Virginia Aviation Pavement Management System: A Historical Perspective

MARGARET BROTEN AND STEVEN MCNEELY

The use of pavement management systems for individual airports and systems of airports is a relatively recent application compared to roadway pavement management system implementations. Several papers have been published that discuss the initial development and implementation of an airport pavement management system. However, published information evaluating the usefulness and success of in-place airport pavement management systems is scarce. This dearth of documentation has contributed to the slow acceptance of pavement management practices for aviation applications. The Virginia Department of Aviation (VDOA) initiated its pavement management efforts in 1990. VDOA uses its pavement management system to prioritize and schedule pavement maintenance and rehabilitation activities. The use of the system has contributed significantly to the increase in the overall condition of Virginia's paved runways from an area-weighted pavement condition index (PCI) of 76 in 1990 to a PCI of 84 in 1993. Use of the pavement management system permitted VDOA to obtain this increase in condition without having to obtain a substantial increase in funding. In addition, the PMS is expected to fully satisfy the requirements of the 1994 Airport Improvement Program reauthorization legislation pertaining to airport pavement maintenance management. A case study of a state aviation pavement management system is presented. The implementation process and the impact of the system on the selection of pavement maintenance and rehabilitation projects are documented. Further, condition and budget information prior to, and after, full implementation and use of the pavement management system is presented.

Since 1928, the Commonwealth of Virginia has taken an active role in the development of an efficient statewide air transportation system. Today, Virginia's air transportation system consists of 70 public-use airports and 1 heliport. Aviation is very important to the commonwealth, because airports link Virginia with commercial markets, serve as gateways for tourism, generate $1.5 billion in wages, and contribute $7.2 billion to the economic activity of Virginia. These airports will continue to play a vital role in the economic health of the commonwealth well into the 21st century, and the protection of their physical infrastructure is of critical importance.

Prior to implementing a pavement management system (PMS), the Virginia Department of Aviation (VDOA) relied heavily on each airport sponsor's knowledge of project justification when pavement-related funding was requested. Often, these sponsors did not have experience in identifying pavement-related needs at airport facilities. Historically, this lack of experience led to problems. Some projects that could have been delayed were funded, whereas other projects that were needed went unrecognized and unfunded.

As a result of a commitment and responsibility to maintain a safe and efficient system of air transportation, and to protect the large capital investment that the airports represented, Virginia implemented a PMS to enable the VDOA to assist sponsors in managing airport pavements. It is used to store, analyze, and retrieve pavement condition data. The PMS permits the department to efficiently monitor pavement condition, correct airport deficiencies, and take advantage of limited budgets. In addition, the program facilitates the development of annual maintenance plans and the preparation of long-term (5- to 20-year) capital improvement programs (CIPs).

VDOA began the process of implementing a PMS in 1990 (*1*). The first step in the implementation process involved determining the current condition status of the pavements at selected airports, as measured by the pavement condition index (PCI) (*2*). In 1990, the overall area-weighted PCI of Virginia's airport pavement network (runways, taxiways, and aprons) was 76. The area-weighted PCI for the runways was also 76. In 1993, after the PMS had been fully implemented and in use for 3 years, the area-weighted PCI for the entire pavement network had increased to 82, and the runway area-weighted PCI had increased to 84. VDOA attributes much of this improvement in pavement condition, obtained without a significant increase in pavement-related expenditures, to its use of its PMS during the past 4 years.

The objective of this paper is to provide a historical perspective of the implementation and long-term use of a PMS for the management of a state aviation pavement network. The paper documents the implementation process and the impact the system has made on the selection of pavement maintenance and rehabilitation projects. Finally, the paper presents condition and budget information before and after full implementation and use of the PMS. Because very little published information is available on the actual results of using an airport PMS, it is hoped this paper will partially fill the void that has contributed to the relatively slow acceptance of pavement management practices for aviation applications.

MANAGEMENT OF PAVEMENTS BEFORE IMPLEMENTATION OF PMS

Prior to 1990, VDOA did not have a pavement management system. Pavement-related projects were typically undertaken when requested by an airport sponsor. Due to a lack of current and accurate pavement condition information, VDOA did not have the means to evaluate these requests for appropriateness or to prioritize one request over another. During this period, however, VDOA was able to begin its move toward more proactively managing its airport pavements through the implementation of a highly successful maintenance program (which is still in operation).

