After the initial detailed inspection is completed and the maintenance program has been implemented, a regular schedule of drive-by inspections should be followed to track the condition of the pavement. The schedules may be broken down with respect to the degree and interval of inspections. A typical schedule could include daily inspections for minor surface defects that could present a safety problem and monthly inspections for major pavement distress. It should be noted that any or all schedules may require adjustment, depending upon the performance of the pavement in question. These inspections should be well documented and the resulting action noted. By developing a checklist or fill-in-the-blank form, some of the individual differences between inspectors are eliminated. Properly completed forms will provide uniformity and consistency to the inspection reports.

Summary

Most airport pavements do not fail because of load-induced damage, rather, they are eventually destroyed by the elements. If protected from weather induced damage, the service life of the pavement can be prolonged indefinitely.

The most destructive element to any properly constructed pavement section is excess moisture. Regardless of how strong the pavement material is, or how good the construction, excess moisture in the pavement layers will speed up the deterioration process. Ironically, keeping pavement cracks and joints sealed is the most neglected

maintenance item. Far too often, sponsors feel that they can save money by putting off regular sealing of cracks. Cracks and joints must be sealed and resealed to keep excess moisture out of the pavement structure, and they must be sealed in a timely manner. Likewise subdrain systems must be kept operable. Periodic inspection and cleaning of subdrain pipes and outlets must be performed to prevent trapping water in the pavement structure.

Pavement maintenance is not an exact science and how to properly maintain each individual pavement section is not easily put into words. As experience is gained in maintaining pavement structures, the necessary and proper maintenance items will become self-evident. Regardless of the extent or amount of maintenance performed, the rewards will be readily visible.

Attachment 1A

The following is a sample 5-year maintenance plan and is the type to be included in all of the programs:

Sample Airport
Maintenance Plan

1999
Crack seal all asphalt pavements on a 2-year cycle and *fog seal all asphalt pavements on a 4-year cycle. All alligator cracked pavement will be replaced with full-depth asphalt patches as they develop. Every 2 years, replace any damaged joint seal material on Portland Cement Concrete (PCC) pavements.

Summary:

Item	Est. Quantity	Est. Cost	Funds Source
Crack Seal All Asphalt Pavements	33,000 lf	$11,000	State
*Fog Seal All Asphalt Pavements	88,000 sy	$22,000	State
Full-Depth Asphalt Patching	5,000 sf	$11,000	State
Replace PCC Joint Sealant Where Needed	6,000 lf	$ 6,000	State

2000
Nothing major should be needed. All minor maintenance to be accomplished with local funds.

2001
Crack seal asphalt pavements and replace failed PCC joint sealant per established schedule.

Summary:

Item	Est. Quantity	Est. Cost	Funds Source
Crack Seal All Asphalt Pavements	36,000 lf	$12,000	State
Full-Depth Asphalt Patching	1,000 sf	$ 2,200	Local
Replace PCC Joint Sealant Where Needed	4,000 lf	$ 4,000	State

2002
Nothing major should be needed. All minor maintenance to be accomplished with local funds.

2003
Crack seal and *fog seal asphalt pavements and replace failed PCC joint sealant per established schedule.

Summary:

Item	Est. Quantity	Est. Cost	Funds Source
Crack Seal All Asphalt Pavements	39,000 sf	$13,000	State
*Fog Seal All Asphalt Pavements	88,000 sy	$22,000	State
Full-Depth Asphalt Patching	1,000 sf	$ 2,000	Local
Replace PCC Joint Sealant Where Needed	4,000 lf	$ 4,000	State

*Note: Fog sealing should be replaced with a more aggressive crack sealing program in the northwest areas of the region where the pavement is exposed to more rainfall and less ultraviolet.

Attachment 2

The following are suggested requirements for states to include in their Pavement Management System contracts.

(Sample- Note text brackets represent optional text)

PAVEMENT CONDITION INDEX (PCI)
DATA COLLECTION AND ANALYSIS
SCOPE OF WORK

a. ELEMENT 1- PAVEMENT CONDITION INDEXING.

(1) The contractor will perform an evaluation of airfield pavement (PCI) at airports identified in the attached list. Criteria for these evaluations will be as per FAA Advisory Circular AC 150/5380-6: Guidelines and Procedures for Maintenance of Airport Pavements. This work will be carried out under a contract between the State Division of [ ] and a qualified consulting firm. [The State Division will provide a staff engineer to assist and accompany the consultant, as the State Division warrants, to guarantee consistency with future yearly inspections and to develop staff expertise.]

(2) In addition to conducting visual inspections and evaluations of the airfield pavement surfaces, information on the types and severity of the pavement distresses will be recorded and entered into a pavement management system data base that operates in the Windows environment [to provide an interactive link with the airport section maps, and other related software such as the Aviation Information Management System (AIMS)]. [The contractor will also provide the State Division with the needed training to utilize the systems software.]

b. ELEMENT 2- REPORTS.

The contractor will be responsible for the preparation and submission of specific reports and data including, but not limited to, the following:

(1) Technical Memoranda - Prepare, for each of the inspected airports, documentation and graphics indicating the condition and location of all sampled airside pavement on the airport.

(2) Data Base Computer Files - The contractor will provide computer input files associated with the pavement inspections. These files will be prepared using pavement management software that operates in the Windows environment [and provides the ability to link with other aviation software such as the AIMS program].

(3) Quarterly Progress Reports - The contractor will provide quarterly progress reports outlining major work elements accomplished, activities during the period, and progress to date.

c. ELEMENT 3- PAVEMENT MANAGEMENT SYSTEM REQUIREMENTS.

(1) The system must operate in a Windows environment.

(2) It should permit multiple condition evaluation methods that do not rely solely on the PCI.

(3) It should feature unlimited user-specific and user-modified treatment alternatives, priority rankings, performance modeling and financial scenarios.

(4) It should feature an interactive interface between the data contained in the database and the analysis program with [auto Computer Aided Drafting (CAD)] maps.

(5) The existing [ ] database will be modified to interact directly with the [State's] current Pavement Management System and be compatible with Paver 3.2, 4.0, or 4.1. The files provided to the FAA should not use a number as the network name, but rather the airport's name or three letter identifier.

[As noted above, the Pavement Management System will be required to be linked to [auto CAD] maps of each airport. This link will facilitate the retrieval and presentation of collected data. It should allow for "point-and-click" operation, so that an individual section at a specific airport can be accessed to obtain inventory data, current and predicted conditions, and the 5-year Capital Improvement Program. This feature will be utilized to enhance the display of color PCI maps and other stored items.]