

AUGUSTA REGIONAL AIRPORT AT BUSH FIELD

PAVEMENT EVALUATION REPORT

JULY 2002



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PAVEMENT EVALUATION REPORT

Introduction

In 2001, the Georgia Department of Transportation (GDOT), Aviation Programs, retained Wilbur Smith Associates, assisted by Applied Pavement Technology, Inc. (APTech), to update the Georgia Aviation System Plan (GASP). APTech's portion of the project involved updating the 1998 State Airport Pavement Management System (APMS) by reevaluating the 94 general aviation airports included in the original APMS plus incorporating eight commercial service airports. The ultimate goal of this project was to provide the airports and the State with the pavement information and analytical tools that can help them identify pavement related needs, optimize the selection of projects and treatments over a multi-year period, and evaluate the long-term impacts of their project priorities.

As part of the GASP Update, an evaluation of the pavement conditions at Augusta Regional Airport at Bush Field was conducted in 2001. The results of this evaluation are presented within this report and can be used by GDOT, the Federal Aviation Administration (FAA), and Augusta Regional Airport at Bush Field to monitor the condition of pavements and to identify, prioritize, and schedule pavement maintenance and rehabilitation actions at the airport.

Pavement conditions were assessed using the Pavement Condition Index (PCI) procedure – the industry standard in aviation for visually assessing the condition of pavements. During a PCI inspection, inspectors identify signs of deterioration on the surface of the pavement. The types, severities, and amounts of distress present in a pavement are quantified during the pavement survey. This information is then used to develop a composite index (PCI number) that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent).

The PCI number provides an overall measure of condition and an indication of the level of maintenance or rehabilitation work that will be required to maintain or repair a pavement. This number also provides an objective means of prioritizing and scheduling pavement rehabilitation work. Further, the individual distress information, such as cracking or rutting, provides insight into what is causing the pavement to deteriorate. These factors can then be used to select the appropriate maintenance or rehabilitation action to correct the problem. PCI data also serve as the basis for a computerized APMS – a tool that is used to track pavement condition, identify pavement repair needs, and develop prioritized maintenance and rehabilitation programs with associated schedules and budgets.

The importance of identifying not only the best repair alternative, but also the optimal time of repair, is illustrated in Figure 1. This figure shows that during the first 75 percent of the life of a pavement, approximately 40 percent of the pavement deterioration takes place. After this point, the pavement deteriorates much faster. The financial impact of delaying repairs until the second drop in condition can mean repair expenses 4 to 5 times higher than repairs triggered over the first 75 percent of the pavements life. By evaluating the condition of pavements, and using an

APMS to project future pavement condition, the most economical time to apply pavement maintenance and rehabilitation can be identified.

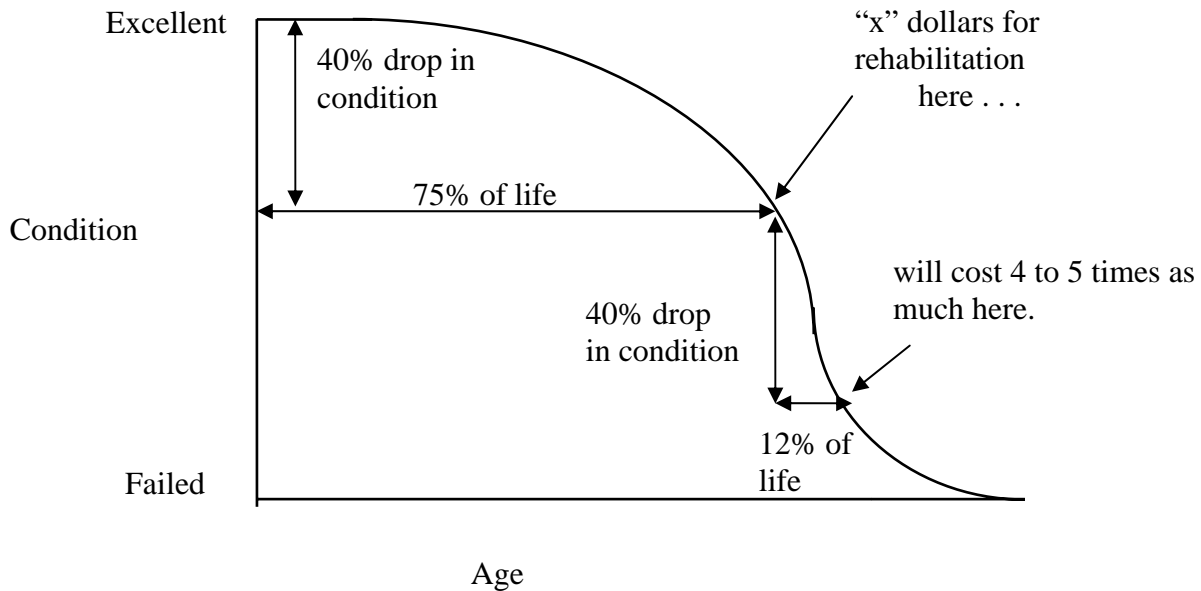


Figure 1. Pavement condition versus cost of repair.

This report contains the results of the 2001 pavement evaluation, as well as a diskette containing the Micro PAVER pavement management software database developed during this project.

Scope of Work

This project included the collection of pavement history information, the development of CAD maps, the evaluation of current pavement condition, and the development of a computerized APMS. The APMS was then used to prepare a 5-year pavement maintenance and rehabilitation program at the state level for the GDOT and the FAA to use as a planning tool.

Individual reports, such as this one, were prepared for each of the project airports to communicate the results of the pavement inspections. A statewide analysis report and an executive summary report were also developed. The statewide analysis report presents the overall results of the study and provides detailed recommendations for future maintenance and rehabilitation actions at the airports. The executive summary presents an overview of the current condition of the State's airports and a summary of the recommended 5-year maintenance and rehabilitation program.

Project Results

Pavement Inventory

Augusta Regional Airport at Bush Field has over 4,698,059 square feet of pavement. Figure 2 shows the area of the pavement system, broken out by pavement use (runway, taxiway, and apron). This figure also shows the average age of the pavements.