Determination of Annual Pavement Project List

Prior to the implementation of a PMS in 1990, VDOA approved the majority of pavement-related projects based upon the airport spon-

M. Broten, ERES Consultants, Inc., 100 Wissahickon Avenue, Suite 110, Ambler, Pa. 19002. S. McNeely, Department of Aviation, Commonwealth of Virginia, 5702 Gulfstream Road, Sandston, Va. 23150.

sors' requests. In many cases, these sponsors consisted of some form of a commission or authority in which the members were appointed by their respective governing bodies. The sponsors' lack of experience in pavement-related issues often created problems. In some situations, sponsors did not request funding for projects soon enough, which resulted in much more extensive work being required when the work was finally identified and scheduled. In other cases, work was scheduled sooner than necessary. Because the department had no easy way to review pertinent pavement condition information when evaluating pavement projects, the sponsors' requests were normally granted if the funding was available.

Implementation of Maintenance Program

A very successful pavement-related effort, the VDOA Airport Maintenance Program, was initiated in 1980. The program was started in an effort to discourage airport sponsors from purposely allowing a pavement to deteriorate through lack of timely maintenance. The FAA does not currently provide funds for pavement maintenance activities; rather, it depends upon airport sponsors to fund and conduct these activities. However, the FAA does provide funding for major pavement rehabilitation and reconstruction. For this reason, sponsors often perceive it to be in their best interest to forgo any maintenance activities and wait until the pavement deteriorates to a point where federal funding can be obtained.

VDOA recognized this as a very expensive management approach. Timely application of the appropriate maintenance activities can significantly increase the life of a pavement for a relatively small investment. VDOA is committed to this program, and the amount of funding provided for pavement maintenance through the Airport Maintenance Program has grown steadily over the past 14 years.

Before implementation of the PMS and the periodic visual pavement inspections, the VDOA depended upon the sponsor to request funding from the Airport Maintenance Program. The department did not have the information readily available to evaluate the timing or appropriateness of the type of maintenance proposed by the sponsor. In addition, VDOA had no way of knowing when an airport was in need of pavement maintenance when it was not requested by the sponsor. Further, the department did not collect the historical condition information and work history information necessary to evaluate which maintenance techniques and materials were working well within the commonwealth.

INITIAL IMPLEMENTATION OF VIRGINIA'S AVIATION PMS

In 1990, VDOA contracted with ERES Consultants, Inc. (ERES) for the implementation of a comprehensive PMS for airfield pavement evaluation and management. Sixty-one commercial, reliever, and general aviation airports were included in the initial study. The PMS implemented by the team members was ERES' Decision Support Software (DSS).

The work performed to meet the project objectives included gathering information pertaining to pavement history, defining the pavement network, conducting visual condition surveys, and establishing a PMS data base. Maintenance and repair cost estimates and prioritization schemes were integrated into the PMS software, and computerized maps showing network layouts and condition ranges were developed and linked to the PMS. Individual airport reports were prepared, the PMS installed, and training conducted. The initial project was completed in 1991.

Records Review

Prior to conducting field work, the project team reviewed existing records to determine the pavement structure and age. These records included as-built construction records, airport layout plans, and FAA 5010 Airport Master Records. Local airport officials were contacted to obtain information if the records were incomplete or unavailable. The information collected was used to divide the airport pavements into distinct pavement sections and to identify pavement performance trends on which future maintenance and rehabilitation requirements could be based.

Pavement Network Definition

The next task involved dividing the pavements at each airport into units referred to as facilities, sections, and sample units, according to procedures outlined in FAA Advisory Circular (AC) 150/5380-6. A facility is a single entity that serves a distinct function. For example, a runway is considered a facility because it serves a single function (allowing aircraft to take off and land). On an airfield, a facility typically represents an entire runway, taxiway, or apron.