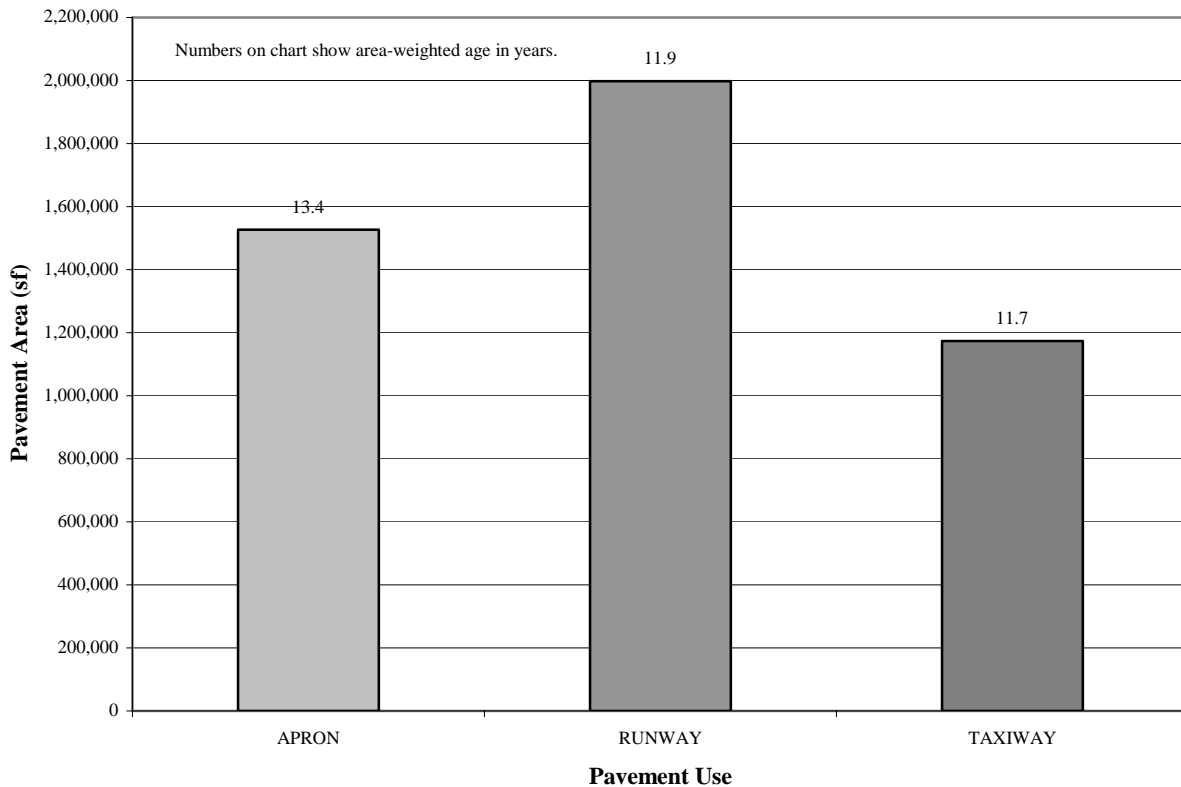


Figure 2. Pavement inventory.

Figure 3 is a network definition map that identifies the pavements at Augusta Regional Airport at Bush Field evaluated during this project. This map shows how the pavement network was divided into branches, sections, and sample units for pavement management purposes. It also shows the nomenclature used in the Micro PAVER pavement management database to identify the different pavement areas. Finally, the map summarizes the construction history information compiled during the records review and identifies the areas inspected during the visual survey.

Figure 3. Network Definition Map (11 x 17 except for very large airports that need larger map folded into a map sleeve.

A branch is a single entity that serves a distinct function. For example, a runway is considered a branch because it serves a single function (allowing aircraft to take off and land). Taxiways and aprons are also separate branches.

A branch may be further divided into sections. Traditionally, sections are defined as parts of the branch that share common attributes, such as cross-section, last construction date, traffic level, and performance. Using the traditional approach, if a runway was built in 1968 and then extended in 1984, it would be comprised of two separate sections. A modified approach to defining pavement sections has become increasingly popular with state aviation agencies in recent years and has been adopted by GDOT. The basic premise of this approach is that the section is considered the management unit of the APMS, and that it should represent a pavement area where it is realistic to expect that pavement maintenance or rehabilitation would be undertaken. For example, if a runway was built in 1968 and then extended in 1984, in the database this runway would be represented by a single section, even though there are two distinct construction periods. This is because in the future if repair work is scheduled for that runway it is probable that it will be programmed for the entire runway and not just a portion of it.

To estimate the overall condition of each pavement section, each section is subdivided into sample units. Portions of these sample units are then evaluated during pavement inspections and this information is extrapolated to predict the condition of the section as a whole.

PCI Procedure

APTech inspected the pavements at Augusta Regional Airport at Bush Field using the PCI procedure. This procedure is described in FAA AC 150/5380-6 and ASTM Standard D5340. A network-level sampling rate was used during the inspection, and the sample units inspected are identified on the network definition map shown in Figure 3.

The PCI provides a numerical indication of overall pavement condition, as illustrated in Figure 4. The types and amounts of deterioration are used to calculate the PCI value of the section. The PCI ranges from 0 to 100, with 100 representing a pavement in excellent condition. It should be noted that a PCI value is based on visual signs of pavement deterioration and does not provide a measure of structural capacity.




Typical Pavement Surface	PCI
	100
	60
	5

Figure 4. Visual representation of PCI scale.

In general terms, pavements with a PCI of 60 to 100 that are not exhibiting significant load-related distress will benefit from preventive maintenance actions, such as crack sealing and surface treatments. Pavements with a PCI of 40 to 60 may require major rehabilitation, such as an overlay. Often, when the PCI is less than 40, reconstruction is the only viable alternative due to the substantial damage to the pavement structure. Figure 5 illustrates how the appropriate repair type varies with the PCI of a pavement section.

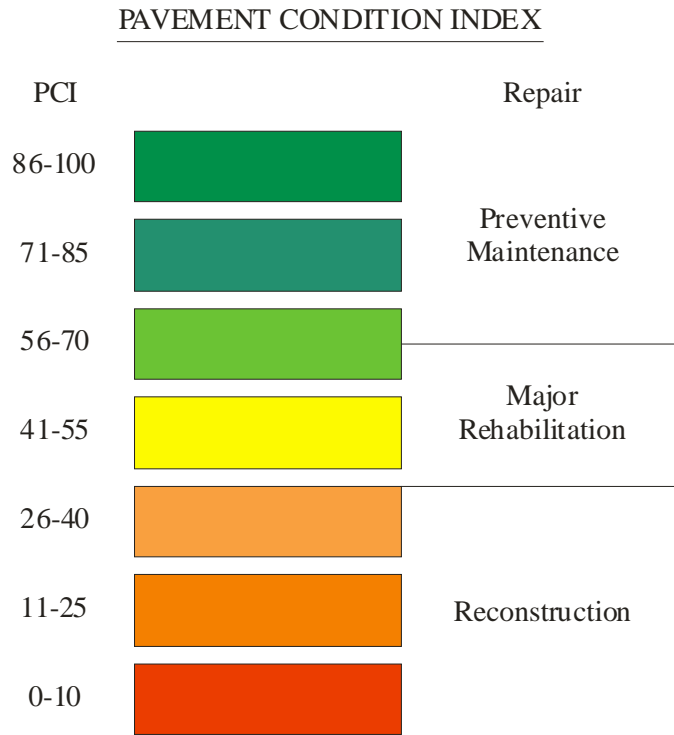


Figure 5. PCI versus repair type.

The types of distress identified during the PCI inspection provide insight into the cause of pavement deterioration. PCI distress types are characterized as load-related (such as alligator cracking on hot-mix asphalt [HMA] pavements or corner breaks on portland cement concrete [PCC] pavements), climate/durability-related (such as weathering [climate-related on HMA pavements) and D-cracking [durability-related on PCC pavements]), and other (distress types that cannot be attributed solely to load or climate/durability). Understanding the cause of distress helps in selecting a rehabilitation alternative that corrects the cause and thus eliminates its recurrence.

Appendix A contains tables for asphalt and concrete pavements indicating the typical types of distresses that may be identified during a PCI survey, the likely cause of each distress type, and feasible maintenance strategies for addressing each distress type.

Inspection Comments

The inspection of Augusta Regional Airport at Bush Field was completed on January 19th, 2002. Thirty sections were defined during the inspection. At the time of inspection, several areas adjacent to Runway 17-35 were undergoing rehabilitation. It was assumed that when complete, these areas would be free of any distress.

Runway 17-35

Three sections running full length were defined in Runway 17-35.

Sections R1735AGR-10W, R1735AGR-10C, and R1735AGR-10E are all in good condition. Moderate amounts of low-severity longitudinal and transverse (L&T) cracking were found throughout the sections primarily at paving lane joints. Smaller quantities of L&T cracking were observed at medium-severity due to the existence of secondary cracking associated with the primary L&T cracks. Swelling was found throughout the sections associated with L&T cracking. In many areas early stages of raveling and weathering were observed that did not yet meet the ASTM criteria for recording the distress.

Runway 8-26

Nine sections were defined during the inspection of Runway 8-26.

Sections R0826AGR-10N, R0826AGR-10C, and R0826AGR-10S are located on the western end of the runway near Taxiway C. All three sections were recently rehabilitated and found to be free from any distress.

Sections R0826AGR-20N, R0826AGR-20C, and R0826AGR-20S are located between Runway 17-35 and Taxiway C. These sections are in fair condition with significant quantities of low and medium-severity L&T cracking observed. Raveling and weathering was found at low-severity over nearly the entire pavement surface. Finally, areas were found on the centerline where secondary cracking patterns formed an area greater than one foot in width. When this situation exists, the pavement is essentially failed and alligator cracking was recorded.

Sections R0826AGR-30N, R0826AGR-30C, and R0826AGR-30S are located east of Runway 17-35. These sections are in similar condition to sections R0826AGR-20N, R0826AGR-20C, and R0826AGR-20S with smaller amounts of raveling and weathering being found.

Taxiway A

Two sections were defined in Taxiway A. TAAGR-10 is located adjacent to Runway 17-35 and was in the process of being rehabilitated during the inspection. It assumed that when finished the section will be free of any distress. TAAGR-20 runs from the approach end of Runway 17 to Taxiway B. This section is in good condition with moderate amounts of low-severity L&T cracking and raveling and weathering observed. Isolated amounts of swelling were found associated with L&T cracking. It appears that the paving lane edges were rolled over creating a vertical displacement at the paving lane joints. These areas were not very wide and were not recorded as depressions. Approximately 35 percent of the L&T cracking observed was associated with the paving lane joints.

Taxiway B

Two sections were defined in Taxiway B. TBAGR-10 runs from the edge of the Main Apron to just short of Runway 17-35. This section is in excellent condition with small quantities of L&T cracking observed. Isolated amounts of swelling were also found throughout the section.

TBAGR-20 is located adjacent to Runway 17-35 and was in the process of being rehabilitated during the inspection. It assumed that when finished the section will be free of any distress.

Taxiway C

Two sections were defined in Taxiway C. TCAGR-10 runs from Taxiway B south to a point just past Taxiway D. This section is good condition with moderate amounts of low-severity L&T cracking found throughout the section. Alligator cracking was observed at the western edge of the taxiway. It appears that the area of alligator cracking exists at the point where the edge of the taxiway overlaps the edge of older apron pavement. Nearly all of the L&T cracking found in the section is associated with paving lane joints. TCAGR-20 runs from the point where TCAGR-10 stops to the approach end of Runway 35. This pavement was recently rehabilitated and was found to be free of any distress.

Taxiway D

One section was defined in Taxiway D. TDAGR-10 is in excellent condition with small quantities of low-severity raveling and weathering being found throughout the section. This distress was found primarily at the paving lane joints. Isolated small amounts of low-severity L&T cracking were also found.

Taxiway E

Two sections were defined in Taxiway E. TEAGR-10 is located between Taxiway C and Runway 17-35 and is in poor condition. Large amounts of low and medium-severity L&T and block cracking were observed. Medium-severity raveling and weathering was also found covering nearly the entire sections surface. TEAGR-20 is located east of Runway 17-35 and is in excellent condition. Moderate amounts of low-severity L&T cracking were found throughout the section.

Main Apron

The Main Apron was divided into five sections. Both A01AGR-10 and A01AGR-20 are located at the northern end and are in excellent condition. Small amounts of low-severity L&T cracking were observed in these sections. A01AGR-30 is in fair condition with substantial amounts of low-severity L&T and block cracking observed throughout the section. Low-severity raveling and weathering was found over the entire surface of the section. Finally, significant quantities of swelling were observed. Periodically, PCC hard stands have been placed in the pavement for the purpose of parking commercial traffic on during loading and unloading. These hard stands are exhibiting signs of failure with multiple distresses evident in them. Since these areas are not large enough to define a separate section under ASTM criteria, they were recorded as high-severity patching in an additional sample unit. A01AGR-40 is in excellent condition with moderate amounts of low-severity L&T cracking found. Isolated areas of swelling were also observed in the section. A01AGR-50 was recently constructed and found to be free of any distress.