Because of the disparity of characteristics that can occur throughout a facility, it is further subdivided into units called sections. A section is a portion of the pavement that has uniform construction history, pavement structure, traffic patterns, and condition throughout its entire length or area. Sections are used as a management unit for the selection of potential maintenance and rehabilitation projects. The subdivision of facilities into sections is one of the most important tasks conducted during the implementation of the PMS. The best guideline to use in deciding the location of section breaks is to think of the section as the "repair unit," or a portion of the pavement that will be managed independently and evaluated separately for pavement maintenance and rehabilitation.

During the actual survey, it may be necessary to define additional section divisions if there is a definite change in condition or surface. Pavement sectioning should account for differences that will affect pavement performance over time. On pavements receiving heavy loads, it is important to separate heavily trafficked areas from nontrafficked or lightly trafficked areas, because the deterioration patterns associated with these areas may be markedly different. When defining the pavement sections, it is extremely important to exercise diligence, as poor sectioning can lead to erroneous results. The value of any PCI survey is dependent directly on the successful completion of this task.

Pavement sections are further subdivided into sample units for inspection purposes. FAA AC 150/5380-6 states that "a sample unit for jointed rigid pavement is approximately 20 slabs; a sample unit for flexible pavement is an area of approximately 5,000 square feet" (*2*). To determine an overall assessment of the network pavement condition and to identify sections in need of repair within the planning period, not all sample units need be inspected. A network sampling rate that is acceptable to the agency is normally used. In areas that have experienced rapid deterioration or high traffic volumes, a high-density inspection rate may be recommended. Additionally,

localized areas of weakness may be selected for a more comprehensive evaluation.

For Virginia's PMS to work efficiently, some unique identifiers were added to the data base. The facility numbers were designed to assist in identification of the pavement area. The first character is either an A, R, or T (for apron, runway, or taxiway). The second and third characters are used to identify the pavement section. The last two characters represent an airport code that is unique for each airport and is used to avoid duplication of a facility number throughout the 61 airports.

Pavement use, rank, zone, and category were defined for each pavement section. Pavement use refers to the primary function a section serves and is always a runway, taxiway, or apron. A pavement rank of "primary" or "secondary" has been assigned to all taxiway and apron pavements. At airports with multiple runways, runways are identified as either "primary" or "secondary." The Virginia Department of Aviation provided assistance in assigning pavement rank to sections.

Zones are used to separate the individual airports within the data base. The FAA airport designator has been used to define each airport's zone. Finally, categories are used to identify the region of the state in which an airport is located, as well as whether the airport is classified commercial, reliever, or general aviation.

Map Preparation

Maps were prepared for all pavement areas to be inspected and included in the PMS. These maps provide important pavement dimensions and the location of feature, section, and sample unit boundaries. The maps were generated using a computer-aided design (CAD) package, because computer-generated maps are far more flexible and can present greater amounts of information than their conventional, manually drawn counterparts. Furthermore, these programs possess a powerful layering capability. Once a base map is created, layers can be generated that use the base map to show the location of any desired feature, such as lighting and landing systems, drainage structures, and so forth.

Virginia's PMS links each CAD airport map to the data base, thus allowing information stored in the data base and analysis results to be displayed on these maps. As a tool, one of the most important functions of a PMS is to convey pavement needs to the government body that approves funding. The ability to create high-quality maps and graphics with the PMS assists VDOA in communicating pavement-related needs to the FAA, the Board of Aviation, and the public, making it clear to even those unfamiliar with pavements that funding levels can have a dramatic impact on current and future pavement condition and can significantly affect future expenditures.

Pavement Condition Index Survey

The PCI procedure, outlined in FAA AC 150/5380-6 for airfield pavements, and further defined in the ASTM Standard D5340, is used by the aviation industry and the military to assess current airport pavement conditions. The PCI was developed to provide engineers with a numerical value indicating overall pavement condition. The final calculated PCI value is a number from 0 to 100, with 100 representing a pavement in excellent condition.

The airport PCI surveys were conducted using the standardized method outlined in AC 150/5380-6. This manual defines distress types and severities and specifies how to measure and record the distress. Specially trained and highly experienced engineers and engineering technicians were used to complete this task, because accurate condition ratings are imperative for identifying appropriate maintenance and repair alternatives.

It was important to inspect all of the pavements within each airport, including new pavements and those in very poor condition, to establish the rate and cause of deterioration. This information was vital during the development of pavement deterioration curves and during the determination of suitable maintenance and repair alternatives.