Garrett Aviation Apron

Two sections were defined in the Garrett Aviation Apron. AGARRETAGR-10 consists of the apron area adjacent to the Garrett Aviation main hangar. Large quantities of low-severity block and L&T cracking were found throughout the section. Smaller quantities of swelling were also observed. AGARRETAGR-20 used to be the access taxiway into the Garrett Aviation area but is now considered part of the apron area. This section was recently rehabilitated and was found to be free of any distress.

Helipad

Two sections were defined in the Helipad. AHELIAGR-10 consists of the small asphalt pavement joining the Helipad and the Main Apron. This section is in poor condition with significant amounts of medium-severity raveling and weathering found throughout. Substantial quantities of L&T cracking and depression as well as isolated amounts of swelling and bleeding were also observed. AHELIAGR-20 consists of a PCC pavement and comprises the main portion of the Helipad. This section is in excellent condition with only medium-severity joint seal damage being found.

Overall Pavement Condition

The 2001 area-weighted condition of Augusta Regional Airport at Bush Field is 80, with conditions ranging from 36 to 100 [on a scale of 0 (failed) to 100 (excellent)]. Figures 6 and 7 provide graphs summarizing the overall condition of the pavements at Augusta Regional Airport at Bush Field. Figure 8 is a map that displays the condition of the pavements evaluated. Table 1 summarizes the results of the pavement evaluation.

Appendix B presents photographs taken during the PCI inspection, and Appendix C contains a detailed inspection report. The detailed inspection report provides information on the quantity of the different types and severities of distresses observed during the visual survey.

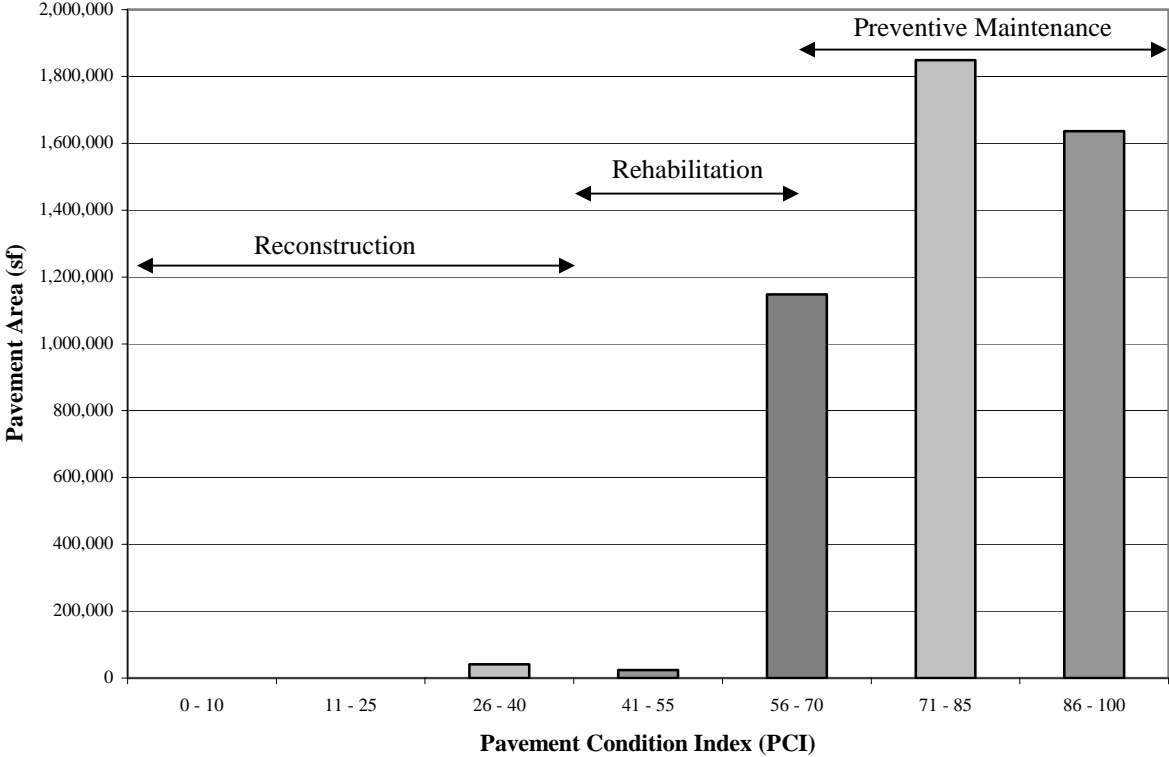


Figure 6. Condition distribution.

Numbers on chart show area-weighted age in years at the time of inspection.

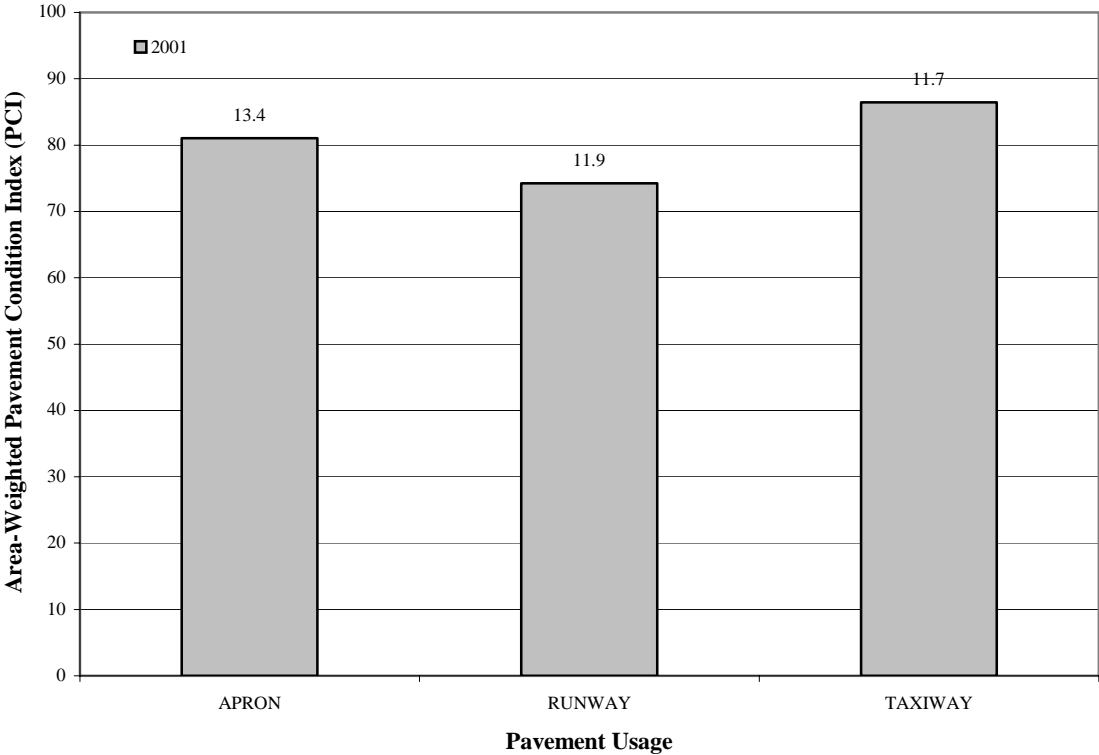
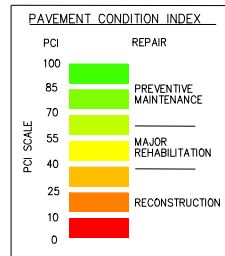
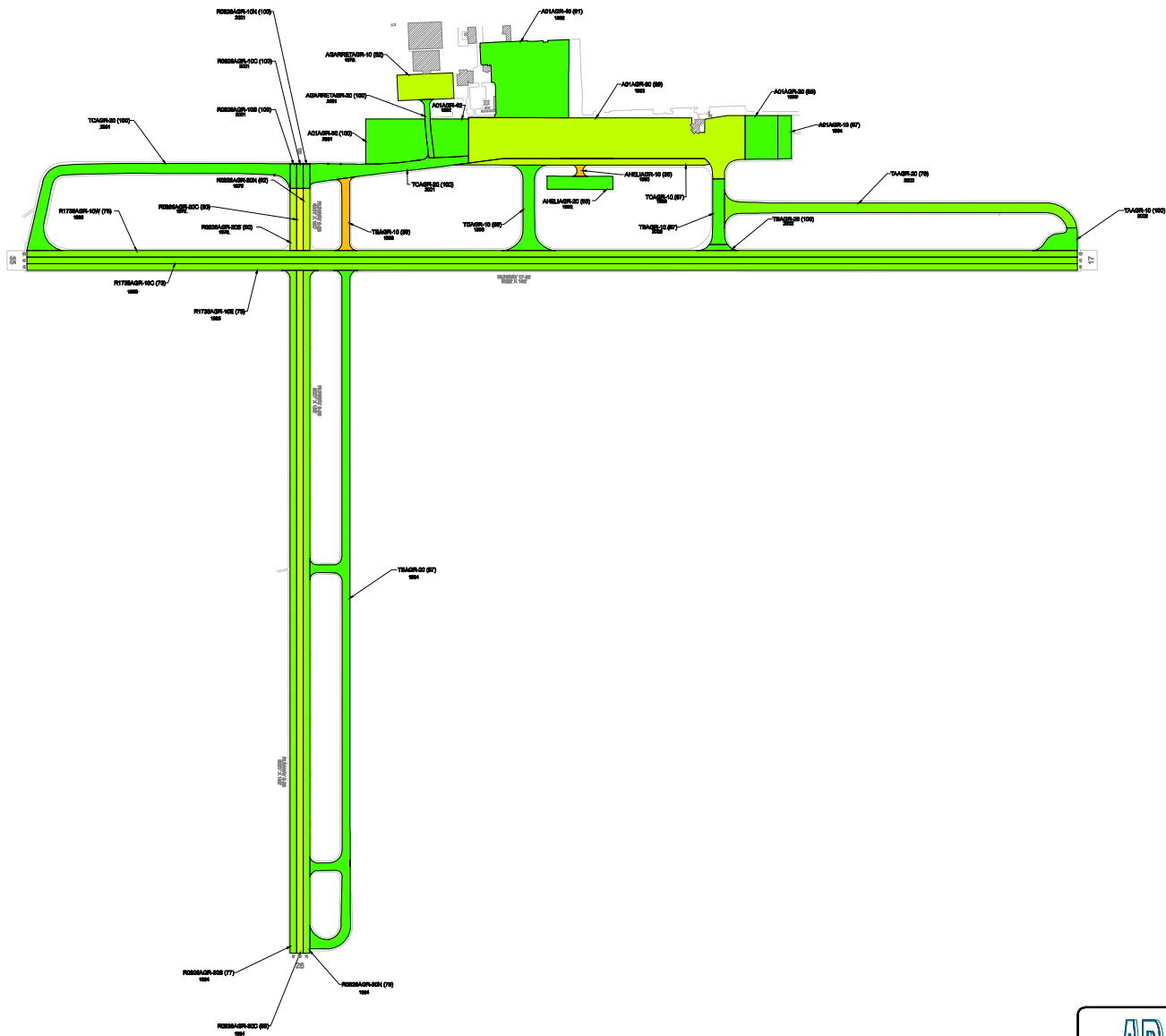


Figure 7. Condition by use.



	Georgia Department of Transportation Aviation Programs			
	PROJECT: Augusta Regional Airport at Bush Field.dwg Augusta, Georgia			
	DRAWING: Pavement Condition Index Map			
	DATE: 19-Dec-02 SCALE: 1" = 400' AUTHOR: JLB AUGUSTA REGIONAL AIRPORT AT BUSH FIELD.DWG	DATE: 19-Dec-02 SCALE: 1" = 400' AUTHOR: JLB AUGUSTA REGIONAL AIRPORT AT BUSH FIELD.DWG	PROJECT NUMBER: 00-004 REVISION: JLB DATE: 10/11/02	DRAWN BY: JLB CHECKED BY: JLB DATE: 10/11/02

Table 1. 2001 pavement inspection results.