The survey crews consisted of two team members. To check the validity of the data collected, the quality assurance approach used was to require that at least 5 percent of the sample units be inspected independently by each inspector. During the PCI survey, 35-mm photographs of each section were taken. These photographs provided an overview of typical conditions and covered any unusual or severe distress identified in the field.

PMS Software Implementation and Data Base Development

All information collected was input into a PMS. An interim software delivery included the Corps of Engineers PMS, Micro PAVER, supplemented by ERES's software. This system was later converted to ERES's PMS software, DSS.

PMS Customization

Once the PMS data base had been established, the system was customized for the department. Deterioration models were established for similar types of pavements based on the results of the PCI field surveys. Maintenance and rehabilitation alternatives for use at the airports, along with associated unit costs, were identified. Decision trees were constructed that defined the situations under which each alternative was applicable. Finally, a prioritization scheme was developed with the department to identify the highest priority pavements for the allocation of available funding. VDOA's engineers were consulted throughout this customization process to ensure that the annual maintenance plans and the long-range rehabilitation programs produced by the PMS actually reflect their management philosophy as it is practiced.

Pavement Condition Prediction

Pavement management involves forecasting needs based on pavement performance predictions. By projecting the rate at which the pavement condition will change over time, a meaningful life-cycle cost analysis can be performed to compare the costs of various maintenance and rehabilitation alternatives. In addition to identifying the most economical repair alternative through condition prediction modeling, the optimal time for applying treatments can be estimated. Typically, the optimal repair time is the point at which a gradual rate of deterioration begins to increase at a much faster rate. It is critical to identify this point in time to avoid higher maintenance and rehabilitation costs caused by excess deterioration.

Many methods for predicting condition are available. DSS uses an advanced modeling technique that involves organizing the pavement network into "families" of pavements that perform in a simi-

lar manner (*3*). For example, asphalt pavements that have never received an overlay and are subjected to heavy traffic may be grouped into a family. If the PMS is being implemented for a state, a further separation of families may be based on geographic location. By plotting the condition and age of all pavement sections that fit within a given family description, a curve can be generated that represents the performance trends of that particular family.

A meeting was held during the initial implementation project in 1990 during which decisions pertaining to the customization of the software were made. One of the first steps was to divide the network into families of pavements, which were developed to establish deterioration curves that reflect the actual performance of these pavement types. The families distinguished among pavement use, pavement type, traffic levels, and geographic location. These performance models were revised after the pavements were reinspected in 1993 and more data points were available. The revised performance models are provided in Table 1.

Selection of Feasible Repair Alternatives

Once an acceptable method for predicting performance was in place in the PMS, the next step was to define a rehabilitation decision matrix. DSS permits the user to define feasible rehabilitation treatments. The user sets the condition level at which each treatment is considered feasible, as well as any other factors that would influence the selection of a treatment. The objective of this type of program is to develop an automated version of the thought process used to identify feasible rehabilitation strategies. The analysis program uses this information to determine an optimized and prioritized project list that contains only agency-specific feasible rehabilitation options.

During a meeting with VDOA, the applicability of various rehabilitation types in different situations and to repair different types of pavements was discussed, as were the impacts on condition and typical costs. This step in the customization process ensures that the recommended treatments are directly applicable to the existing techniques used by the department. Table 2 contains the VDOA treatment matrix.

Selection of Most Desirable Repair Alternative

The next analysis routine that a PMS needs to function is one that is used to select a single rehabilitation method from a list of feasible alternatives to repair a given section. DSS uses a benefit-cost analysis that evaluates not only the additional pavement life anticipated by the application of a treatment but also the change in condition provided by that treatment. The result is a benefit-cost ratio that can be used to rank treatments based on their overall cost-effectiveness. DSS allows the selections indicated by the program to be overridden if political or managerial factors prohibit the selection of the recommended treatment, or if projects were already "in the pipeline" prior to implementing the program.

Preparation of Prioritization Scheme

A prioritization scheme was also developed during this project. The priority matrix is used to assist in ranking pavement rehabilitation alternatives according to the practices used by VDOA. This allows the department to weight certain projects more heavily than others based on the pavement section's importance to the Virginia aviation system. Table 3 contains the VDOA prioritization matrix.