AUGUSTA REGIONAL AIRPORT AT BUSH FIELD								
BRANCH ID	SECTION ID	SURFACE TYPE ¹	SECTION AREA (sf)	LCD ²	2001 PCI	% Distress due to:		DISTRESS TYPES ⁵
						LOAD ³	CLIMATE OR DURABILITY ⁴	
A01AGR	10	AC	33,990	1994	97	0	100	L & T CR
A01AGR	20	AC	82,500	1993	96	0	100	L & T CR
A01AGR	30	AC	670,639	1984	69	0	68	L & T CR, WEATH/RAVEL, PATCH/UT CUT, DEPRESSION, CORRUGATION, BLOCK CR, BLEEDING, ALLIGATOR CR, SWELL
A01AGR	40	AAC	429,834	1992	91	0	83	SWELL, L & T CR, PATCH/UT CUT
A01AGR	50	AC	153,031	2001	100	0	0	N/A
AGARRETAGR	10	AC	82,875	1976	62	0	91	BLOCK CR, L & T CR, SWELLING
AGARRETAGR	20	AAC	18,000	2001	100	0	0	N/A
AHELIAGR	10	AC	5,750	1990	36	0	86	WEATH/RAVEL, L & T CR, DEPRESSION, PATCHING, SWELLING, BLEEDING
AHELIAGR	20	PCC	50,000	1990	93	0	100	JT SEAL DMG
R0826AGR	10C	AAC	9,400	2001	100	0	0	N/A
R0826AGR	10N	AAC	9,400	2001	100	0	0	N/A
R0826AGR	10S	AAC	9,400	2001	100	0	0	N/A
R0826AGR	20C	AAC	23,681	1976	50	35	63	WEATH/RAVEL, SWELLING, L & T CR, ALLIGATOR CR
R0826AGR	20N	AAC	23,681	1976	62	0	100	WEATH/RAVEL, L & T CR
R0826AGR	20S	AAC	23,681	1976	60	0	100	L & T CR, WEATH/RAVEL
R0826AGR	30C	AAC	260,135	1984	68	32	68	ALLIGATOR CR, L & T CR, WEATH/RAVEL
R0826AGR	30N	AAC	260,135	1984	75	17	83	L & T CR, WEATH/RAVEL, ALLIGATOR CR
R0826AGR	30S	AAC	261,048	1984	77	0	100	L & T CR, WEATH/RAVEL
R1735AGR	10C	AAC	372,500	1995	73	0	90	L & T CR, SWELLING
R1735AGR	10E	AAC	372,500	1995	75	0	84	SWELLING, L & T CR
R1735AGR	10W	AAC	372,500	1995	78	0	85	L & T CR, SWELLING
TAAGR	10	AAC	35,336	2002	100	0	0	N/A
TAAGR	20	AAC	209,700	1983	78	0	93	SWELLING, L & T CR, WEATH/RAVEL
TBAGR	10	AAC	46,408	1983	87	0	93	L & T CR, SWELLING
TBAGR	20	AAC	8,910	2002	100	0	0	N/A

Table 1 (continued). 2002 pavement inspection results.

BRANCH ID	SECTION ID	SURFACE TYPE ¹	SECTION AREA (sf)	LCD ²	2001 PCI	% Distress due to:		DISTRESS TYPES ⁵
						LOAD ³	CLIMATE OR DURABILITY ⁴	
TCAGR	10	AC	87,246	1993	67	69	31	L & T CR, PATCHING, BLEEDING, ALLIGATOR CR, RUTTING
TCAGR	20	AAC	305,285	2001	100	0	0	N/A
TDAGR	10	AC	73,500	1996	89	0	100	WEATH/RAVEL, L & T CR
TEAGR	10	AAC	35,673	1983	39	7	93	ALLIGATOR CR, BLOCK CR, L & T CR, WEATH/RAVEL
TEAGR	20	AAC	371,321	1984	87	0	100	L & T CR

NOTES:

¹See Figure 3 for the location of the branch.

²AC = asphalt cement concrete; AAC = asphalt overlay on AC; PCC = portland cement concrete; APC = asphalt overlay on PCC.

³LCD = last construction date.

⁴Distress due to load includes those distresses attributed to a structural deficiency in the pavement, such as alligator (fatigue) cracking, rutting, or shattered concrete slabs.

⁵Distress due to climate or durability includes those distresses attributed to either the aging of the pavement and the effects of the environment (such as weathering and raveling or block cracking in asphalt pavements) or to a materials-related problem (such as durability cracking in a concrete pavement).

⁶L & T CR = longitudinal and transverse cracking.

5-Year Pavement Maintenance and Rehabilitation Recommendations

As part of the statewide analysis, a 5-year pavement maintenance and rehabilitation program was developed for Augusta Regional Airport at Bush Field. The initial steps in generating this program were developing maintenance policies and determining unit cost information for maintenance and rehabilitation actions. A copy of this information is provided in Appendix D. Please note that this information was developed in conjunction with the GDOT and is of a general nature for the entire state.

For purposes of this analysis, pavement repair was categorized as follows:

- ➔ major rehabilitation (reconstruction, overlay), and
- ➔ localized preventive maintenance (a preventive maintenance action that is applied only to a distressed area, such as crack sealing or patching).

Many budget scenarios were investigated during the statewide analysis, and the results of those may be found in the statewide detailed analysis report. For the purposes of this report, however, only the results of the unlimited budget scenario (where all identified projects are funded) are presented. The analysis results identify those pavement areas that are predicted to need major rehabilitation within the next 5 years, as well as those recommended for preventive maintenance actions.

An unlimited budget was used in the analysis with the goal of maintaining the pavement above its critical PCI value. For runway pavements this value is 70. The rest of the pavements on the airport were assigned a value of 65. In general, preventive maintenance is recommended for pavements with a PCI above the critical value while major rehabilitation is recommended for pavements that have a PCI below the critical value. An inflation rate of 3 percent was used during the analysis.

A summary of the 5-year pavement maintenance and rehabilitation program is presented in Table 2. Detailed information on the recommendations for localized maintenance in Year 1 of the analysis is contained in Appendix E and Appendix F. In Year 1, all distresses observed during the inspection are considered in determining viable localized maintenance projects. Preventive maintenance recommendations that are identified in subsequent years only address crack sealing those cracks in asphalt pavements that were rated as low severity at the time of inspection.

Note that these recommendations are based upon a broad network level analysis and are meant to provide the Airport with an indication of the type of pavement-related work required during the next 5 years. Further engineering investigation will need to be performed to identify exactly which repair action is most appropriate and to more accurately estimate the cost of such work. In addition, the cost estimates provided were based on a statewide policy and each airport should adjust the maintenance policies and unit costs to match its own approach to pavement maintenance and to reflect local costs.

Major rehabilitation projects may be clustered in the first year of the analysis. Obviously, for economic and operational reasons, this work will often need to be distributed over several years. It is important to remember that regardless of the recommendations presented within this report, the Airport is responsible for repairing pavements where existing conditions pose a hazard to safe operations.

Table 2. 5-year program under an unlimited funding analysis scenario.