Data Analysis

The PMS was used to prepare a multiyear CIP and an annual maintenance program for each airport in the data base. A benefit-cost

TABLE 1 Pavement Performance Models

Pavements Modeled	Mathematical Equation of Curve
AC Aprons at Commercial and Reliever Airports	$-0.00022754\ age^4 + 0.01484700\ age^3 - 0.24818000\ age^2 - 1.580\ age + 100$
AAC Pavements at Commercial and Reliever Airports	$-0.00079944\ age^4 + 0.02846000\ age^3 - 0.29900000\ age^2 - 0.238\ age + 100$
APC Pavements at Commercial and Reliever Airports	$+0.00014068\ age^4 - 0.01534000\ age^3 + 0.42896000\ age^2 - 4.690\ age + 100$
PCC Pavements at Commercial and Reliever Airports	$-0.00016512\ age^4 + 0.00912700\ age^3 - 0.12000000\ age^2 - 0.990\ age + 100$
AC Runways at Commercial and Reliever Airports	$-0.00025938\ age^4 + 0.01388200\ age^3 - 0.17810000\ age^2 - 1.89\ age + 100$
AC Taxiways at Commercial and Reliever Airports	$-0.00021172\ age^4 + 0.01567000\ age^3 - 0.30786000\ age^2 - 1.070\ age + 100$
AAC Aprons at General Aviation Airports	$-0.00062051\ age^4 + 0.02678600\ age^3 - 0.40332000\ age^2 - 0.092\ age + 100$
AC Aprons at General Aviation Airports	$-0.00022547\ age^4 + 0.01149400\ age^3 - 0.12942000\ age^2 - 2.400\ age + 100$
APC Aprons at General Aviation Airports	$+0.00004399\ age^4 - 0.00450000age^3 + 0.16443000\ age^2 - 4.680\ age + 100$
PCC Pavements at General Aviation Airports	$+0.00000833\ age^4 + 0.00095900\ age^3 - 0.1130200\ age^2 - 0.051\ age + 100$
AC Runways at General Aviation Airports	$-0.00033938\ age^4 + 0.01969400\ age^3 - 0.2867000\ age^2 - 1.580\ age + 100$
AAC Runways and Taxiways at General Aviation Airports	$-0.00000766\ age^4 + 0.00095000\ age^3 - 0.10054000\ age^2 - 0.900\ age + 100$
APC Runways and Taxiways at General Aviation Airports	$+0.00012715\ age^4 - 0.01354800\ age^3 + 0.44581000\ age^2 - 6.540\ age + 100$
AC Taxiways at General Aviation Airports	$-0.00022197\ age^4 + 0.00955900\ age^3 - 0.04599000\ age^2 - 3.080\ age + 100$

AC = asphalt concrete; PCC = portland cement concrete; APC = asphalt overlay on PCC; AAC = asphalt overlay on AC

TABLE 2 Treatment Matrix

Treatment	PCI	Surface Type	Deducts due to Load	Pavement Use	Unit Cost (sq m)
Slurry and Crack Seal	75 - 90	AC, AAC, APC	≤ 10%	All General Aviation	$0.97
Slurry and Crack Seal	75 - 90	AC, AAC, APC	≤ 10%	Commercial/Reliever Aprons	$0.97
AC Overlay and Seal Coat	40 - 75	All	≤ 50%	Aprons	$11.84
AC Overlay	40 - 80	All	≤ 50%	Runways/Taxiways	$9.47
Mill, Overlay, and Seal Coat	40 - 75	AC, AAC, APC	50 - 75%	Aprons	$11.84
Mill and Overlay	40 - 80	AC, AAC, APC	50 - 75%	Runways/Taxiways	$9.47
Total AC Reconstruction and Seal Coat	0 - 60	All	> 75%	Aprons	$16.75
Total AC Reconstruction	0 - 60	All	> 75%	Runways/Taxiways	$14.32
Total PCC Reconstruction	0 - 60	All	> 75%	All	$22.71
Partial AC Reconstruction and Seal Coat	0 - 40	All	≤ 50%	Aprons	$14.32
Partial AC Reconstruction	0 - 40	All	≤ 50%	Runways/Taxiways	$11.95

AC = asphalt concrete; PCC = portland cement concrete; AAC = asphalt overlay on AC; APC = asphalt overlay on PCC

ratio is determined for each feasible alternative, and the highest ranking ratio is selected as the recommended treatment for that particular section. Benefit is determined as the area between the section's deterioration curve, assuming no repair is done, and the new deterioration curve for the section following repair. Costs are determined on a life-cycle cost basis so that alternatives with differing useful lives can be evaluated on an equal basis. Based on user input budget estimates and the department's prioritization scheme, the ratios are ranked for each of the years in the budget analysis.