Branch ¹	Section	Year	Type of Repair ²	Estimated Cost ³
R0826AGR	20C	2002	Major M&R	\$78,964
R0826AGR	20N	2002	Major M&R	\$38,942
R0826AGR	20S	2002	Major M&R	\$42,945
R0826AGR	30C	2002	Major M&R	\$427,781
R0826AGR	30N	2002	Preventive	\$810
R0826AGR	30S	2002	Preventive	\$6,270
R1735AGR	10C	2002	Preventive	\$506
TCAGR	10	2002	Major M&R	\$143,472
TEAGR	10	2002	Major M&R	\$118,951
A01AGR	30	2002	Major M&R	\$1,556,194
AGARRETAGR	10	2002	Major M&R	\$136,284
AHELIAGR	10	2002	Major M&R	\$19,173
AHELIAGR	20	2002	Preventive	\$29,601
R0826AGR	30N	2006	Preventive	\$68,263
R0826AGR	30S	2006	Preventive	\$45,702
R1735AGR	10C	2006	Preventive	\$151,085
R1735AGR	10E	2006	Preventive	\$134,194
R1735AGR	10W	2006	Preventive	\$102,878
TAAGR	20	2006	Preventive	\$36,642
TBAGR	10	2006	Preventive	\$7,380
TEAGR	20	2006	Preventive	\$50,235
A01AGR	10	2006	Preventive	\$1,698
A01AGR	20	2006	Preventive	\$5,602
A01AGR	40	2006	Preventive	\$64,656

¹See Figure 3 for the location of the branch.

²Major Rehabilitation: overlay, mill and overlay, reconstruction, and so on;
Preventive Maintenance: crack sealing, patching, joint resealing, and so on.

³Cost estimates based on broad statewide policy and should be adjusted to reflect local costs.

Summary

This report documents the results of the pavement evaluation conducted at Augusta Regional Airport at Bush Field. During a visual inspection of the pavements in 2001, it was found that the overall condition of the pavement network is a PCI of 80. A 5-year pavement repair program was generated for the Airport, which revealed that approximately \$3,268,228 needs to be expended on the pavement system in order to preserve its condition.

APPENDIX A

CAUSE OF DISTRESS TABLES

Table A-1. Cause of pavement distress, asphalt-surfaced pavements.

Distress Type	Probable Cause of Distress	Feasible Maintenance Strategies
Alligator Cracking	Fatigue failure of the asphalt concrete surface under repeated traffic loading	If localized, partial- or full-depth asphalt patch. If extensive, major rehabilitation needed.
Bleeding	Excessive amounts of asphalt cement or tars in the mix and/or low air void content	Spread heated sand, roll, and sweep. Another option is to plane excess asphalt. Or, remove and replace.
Block Cracking	Shrinkage of the asphalt concrete and daily temperature cycling; it is not load associated	At low severity levels, crack seal and/or surface treatment. At higher severities, consider overlay.
Corrugation	Traffic action combined with an unstable pavement layer	If localized, mill. If extensive, remove and replace.
Depression	Settlement of the foundation soil or can be “built up” during construction	Patch.
Jet Blast	Bituminous binder has been burned or carbonized	Patch.
Joint Reflection	Movement of the concrete slab beneath the asphalt concrete surface because of thermal and moisture changes	At low and medium severities, crack seal. At higher severities, especially if extensive, consider overlay.
Longitudinal and Transverse Cracking	Cracks may be caused by 1) poorly constructed paving lane joint, 2) shrinkage of the AC surface due to low temperatures or hardening of the asphalt, or 3) reflective crack caused by cracks in an underlying PCC ¹ slab	At low and medium severity levels, crack seal. At higher severities, especially if extensive, consider overlay options.
Oil Spillage	Deterioration or softening of the pavement surface caused by the spilling of oil, fuel, or other solvents	Patch.
Patching	N/A	Replace patch if deteriorated.
Polished Aggregate	Repeated traffic applications	Aggregate seal coat is one option. Could also groove or mill. Overlay is another option.
Raveling and Weathering	Asphalt binder may have hardened significantly	Patch if isolated. If low-severity, consider surface treatment if extensive. At medium and high severity levels, consider major rehabilitation if extensive.
Rutting	Usually caused by consolidation or lateral movement of the materials due to traffic loads	Patch medium and high severity levels if localized. If extensive, consider major rehabilitation.
Shoving	Where PCC pavements adjoin flexible pavements, PCC “growth” may shove the asphalt pavement	Mill and patch as needed.
Slippage Cracking	Low strength surface mix or poor bond between the surface and next layer of pavement structure	Partial- or full-depth patch.
Swelling	Usually caused by frost action or by swelling soil	Patch if localized. Major rehabilitation if extensive.

¹PCC: portland cement concrete

Table A-2. Cause of pavement distress, portland cement concrete pavements.

Distress Type	Probable Cause of Distress	Feasible Maintenance Strategies
Blow-Up	Incompressibles in joints	Partial- or full-depth patch. Slab replacement.
Corner Break	Load repetition combined with loss of support and curling stresses	Seal cracks at low severity. Full-depth patch.
Cracks	Combination of load repetition, curling stresses, and shrinkage stresses	Seal cracks. At high severity, may need full-depth patch or slab replacement.
Durability Cracking	Concrete's inability to withstand environmental factors such as freeze-thaw cycles	Full-depth patch if present on small amount of slab. At higher severity levels, once it has appeared on most of slab, slab replacement.
Joint Seal Damage	Stripping of joint sealant, extrusion of joint sealant, weed growth, hardening of the filler (oxidation, loss of bond to the slab edges, or absence of sealant in joint)	Replace joint seal.
Patching (Small and Large)	N/A	Replace patches if deteriorated.
Popouts	Freeze-thaw action in combination with expansive aggregates	Monitor.
Pumping	Poor drainage, poor joint sealant	Seal cracks and joints. Underseal is an option if voids have developed. Establish good drainage.
Scaling	Overfinishing of concrete, deicing salts, improper construction, freeze-thaw cycles, poor aggregate, and alkali-silica reactivity	At low severity levels, do nothing. At medium and high severity levels, partial-depth patches or slab replacement.
Settlement	Upheaval or consolidation	At higher severity levels, leveling patch or grind to restore smooth ride.
Shattered Slab	Load repetition	Replace slab.
Shrinkage	Setting and curing of the concrete	Monitor.
Spalling (Joint and Corner)	Excessive stresses at the joint caused by infiltration of incompressible materials or traffic loads; weak concrete at joint combined with traffic loads	Partial-depth patch.

APPENDIX B

PHOTOGRAPHS



Overview of section R1735AGR-10C.



Overview of section R1735AGR-10E.



Overview of section R1735AGR-10W.



L&T cracking in section R1735AGR-10W.



Overview of section R826AGR-10C.



Overview of section R826AGR-10N.



Overview of section R826AGR-10S.



Overview of section R826AGR-20N.



Overview of section R826AGR-20N.



Overview of section R826AGR-20S.



Overview of section R826AGR-30C.



Overview of section R826AGR-30N.



Overview of section R826AGR-30S.



Overview of section TAAGR-20.



Overview of section TBAGR-20.



Overview of section TCAGR-10.



Alligator cracking in section TCAGR-10.



Overview of section TCAGR-20.



Overview of section TDAGR-10.



Overview of section TEAGR-10.



L&T cracking in section TEAGR-10.



Overview of section TEAGR-20.



Overview of section A01AGR-10.



Overview of section A01AGR-20.



Overview of section A01AGR-30.



Overview of an additional sample unit with a PCC patch in section A01AGR-30.



Overview of section A01AGR-40.



Overview of section A01AGR-50.



Overview of section AGARRETAGR-10.



Block cracking in section AGARRETAGR-10.



Overview of section AHELIAGR-10.



Overview of section AHELIAGR-20.

APPENDIX C
INSPECTION REPORT

APPENDIX D

**MAINTENANCE POLICIES
AND UNIT COSTS**

Table D-1. GDOT’s preventive maintenance policy, asphalt-surfaced pavements.

Distress Type	Severity Level	Maintenance Action
Alligator Cracking	Low	Monitor
	Medium	Patch (major rehabilitation if extensive)
	High	Patch (major rehabilitation if extensive)
Bleeding	N/A	Monitor (major rehabilitation required if skid resistance significantly impacted by the distress)
Block Cracking	Low	Monitor
	Medium	Crack Seal
	High	Crack Seal (major rehabilitation if extensive)
Corrugation	Low	Monitor
	Medium	Patch (major rehabilitation if extensive)
	High	Patch (major rehabilitation if extensive)
Depression	Low	Monitor
	Medium	Patch
	High	Patch
Jet Blast	N/A	Patch
Joint Reflection Cracking	Low	Monitor
	Medium	Crack Seal
	High	Crack Seal (major rehabilitation if extensive)
Longitudinal and Transverse Cracking	Low	Monitor
	Medium	Crack Seal
	High	Crack Seal (major rehabilitation if extensive)
Oil Spillage	N/A	AC Patch
Patching	Low	Monitor
	Medium	Monitor
	High	Patch
Polished Aggregate	N/A	Monitor (major rehabilitation required if skid resistance significantly impacted by the distress)
Raveling and Weathering	Low	Monitor (global preventive maintenance action such as surface treatment if extensive)
	Medium	Patch if localized
	High	Patch if localized
Rutting	Low	Monitor
	Medium	Patch (major rehabilitation if extensive)
	High	Patch (major rehabilitation if extensive)
Shoving	Low	Monitor
	Medium	Patch
	High	Patch
Slippage Cracking	N/A	Patch (major rehabilitation if extensive)
Swelling	Low	Monitor
	Medium	Patch
	High	Patch

Table D-2. GDOT’s preventive maintenance policy, portland cement concrete pavements.

Distress Type	Severity Level	Maintenance Action
Blow-Up	Low	Patch
	Medium	Patch
	High	Patch
Corner Break	Low	Crack Seal
	Medium	Crack Seal
	High	Patch
Cracks	Low	Crack Seal
	Medium	Crack Seal
	High	Crack Seal
Durability Cracking	Low	Monitor
	Medium	Patch
	High	Slab Replacement
Joint Seal Damage	Low	Monitor
	Medium	Joint Seal
	High	Joint Seal
Patching	Low	Monitor
	Medium	Patch
	High	Patch
Popouts	N/A	Monitor
Pumping	N/A	Monitor
Scaling	Low	Monitor
	Medium	Slab Replacement
	High	Slab Replacement
Settlement	Low	Monitor
	Medium	Monitor
	High	Grinding
Shattered Slab	Low	Crack Seal
	Medium	Slab Replacement
	High	Slab Replacement
Shrinkage	N/A	Monitor
Spalling (Joint and Corner)	Low	Monitor
	Medium	Patch
	High	Patch

Table D-3. Unit costs for GDOT preventive maintenance actions, commercial service airports.

Maintenance Action	Unit Cost (\$/sf)
Patching	2.55
Crack Sealing	3.20
Slab Replacement	5.10
Joint Sealing	4.00
Grinding	50.00

Table D-4. GDOT's unit costs based on PCI ranges, commercial service airports.

Work Type	PCI Range							
	0 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79	80 – 89	> 89
Major Rehabilitation: CS	\$30.01/sy	\$30.01/sy	\$30.01/sy	\$14.80/sy	\$14.80/sy	\$14.80/sy	\$10.71/sy	\$10.71/sy

APPENDIX E

**YEAR 2002 MAINTENANCE PLAN
ORGANIZED BY SECTION**

Table E-1. 2002 maintenance plan organized by section.

Plan Year	Network	Branch	Section	Distress Description	Severity	Work Description	Work Qty.	Work Unit	Unit Cost	Work Cost
2002	AUG-AGS	HELIAGR	20	JT SEAL DMG	M	Joint Seal	7,400	LF	\$4.00	\$29,601
2002	AUG-AGS	R0826AGR	30N	L & T CR	M	Crack Sealing	253	LF	\$3.20	\$810
2002	AUG-AGS	R0826AGR	30S	L & T CR	M	Crack Sealing	1,959	LF	\$3.20	\$6,270
2002	AUG-AGS	R1735AGR	10C	L & T CR	M	Crack Sealing	158	LF	\$3.20	\$506

APPENDIX F

**YEAR 2002 MAINTENANCE PLAN
ORGANIZED BY REPAIR TYPE**

Table F-1. 2002 maintenance plan organized by repair type.

Plan Year	Network	Branch	Section	Distress Description	Severity	Work Description	Work Qty.	Work Unit	Unit Cost	Work Cost
2002	AUG-AGS	R0826AGR	30N	L & T CR	M	Crack Sealing	253	LF	\$3.20	\$810
2002	AUG-AGS	R0826AGR	30S	L & T CR	M	Crack Sealing	1,959	LF	\$3.20	\$6,270
2002	AUG-AGS	R1735AGR	10C	L & T CR	M	Crack Sealing	158	LF	\$3.20	\$506
2002	AUG-AGS	HELIAGR	20	JT SEAL DMG	M	Joint Seal	7,400	LF	\$4.00	\$29,601