The distress data, treatment matrix, priority matrix, maintenance policies, and budget parameters are all used during this analysis. Because the PMS can accommodate multiple treatment, priority, budgeting, and maintenance alternatives, VDOA can quickly and easily analyze different scenarios, such as what effect a reduction in pavement-related funding will have on future pavement condition levels and funding requirements.

Report Preparation

A separate report was prepared for each airport and delivered to VDOA in August 1991. These reports document the work that was accomplished at each airport and present the field survey results. Each airport report also includes a network map, showing the location of all sections and sample units, and a color-coded map showing the pavement condition rating of each section. Color photographs of typical distress types were included in these reports. A summary report presenting the multiyear CIP and annual maintenance program was also prepared.

PMS Installation and Demonstration

The PMS was installed at VDOA. An important consideration in the PMS implementation process is the proper training of the individuals who will be using the system. At the completion of the training process, VDOA personnel had all the skills necessary to operate the program efficiently and effectively. Training included formal sessions that covered topics such as the PCI procedure, PMS concepts, and so forth. More importantly, training was ongoing throughout the implementation process.

Update of Virginia's Aviation PMS

The VDOA PMS was updated during 1993. Sixty airports were reinspected using the PCI procedure. The performance models, treatment matrix, priority matrix, and maintenance policies were revised at that time. The PMS data base and maps were updated and revised; a comprehensive analysis of the collected data was conducted; and reports were prepared. A refresher course in the use of the PMS program was conducted.

The timing of the update was excellent. The 1994 Airport Improvement Program (AIP) reauthorization legislation enacted by Congress has mandated that airport sponsors have a pavement maintenance management program in place as a condition to receiving federal funding for pavement rehabilitation and reconstruction projects. It is expected that the VDOA PMS will fully meet this requirement.

RESULTS OF PMS IMPLEMENTATION

Table 4 summarizes the results of the PCI surveys conducted in 1990 and 1993. As this table indicates, the overall network improved significantly during that time period, with runways showing the most dramatic improvement. Table 5 provides the PCI survey results broken out into pavement condition ranges.

Figure 1 depicts the total expenditures for pavement maintenance made by the department before and after the PMS implementation. A modest increase in maintenance funding has been obtained since the implementation of the PMS. Prior to PMS implementation, an annual average of $244,000 was spent on pavement maintenance. This amount increased to an annual average of $313,000 after the PMS was implemented.

TABLE 3 Prioritization Matrix

Condition Range	Air Carrier/General Aviation Primary Runways	Reliever Primary Runways and General Aviation Primary Taxiways	Air Carrier/Reliever Primary Taxiways and General Aviation Aprons	Air Carrier/Reliever Aprons and General Aviation Secondary Runways	Air Carrier Secondary Runways and General Aviation Secondary Taxiways	Reliever Secondary Runways	Air Carrier/Reliever Secondary Taxiways
Excellent	6	12	18	24	30	36	42
Very Good	5	10	15	20	25	30	35
Good	4	8	12	16	20	24	28
Fair	3	6	9	12	15	18	21
Poor	2	4	6	8	10	12	14
Very Poor/Failed	1	2	3	4	5	6	7

TABLE 4 Area-Weighted PCI Values

Year	Runways	Taxiways	Aprons	Network
1990	76	77	78	76
1993	84	82	80	82

TABLE 5 PCI for Virginia's Airport network in 1990 and 1993

PCI Range	% Area Runways		% Area Taxiways		% Area Aprons	
	1990	1993	1990	1993	1990	1993
86 - 100	42	55	40	49	45	19
71 - 85	30	26	26	28	21	29
56 - 70	11	14	19	11	20	33
41 - 55	10	2	9	3	8	9
26 - 40	5	1	5	8	3	5
11 - 25	2	2	1	1	3	3
0 - 10	0	0	0	0	0	2

Figure 1 also shows the department's total expenditures for pavement rehabilitation projects before and after the PMS implementation. Overall, the expenditures made for pavement rehabilitation prior to the implementation of the PMS ($3,170,250 annually) have remained almost unchanged since the implementation of the PMS ($3,203,000 annually).

Project rehabilitation expenditures initially increased after the implementation of the PMS but declined rapidly beginning in 1994. As a result of the initial study, it was recognized that many pavements did not meet the department's expectations; substantial funding was required in 1992 and 1993 to rehabilitate those pavements. Once those projects were completed, a lower level of funding was needed to maintain the pavement network. This situation is expected to continue as long as timely maintenance continues to be applied at the airports.

VDOA uses the PMS data base and analysis routines to evaluate sponsor requests for maintenance and rehabilitation funding. In several cases during the past 3 years, the PMS helped the department identify inappropriate requests, determine optimal timing of project work, and identify projects that should have been requested but had not been. In one case, an airport sponsor requested a major runway rehabilitation project. Prior to the implementation of the PMS, this request would have been granted if funding was available based primarily on the airport sponsor's justification. Using the PCI data contained in the PMS data base, VDOA was able to determine that the type of deterioration exhibited by the runway could probably be corrected with a less major repair. Further project-level investigation of the runway determined that this was, in fact, the case. In another situation, VDOA was able to use the PMS to identify a runway that required immediate attention, although the airport sponsor had not requested funding for its repair.

Through the use of the system, VDOA is able to better allocate limited resources and assist the sponsors in managing the airport pavements. In addition, VDOA now has a tool to provide objective prioritization of pavement projects. The program allows VDOA to quickly analyze "what if" scenarios to respond to the Board of Aviation's frequent questions about the airport network, such as "What if funding is reduced by 10%?" or "What if that project is delayed for 5 years? What will be the impact on the condition of the pavement due to that delay, and how will it affect feasible repair alternatives at the end of the delay?" Analysis that used to take VDOA many days can now be performed quickly, enabling the department to be more responsive to the FAA, the Board of Aviation, and the public.

SUMMARY

The Virginia Department of Aviation has used a state-of-the-art PMS for the past 4 years. It contains an up-to-date data base and can be easily operated by the department's staff. Through this program, VDOA is able to select specific rehabilitation methods based on

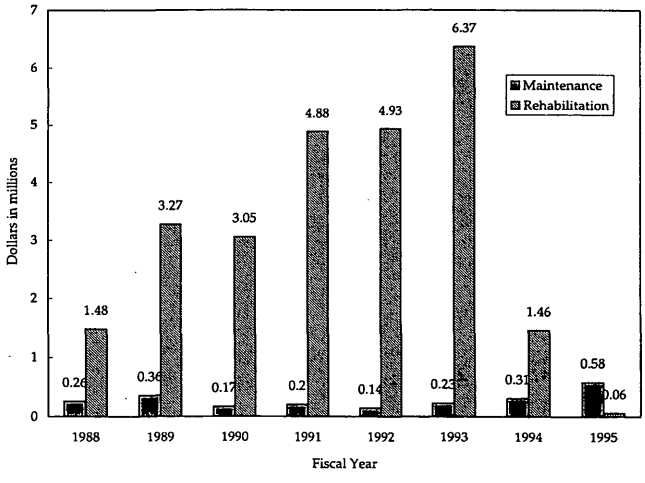

FIGURE 1 Pavement expenditures.

both engineering and economic considerations. In addition, the program helps the commonwealth and the FAA prioritize pavement rehabilitation work.

Through the program, VDOA can demonstrate to the Board of Aviation, the legislature, the FAA, and the public that it is managing the pavements at the public airports in a fiscally responsible manner. Because the system establishes a time frame when rehabilitation work should take place, it permits the better budgeting and allocation of funds. In addition, it enables VDOA to better use its existing Airport Maintenance Program, which provides funds for extending the life of pavements through routine maintenance.

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